Series C3ABD/1

SET ~ 1

रोल नं. *Roll No.*							

प्रश्न–पत्र कोड
Q.P. Code **30/1/1**

परीक्षार्थी प्रश्न–पत्र कोड को उत्तर–पुस्तिका के मुख–पृष्ठ पर अवश्य लिखें।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पृष्ठ **15** हैं।
Please check that this question paper contains **15** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न–पत्र में **38** प्रश्न हैं।
Please check that this question paper contains **38** questions.

(iii) प्रश्न–पत्र में दाहिने हाथ की ओर दिए गए प्रश्न–पत्र कोड को परीक्षार्थी उत्तर–पुस्तिका के मुख–पृष्ठ पर लिखें।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर–पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें।**
Please write down the Serial Number of the question in the answer-book before attempting it.

(v) इस प्रश्न–पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है। प्रश्न–पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा। 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न–पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर–पुस्तिका पर कोई उत्तर नहीं लिखेंगे।
15 minutes time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)

MATHEMATICS (STANDARD)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*
Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं। **सभी** प्रश्न **अनिवार्य** हैं।*

(ii) *प्रश्न-पत्र **पांच** खण्डों में विभाजित है - **क, ख, ग, घ** तथा **ड़**।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय प्रश्न (MCQs) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं।*

(vii) ***खण्ड ड़** में प्रश्न संख्या **36** से **38** तक **प्रकरण अध्ययन आधारित 4** अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है। यद्यपि, खण्ड **ख** के 2 प्रश्नों में, खण्ड **ग** के 2 प्रश्नों में, खण्ड **घ** के 2 प्रश्नों में तथा खण्ड **ड़** के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहां आवश्यक हो, स्वच्छ आकृतियां बनाइए। यदि आवश्यक हो तो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।*

(x) *कैलकुलेटर का उपयोग **वर्जित** है।*

खण्ड – क

20×1 = 20

इस खण्ड में 20 प्रश्न हैं जिनमें प्रत्येक का 1 अंक है।

1. यदि बहुपद $p(x) = 2x^2 - k\sqrt{2}\,x + 1$ के शून्यकों का योगफल $\sqrt{2}$ है, तो k का मान है : **1**

(a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $\frac{1}{2}$

2. यदि एक खिलाड़ी के एक खेल को जीतने की प्रायिकता 0.79 है, तो उसके, उसी खेल को हारने की प्रायिकता है : **1**

(a) 1.79 (b) 0.31 (c) 0.21% (d) 0.21

3. यदि समीकरण $ax^2 + bx + c = 0$, $a \neq 0$ के मूल वास्तविक और समान हैं, तो निम्न में से कौनसा संबंध सही है ? **1**

(a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$

4. एक समांतर श्रेढ़ी में यदि प्रथम पद $a = 7$, nवां पद $a_n = 84$ तथा प्रथम n पदों का योग $s_n = \frac{2093}{2}$ है, तो n का मान है : **1**

(a) 22 (b) 24 (c) 23 (d) 26

5. यदि दो घन पूर्णांकों p तथा q को $p = 18\,a^2b^4$ तथा $q = 20\,a^3b^2$ के रूप में लिखा जा सकता है, जहाँ a तथा b अभाज्य संख्याएं हैं, तो LCM (p, q) है : **1**

(a) $2\,a^2b^2$ (b) $180\,a^2b^2$ (c) $12\,a^2b^2$ (d) $180\,a^3b^4$

General Instructions :

Read the following instructions carefully and follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Question numbers **1** to **18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion – Reason based questions of **1** mark each.*

(iv) *In **Section B,** Question numbers **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Question numbers **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Question numbers **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Question numbers **36** to **38** are **case–study based integrated** questions carrying **4** marks each. Internal choice is provided in **2** marks question in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section **B**, 2 questions in Section **C**, 2 questions in Section **D** and 3 questions of 2 marks in Section **E**.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculators is **NOT allowed.***

SECTION - A

20×1 = 20

This section consists of 20 questions of 1 mark each.

1. If the sum of zeroes of the polynomial $p(x) = 2x^2 - k\sqrt{2}x + 1$ is $\sqrt{2}$, then value of k is : **1**

(a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $\frac{1}{2}$

2. If the probability of a player winning a game is 0.79, then the probability of his losing the same game is : **1**

(a) 1.79 (b) 0.31 (c) 0.21% (d) 0.21

3. If the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and equal, then which of the following relation is true ? **1**

(a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$

4. In an A.P., if the first term $a = 7$, nth term $a_n = 84$ and the sum of first n terms $s_n = \frac{2093}{2}$, then n is equal to : **1**

(a) 22 (b) 24 (c) 23 (d) 26

5. If two positive integers p and q can be expressed as $p = 18\ a^2b^4$ and $q = 20\ a^3b^2$, where a and b are prime numbers, then LCM (p, q) is : **1**

(a) $2\ a^2b^2$ (b) $180\ a^2b^2$ (c) $12\ a^2b^2$ (d) $180\ a^3b^4$

6. त्रिभुज ABC के शीर्ष A(5, – 6), B(6, 4) तथा C(0, 0) हैं तथा AD त्रिभुज की एक माध्यिका है। AD की लंबाई है : 1

(a) $\sqrt{68}$ इकाई (b) $2\sqrt{15}$ इकाई (c) $\sqrt{101}$ इकाई (d) 10 इकाई

7. यदि $\sec\theta - \tan\theta = m$ है, तो $\sec\theta + \tan\theta$ का मान है : 1

(a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$

8. आँकड़ों 1, 4, 7, 9, 16, 21, 25 में से यदि सभी सम संख्याएँ निकाल दी गई हों, तो शेष में यादृच्छया एक अभाज्य संख्या आने की प्रायिकता है : 1

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

9. किन्हीं आँकड़ों $x_1, x_2, \ldots\ldots x_n$ जहाँ $f_1, f_2, \ldots\ldots f_n$ क्रमशः उनकी बारंबारताएँ हैं, के लिए $\sum_1^n f_i\left(x_i - \bar{x}\right)$ का मान है : 1

(a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0

10. यदि बहुपद $x^2 + px + q$ के शून्यक, बहुपद $4x^2 - 5x - 6$ के शून्यकों के दुगने के बराबर हैं, तो p का मान है : 1

(a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10

11. यदि बिंदुओं $(3, -5)$ तथा $(x, -5)$ के बीच की दूरी 15 इकाई है, तो x के मान हैं : 1

(a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12

12. यदि $\cos(\alpha + \beta) = 0$ है, तो $\cos\left(\frac{\alpha + \beta}{2}\right)$ का मान है : 1

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) 0 (d) $\sqrt{2}$

13. एक ठोस गोले को दो अर्धगोलों में काटा गया। इस गोले के पृष्ठीय क्षेत्रफल का दोनों अर्धगोलों के संपूर्ण पृष्ठीय क्षेत्रफल से अनुपात है : 1

(a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2

14. प्रत्येक प्रकार के आँकड़ों को क्रम में व्यवस्थित करने पर सबसे बीच का प्रेक्षण होता है : 1

(a) बहुलक (b) माध्यक (c) माध्य (d) विचलन

15. भुजा 2 cm वाले एक ठोस घन से काटकर निकाले जा सकने वाले अधिकतम आयतन के शंकु का आयतन है : 1

(a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm

6. AD is a median of ΔABC with vertices A(5, – 6), B(6, 4) and C(0, 0). Length AD is equal to : **1**

(a) $\sqrt{68}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units

7. If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is : **1**

(a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$

8. From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the probability of getting at random a prime number from the remaining is : **1**

(a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$

9. For some data $x_1, x_2, \ldots\ldots x_n$ with respective frequencies $f_1, f_2, \ldots\ldots f_n$, the value of $\sum_1^n f_i \left(x_i - \bar{x} \right)$ is equal to : **1**

(a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0

10. The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is : **1**

(a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) – 5 (d) 10

11. If the distance between the points (3, – 5) and (x, – 5) is 15 units, then the values of x are : **1**

(a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12

12. If $\cos(\alpha + \beta) = 0$, then value of $\cos\left(\frac{\alpha + \beta}{2}\right)$ is equal to : **1**

(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) 0 (d) $\sqrt{2}$

13. A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is : **1**

(a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2

14. The middle most observation of every data arranged in order is called : **1**

(a) mode (b) median (c) mean (d) deviation

15. The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is : **1**

(a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm

16. दो पासों को एक साथ उछाला गया। दोनों पासों पर आई संख्याओं का योग 2, 3 या 5 आने की प्रायिकता है : 1

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$

17. एक वृत्त का केंद्र बिंदु (2, 0) पर है। यदि वृत्त के एक व्यास का एक सिरा बिंदु (6, 0) पर है, तो इसके दूसरे सिरे के निर्देशांक हैं : 1

(a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)

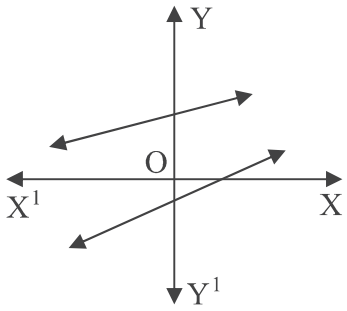
18. दी गई आकृति में दो रैखिक समीकरणों का ग्राफ दर्शाया गया है।
इन रैखिक समीकरणों का युग्म : 1

(a) अद्वितीय हल के साथ संगत है।

(b) अपरिमित रूप से अनेक हलों के साथ संगत है।

(c) असंगत है।

(d) असंगत है परन्तु रेखाओं को बढ़ाने पर संगत बनाया जा सकता है।



निर्देश :

प्रश्न संख्या 19 तथा 20 में एक अभिकथन (A) के बाद एक तर्क (R), कथन दिया गया है। सही विकल्प चुनिए।

(a) दोनों, अभिकथन (A) तथा तर्क (R) सही हैं। तर्क (R), अभिकथन (A) की सही व्याख्या करता है।

(b) दोनों, अभिकथन (A) तथा तर्क (R) सही हैं परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या नहीं करता।

(c) अभिकथन (A) सही है परन्तु तर्क (R) गलत है।

(d) अभिकथन (A) गलत है जबकि तर्क (R) सही है।

19. **अभिकथन (A) :** वृत्त के किसी व्यास के सिरों पर खींची गई स्पर्श रेखाएँ परस्पर समांतर होती हैं।

तर्क (R) : एक वृत्त का व्यास इसकी सबसे लम्बी जीवा होती है। 1

20. **अभिकथन (A) :** यदि किसी बहुपद का ग्राफ x-अक्ष को केवल एक बिंदु पर स्पर्श करता है, तो यह द्विघात बहुपद नहीं हो सकता।

तर्क (R) : घात $n(n>1)$ के बहुपद के अधिकतम शून्यक n होते हैं। 1

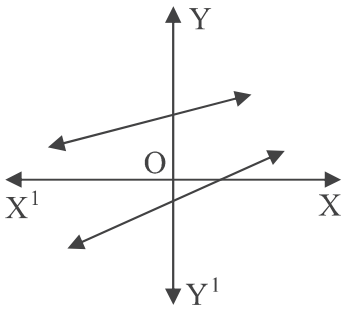
16. Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5, is : **1**

(a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$

17. The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at : **1**

(a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)

18. In the given figure, graphs of two linear equations are shown. The pair of these linear equations is : **1**



(a) consistent with unique solution.

(b) consistent with infinitely many solutions.

(c) inconsistent.

(d) inconsistent but can be made consistent by extending these lines.

Directions :
In Q. No. 19 and 20 a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

(a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A).

(b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not correct explanation for Assertion (A).

(c) Assertion (A) is true but Reason (R) is false.

(d) Assertion (A) is false but Reason (R) is true.

19. **Assertion (A) :** The tangents drawn at the end points of a diameter of a circle, are parallel.

Reason (R) : Diameter of a circle is the longest chord. **1**

20. **Assertion (A) :** If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial.

Reason (R) : A polynomial of degree $n(n > 1)$ can have at most n zeroes. **1**

खण्ड – ख

इस खण्ड में 5 प्रश्न हैं जिनमें प्रत्येक के 2 अंक हैं।

21. निम्न रैखिक समीकरण निकाय का हल ज्ञात कीजिए

$7x - 2y = 5$ तथा $8x + 7y = 15$ और अपने उत्तर को सत्यापित कीजिए। **2**

22. एक अच्छी प्रकार से फेंटी गई 52 पत्तों की ताश की गड्डी में से यादृच्छया एक पत्ता निकाला गया। यदि यह एक काले रंग का पत्ता है, तो इसे अलग रखकर शेष पत्तों में से एक पत्ता यादृच्छया निकाला गया। इस पत्ते के पान की बेगम वाला पत्ता आने की प्रायिकता ज्ञात कीजिए। **2**

23. **(A)** मान ज्ञात कीजिए : $2\sqrt{2}\ \cos 45^\circ \sin 30^\circ + 2\sqrt{3}\ \cos 30^\circ$ **2**

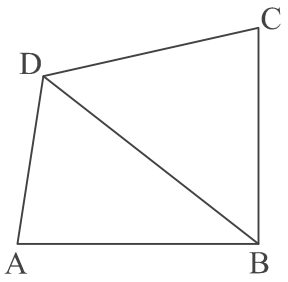
अथवा

(B) यदि $A = 60^\circ$ तथा $B = 30^\circ$ है, तो सत्यापित कीजिए कि :

$\sin (A + B) = \sin A \cos B + \cos A \sin B$ **2**

24. दी गई आकृति में, ABCD एक चतुर्भुज है जिसका विकर्ण BD, कोण B तथा कोण D को समद्विभाजित करता है।

सिद्ध कीजिए : **2**



(i) $\Delta ABD \sim \Delta CBD$

(ii) $AB = BC$

25. **(A)** सिद्ध कीजिए कि $5 - 2\sqrt{3}$ एक अपरिमेय संख्या है जब यह दिया है कि $\sqrt{3}$ अपरिमेय संख्या है। **2**

अथवा

(B) दर्शाइए कि संख्या $5\times11\times17+3\times11$ एक भाज्य संख्या (समग्र संख्या) है। **2**

खण्ड – ग

इस खण्ड में 6 प्रश्न हैं जिनमें प्रत्येक के 3 अंक हैं।

26. **(A)** वह अनुपात ज्ञात कीजिए जिसमें बिंदु $\left(\frac{8}{5}, y\right)$ बिंदुओं (1, 2) तथा (2, 3) को मिलाने वाले रेखाखण्ड को विभाजित करता है। y का मान भी ज्ञात कीजिए। **3**

अथवा

(B) बिंदु A (–1, –1), B (–1, 6), C (3, 6) तथा D (3, –1) एक आयत ABCD बनाते हैं। यदि P, Q, R तथा S क्रमशः भुजाओं AB, BC, CD तथा DA के मध्य बिंदु हैं तो सिद्ध कीजिए कि चतुर्भुज PQRS के विकर्ण एक-दूसरे का समद्विभाजन करते हैं। **3**

SECTION - B

This section consists of 5 questions of 2 marks each.

21. Solve the following system of linear equations
$7x - 2y = 5$ and $8x + 7y = 15$ and verify your answer. **2**

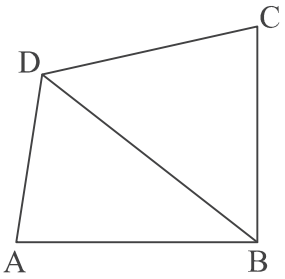
22. In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card. **2**

23. **(A)** Evaluate : $2\sqrt{2}\ \cos 45^{o} \sin 30^{o} + 2\sqrt{3}\ \cos 30^{o}$ **2**

OR

(B) If $A = 60^{o}$ and $B = 30^{o}$, verify that :
$\sin (A + B) = \sin A \cos B + \cos A \sin B$ **2**

24. In the given figure, ABCD is a quadrilateral. Diagonal BD bisects $\angle B$ and $\angle D$ both.
Prove that : **2**



(i) $\Delta ABD \sim \Delta CBD$

(ii) $AB = BC$

25. **(A)** Prove that $5 - 2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number. **2**

OR

(B) Show that the number $5 \times 11 \times 17 + 3 \times 11$ is a composite number. **2**

SECTION - C

This section consists of 6 questions of 3 marks each.

26. **(A)** Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y. **3**

OR

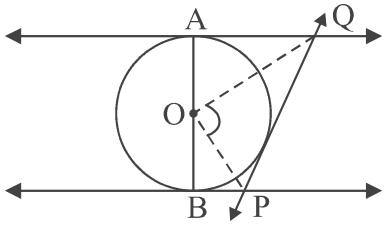
(B) ABCD is a rectangle formed by the points A (–1, –1), B (–1, 6), C (3, 6) and D (3, –1). P, Q, R and S are mid–points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other. **3**

27. अध्यापकों की एक कार्यशाला में फ्रेंच, हिन्दी तथा अंग्रेजी के क्रमशः 48, 80 तथा 144 अध्यापक हैं। यदि प्रत्येक कमरे में एक ही विषय के अध्यापकों की समान संख्या रखनी हो, तो कम से कम कितने कमरों की आवश्यकता होगी? **3**

28. सिद्ध कीजिए : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta\,\text{cosec}\,\theta$ **3**

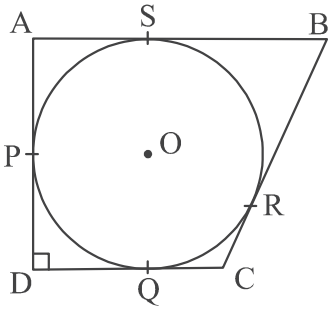
29. तीन वर्ष पहले, रश्मि की आयु नजमा की आयु की तीन गुनी थी। दस वर्ष पश्चात् रश्मि की आयु नजमा की आयु की दुगनी रह जाएगी। उन दोनों की वर्तमान आयु ज्ञात कीजिए। **3**

30. **(A)** दी गई आकृति में, AB वृत्त का व्यास है तथा O वृत्त का केंद्र है। AQ, BP तथा PQ वृत्त पर खींची गई स्पर्श रेखाएँ हैं। सिद्ध कीजिए कि $\angle POQ = 90^\circ$ है। **3**



अथवा

(B) एक चतुर्भुज ABCD के अंतर्गत एक 8 सेमी त्रिज्या वाला वृत्त इस प्रकार खींचा गया कि P, Q, R, S स्पर्श बिंदु हैं, जैसा आकृति में दर्शाया गया है। यदि $AD \perp DC$ है तथा BC = 30 सेमी और BS = 24 सेमी है तो DC की लंबाई ज्ञात कीजिए। **3**



31. 14 सेमी लंबे एक लंबवृत्तीय खोखले बेलन की बाह्य तथा अन्तः त्रिज्याओं का अंतर 1 सेमी है। यदि इस बेलन को बनाने में लगी धातु का आयतन 176 सेमी^{3} है, तो इसकी बाह्य तथा अन्तः त्रिज्याएँ ज्ञात कीजिए। **3**

खण्ड – घ

इस खण्ड में 4 प्रश्न हैं जिनमें प्रत्येक के 5 अंक हैं।

32. त्रिज्या 21 सेमी वाले वृत्त का एक चाप केंद्र पर 60° का कोण अंतरित करता है। ज्ञात कीजिए : **5**

(i) चाप की लंबाई।

(ii) संगत जीवा द्वारा बनाए गए लघु वृत्तखण्ड का क्षेत्रफल।

33. **(A)** एक समांतर श्रेढ़ी (A.P.) के प्रथम तथा आठवें पदों का योगफल 32 है तथा गुणनफल 60 है। इस श्रेढ़ी का प्रथम पद तथा सार्वअंतर ज्ञात कीजिए। इस श्रेढ़ी के प्रथम 20 पदों का योग भी ज्ञात कीजिए। **5**

अथवा

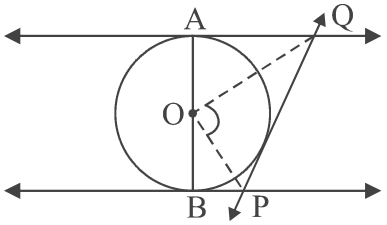
(B) 40 पदों की एक समांतर श्रेढ़ी के प्रथम 9 पदों का योगफल 153 है तथा इसके आखिरी छः पदों का योग 687 है। इस श्रेढ़ी का प्रथम पद तथा सार्वअन्तर ज्ञात कीजिए। इस श्रेढ़ी के सभी पदों का योगफल भी ज्ञात कीजिए। **5**

27. In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject. **3**

28. Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$ **3**

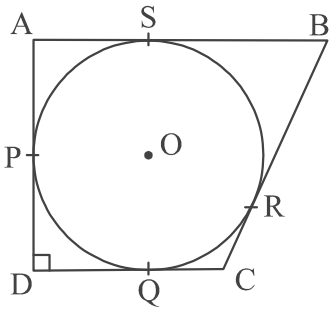
29. Three years ago, Rashmi was thrice as old as Nazma. Ten years later, Rashmi will be twice as old as Nazma. How old are Rashmi and Nazma now ? **3**

30. **(A)** In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that $\angle POQ = 90^o$. **3**



OR

(B) A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, BC = 30 cm and BS = 24 cm, then find the length DC. **3**



31. The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder. **3**

SECTION - D

This section consists of 4 questions of 5 marks each.

32. An arc of a circle of radius 21 cm subtends an angle of 60^o at the centre. Find : **5**

(i) the length of the arc.

(ii) the area of the minor segment of the circle made by the corresponding chord.

33. **(A)** The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms. **5**

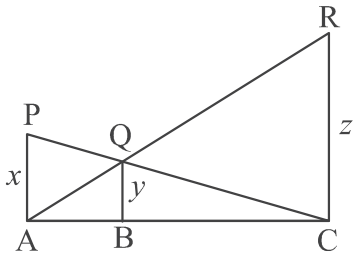
OR

(B) In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P. **5**

34. **(A)** यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि यह भुजा अन्य भुजाओं को एक ही अनुपात में विभाजित करती है। **5**

अथवा

(B) दी गई आकृति में PA, QB तथा RC प्रत्येक AC पर लंब हैं। यदि AP = x, BQ = y तथा CR = z हैं, तो सिद्ध कीजिए कि $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$ **5**



35. एक खम्भा जिसकी ऊँचाई 6 मीटर है, एक मीनार के शिखर पर खड़ा है। भूमि पर एक बिंदु P से खम्भे के शिखर का उन्नयन कोण 60^o तथा मीनार के शिखर से बिंदु P का अवनमन कोण 45^o है। मीनार की ऊँचाई तथा बिंदु P की मीनार के पाद से दूरी ज्ञात कीजिए। ($\sqrt{3} = 1.73$ लीजिए) **5**

खण्ड – ड़

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं। प्रत्येक प्रश्न के 4 अंक हैं।

36. एक आयताकार क्षेत्र के फर्श को 200 वर्गाकार टाइलों द्वारा पूरा ढका (भरा) जा सकता है। यदि प्रत्येक टाइल की भुजा 1 इकाई बढ़ा दी जाए तो फर्श केवल 128 टाइलों से ही ढक जाता है।

(i) यह मानते हुए कि टाइल की प्रत्येक भुजा की मूल लंबाई x इकाई है, उपरोक्त सूचना को द्विघात समीकरण द्वारा निरूपित कीजिए। **1**

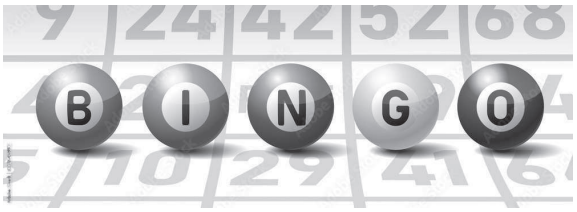
(ii) संगत द्विघात समीकरण को मानक रूप में लिखिए। **1**

(iii) (a) गुणनखण्डन से x का मान ज्ञात कीजिए। **2**

अथवा

(b) द्विघात समीकरण को द्विघात सूत्र से हल कीजिए। **2**

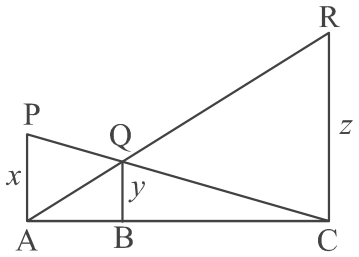
37. **बिंगो** एक संयोग का खेल है। मेजबान के पास 1 से 75 तक क्रमांकित 75 गेंदें हैं। प्रत्येक खिलाड़ी के पास एक **बिंगो** कार्ड है जिस पर कुछ संख्याएँ अंकित हैं। एक गेंद यादृच्छया चुनकर उस पर लिखी संख्या बोले जाने पर प्रतिभागी कार्ड पर वह संख्या रद्द कर देता है। जो भी कार्ड की सारी संख्याएँ रद्द कर पाता है तो वह **बिंगो** बोल कर खेल जीत जाता/जाती है।



34. **(A)** If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio. **5**

OR

(B) In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$ **5**



35. A pole 6m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60^o and the angle of depression of the point P from the top of the tower is 45^o. Find the height of the tower and the distance of point P from the foot of the tower. (Use $\sqrt{3} = 1.73$) **5**

SECTION - E

This section consists of 3 Case-Study Based Questions of 4 marks each.

36. A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor.

(i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information. **1**

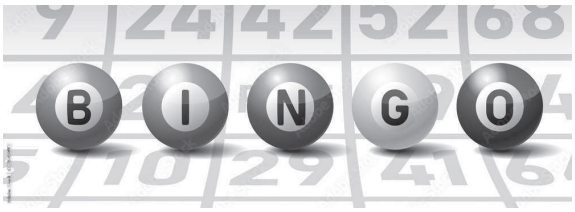
(ii) Write the corresponding quadratic equation in standard form. **1**

(iii) (a) Find the value of x, the length of side of a tile by factorisation. **2**

OR

(b) Solve the quadratic equation for x, using quadratic formula. **2**

37. BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it. The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game.



नीचे दिए आँकड़े, एक ऐसा खेल दर्शाते हैं जिसमें तारा के **'बिंगो'** कहने से पहले 48 गेंद प्रयोग में लाई गईं।

बोली गई संख्या	कितनी बार
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

उपरोक्त जानकारी के आधार पर निम्न के उत्तर दीजिए :

(i) माध्यक वर्ग लिखिए। **1**

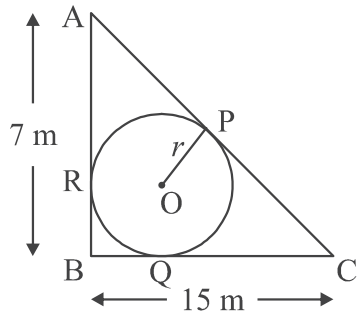
(ii) जब पहली गेंद निकाली गई थी उस समय एक सम संख्या के बोलने की क्या प्रायिकता थी ? **1**

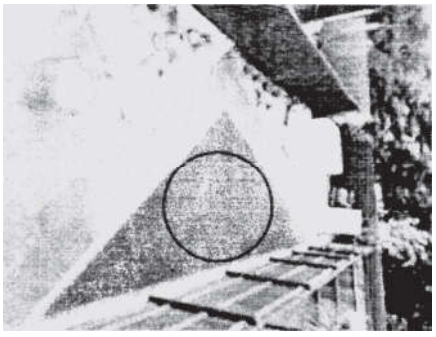
(iii) (a) दिए गए आँकड़ों का माध्यक ज्ञात कीजिए। **2**

अथवा

(b) दिए गए आँकड़ों का बहुलक ज्ञात कीजिए। **2**

38. एक भवन के पीछे का हिस्सा एक त्रिभुज ABC के आकार का है जिसका कोण B समकोण है। AB = 7 मी. तथा BC = 15 मी. है। इसके अंदर एक वृत्ताकार खड्डा इस प्रकार खोदा गया कि यह भुजाओं AC, BC तथा AB को क्रमशः P, Q तथा R पर स्पर्श करता है तथा AP = x मी. है।





उपरोक्त जानकारी के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) x के पदों में AR की लंबाई ज्ञात कीजिए। **1**

(ii) चतुर्भुज BQOR किस प्रकार का चतुर्भुज है? **1**

(iii) (a) PC की लंबाई x के पदों में ज्ञात कीजिए और x का मान ज्ञात कीजिए। **2**

अथवा

(b) x का मान ज्ञात कीजिए और वृत्त की त्रिज्या r का मान ज्ञात कीजिए। **2**

The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following :

(i) Write the median class. **1**

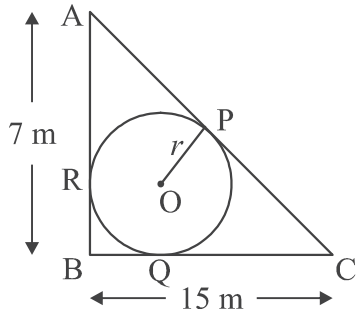
(ii) When first ball was picked up, what was the probability of calling out an even number ? **1**

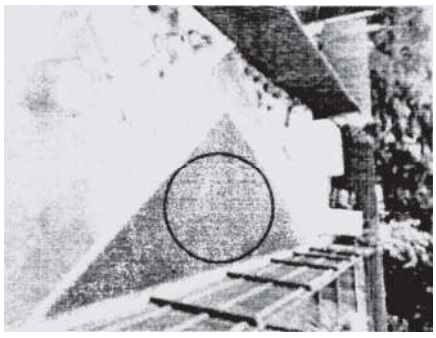
(iii) (a) Find median of the given data. **2**

OR

(b) Find mode of the given data. **2**

38. A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m.





Based on the above information, answer the following questions :

(i) Find the length of AR in terms of x. **1**

(ii) Write the type of quadrilateral BQOR. **1**

(iii) (a) Find the length PC in terms of x and hence find the value of x. **2**

OR

(b) Find x and hence find the radius r of circle. **2**

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/1/1

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class - X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

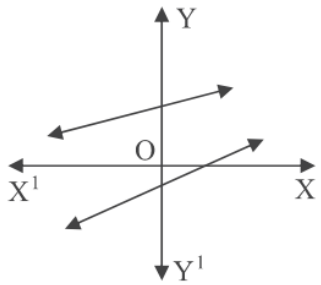
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/1/1)

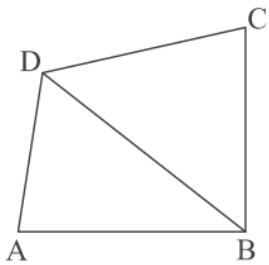
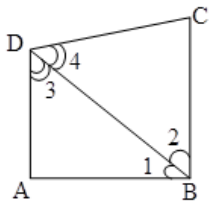
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section consists of 20 questions of 1 mark each.	
1.	If the sum of zeroes of the polynomial $p(x) = 2x^2 - k\sqrt{2}x + 1$ is $\sqrt{2}$, then value of k is : (a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) $\frac{1}{2}$	
Sol.	(b) 2	1
2.	If the probability of a player winning a game is 0.79, then the probability of his losing the same game is : (a) 1.79 (b) 0.31 (c) 0.21% (d) 0.21	
Sol.	(d) 0.21	1
3.	If the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$ are real and equal, then which of the following relation is true ? (a) $a = \frac{b^2}{c}$ (b) $b^2 = ac$ (c) $ac = \frac{b^2}{4}$ (d) $c = \frac{b^2}{a}$	
Sol.	(c) ac = $\frac{b^2}{4}$	1
4.	In an A.P., if the first term $a = 7$, nth term $a_n = 84$ and the sum of first n terms $s_n = \frac{2093}{2}$, then n is equal to : (a) 22 (b) 24 (c) 23 (d) 26	
Sol.	(c) 23	1
5.	If two positive integers p and q can be expressed as $p = 18\ a^2b^4$ and $q = 20\ a^3b^2$, where a and b are prime numbers, then LCM (p, q) is : (a) $2\ a^2b^2$ (b) $180\ a^2b^2$ (c) $12\ a^2b^2$ (d) $180\ a^3b^4$	
Sol.	(d) 180 a^3b^4	1

6.	AD is a median of ΔABC with vertices A(5, – 6), B(6, 4) and C(0, 0). Length AD is equal to : (a) $\sqrt{68}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units	
Sol.	(a) $\sqrt{68}$ units	1
7.	If $\sec\theta - \tan\theta = m$, then the value of $\sec\theta + \tan\theta$ is : (a) $1-\frac{1}{m}$ (b) $m^2 - 1$ (c) $\frac{1}{m}$ (d) $-m$	
Sol.	(c) $\frac{1}{m}$	1
8.	From the data 1, 4, 7, 9, 16, 21, 25, if all the even numbers are removed, then the probability of getting at random a prime number from the remaining is : (a) $\frac{2}{5}$ (b) $\frac{1}{5}$ (c) $\frac{1}{7}$ (d) $\frac{2}{7}$	
Sol.	(b) $\frac{1}{5}$	1
9.	For some data $x_1, x_2, \ldots\ldots x_n$ with respective frequencies $f_1, f_2, \ldots\ldots f_n$, the value of $\sum_1^n f_i\left(x_i - \bar{x}\right)$ is equal to : (a) $n\bar{x}$ (b) 1 (c) $\sum f_i$ (d) 0	
Sol.	(d) 0	1
10.	The zeroes of a polynomial $x^2 + px + q$ are twice the zeroes of the polynomial $4x^2 - 5x - 6$. The value of p is : (a) $-\frac{5}{2}$ (b) $\frac{5}{2}$ (c) -5 (d) 10	
Sol.	(a) $-\frac{5}{2}$	1
11.	If the distance between the points (3, – 5) and (x, – 5) is 15 units, then the values of x are : (a) 12, – 18 (b) – 12, 18 (c) 18, 5 (d) – 9, – 12	
Sol.	(b) – 12, 18	1

12.	If $\cos(\alpha + \beta) = 0$, then value of $\cos\left(\frac{\alpha + \beta}{2}\right)$ is equal to : (a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) 0 (d) $\sqrt{2}$	
Sol.	(a) $\frac{1}{\sqrt{2}}$	1
13.	A solid sphere is cut into two hemispheres. The ratio of the surface areas of sphere to that of two hemispheres taken together, is : (a) 1 : 1 (b) 1 : 4 (c) 2 : 3 (d) 3 : 2	
Sol.	(c) 2 : 3	1
14.	The middle most observation of every data arranged in order is called : (a) mode (b) median (c) mean (d) deviation	
Sol.	(b) median	1
15.	The volume of the largest right circular cone that can be carved out from a solid cube of edge 2 cm is : (a) $\frac{4\pi}{3}$ cu cm (b) $\frac{5\pi}{3}$ cu cm (c) $\frac{8\pi}{3}$ cu cm (d) $\frac{2\pi}{3}$ cu cm	
Sol.	(d) $\frac{2\pi}{3}$ cu cm	1
16.	Two dice are rolled together. The probability of getting sum of numbers on the two dice as 2, 3 or 5, is : (a) $\frac{7}{36}$ (b) $\frac{11}{36}$ (c) $\frac{5}{36}$ (d) $\frac{4}{9}$	
Sol.	(a) $\frac{7}{36}$	1
17.	The centre of a circle is at (2, 0). If one end of a diameter is at (6, 0), then the other end is at : (a) (0, 0) (b) (4, 0) (c) (– 2, 0) (d) (– 6, 0)	
Sol.	(c) (– 2, 0)	1

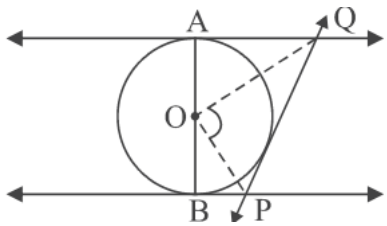
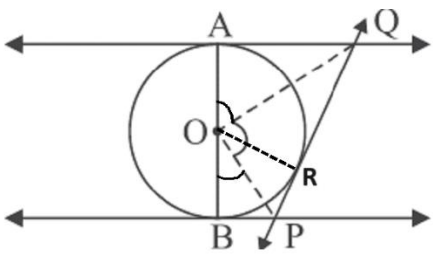
18.	In the given figure, graphs of two linear equations are shown. The pair of these linear equations is : (a) consistent with unique solution. (b) consistent with infinitely many solutions. (c) inconsistent. (d) inconsistent but can be made consistent by extending these lines. 	
Sol.	(a) consistent with unique solution	1
	Directions : **In Q. No. 19 and 20 a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.** (a) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A). (b) Both, Assertion (A) and Reason (R) are true but Reason (R) is not correct explanation for Assertion (A). (c) Assertion (A) is true but Reason (R) is false. (d) Assertion (A) is false but Reason (R) is true.	
19.	**Assertion (A) :** The tangents drawn at the end points of a diameter of a circle, are parallel. **Reason (R) :** Diameter of a circle is the longest chord.	
Sol.	(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation for Assertion (A).	1
20.	**Assertion (A) :** If the graph of a polynomial touches x-axis at only one point, then the polynomial cannot be a quadratic polynomial. **Reason (R) :** A polynomial of degree $n(n > 1)$ can have at most n zeroes.	
Sol.	(d) Assertion (A) is false but Reason (R) is true.	1

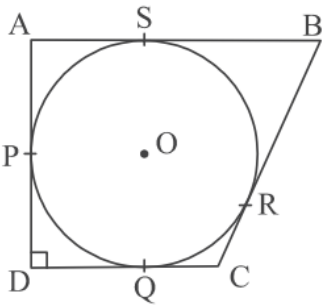
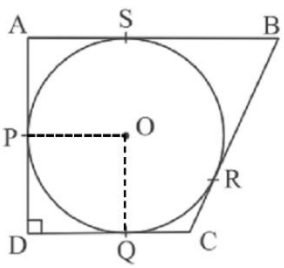
	SECTION B This section consists of 5 questions of 2 marks each.	
21.	Solve the following system of linear equations $7x - 2y = 5$ and $8x + 7y = 15$ and verify your answer.	
Sol.	$7x - 2y = 5$ ----- (i) $8x + 7y = 15$ ----- (ii) Solving equation (i) and (ii), we get $x = 1$, $y = 1$ Verification of answer	 1 + ½ ½
22.	In a pack of 52 playing cards one card is lost. From the remaining cards, a card is drawn at random. Find the probability that the drawn card is queen of heart, if the lost card is a black card.	
Sol.	Total number of remaining cards = 51 P (getting queen of heart) = $\frac{1}{51}$	1 1
23. (A)	Evaluate : $2\sqrt{2}\ \cos 45^\circ \sin 30^\circ + 2\sqrt{3}\ \cos 30^\circ$	
Sol.	$2\sqrt{2} \times \frac{1}{\sqrt{2}} \times \frac{1}{2} + 2\sqrt{3} \times \frac{\sqrt{3}}{2}$ $= 4$	½+½ + ½ ½
	OR	
23. (B)	If $A = 60^\circ$ and $B = 30^\circ$, verify that : $\sin (A + B) = \sin A \cos B + \cos A \sin B$	
Sol.	LHS = $\sin (60° + 30°) = \sin 90° = 1$ RHS = $\sin 60° \cos 30° + \cos 60° \sin 30°$ $= \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2} + \frac{1}{2} \times \frac{1}{2} = 1$ ∴ LHS = RHS	1 1

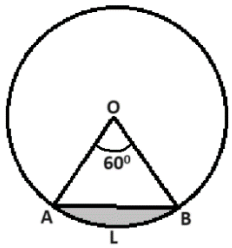
24.	In the given figure, ABCD is a quadrilateral. Diagonal BD bisects ∠B and ∠D both. Prove that : (i) ΔABD ~ ΔCBD (ii) AB = BC 	
Sol.	(i) In ΔABD & ΔCBD ∠ 3 = ∠ 4 ∠1 = ∠ 2 ∴ ΔABD ~ ΔCBD (ii) ΔABD ≅ ΔCBD ∴ AB = BC 	1 1
25. (A)	Prove that $5-2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number.	
Sol.	Assuming $5 - 2\sqrt{3}$ to be a rational number. Let $5 - 2\sqrt{3} = \frac{a}{b}$ where a and b are integers & $b \neq 0$ $\Longrightarrow \sqrt{3} = \frac{5b-a}{2b}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong. Hence, $5 - 2\sqrt{3}$ is an irrational number.	½ ½ ½ ½
	OR	
25. (B)	Show that the number $5\times11\times17+3\times11$ is a composite number.	
Sol.	$5 \times 11 \times 17 + 3 \times 11 = 11 \times (5 \times 17 + 3)$ $= 11\times 88$ or $11 \times 11 \times 2^3$ It means the number can be expressed as a product of two factors other than 1, therefore the given number is a composite number.	1 ½ ½

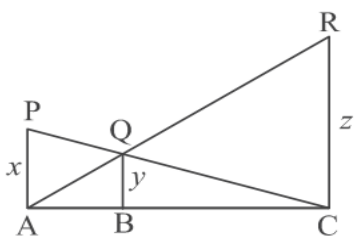
	SECTION C This section consists of 6 questions of 3 marks each.	
26. (A)	Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points (1, 2) and (2, 3). Also, find the value of y.	
Sol.	Let AP: PB = k : 1 $\therefore \frac{2k+1}{k+1} = \frac{8}{5}$ $\Rightarrow k = \frac{3}{2}$ $\therefore$ required ratio is 3: 2. $y = \frac{3\times3+2\times2}{3+2} = \frac{13}{5}$	1 ½ ½ 1
	OR	
26. (B)	ABCD is a rectangle formed by the points A (–1, –1), B (–1, 6), C (3, 6) and D (3, –1). P, Q, R and S are mid–points of sides AB, BC, CD and DA respectively. Show that diagonals of the quadrilateral PQRS bisect each other.	
Sol.	Co-ordinates of point P are $\left(\frac{-1-1}{2}, \frac{-1+6}{2}\right)$ i.e. $\left(-1, \frac{5}{2}\right)$ Co-ordinates of point Q are $\left(\frac{-1+3}{2}, \frac{6+6}{2}\right)$ i.e. $(1, 6)$ Co-ordinates of point R are $\left(\frac{3+3}{2}, \frac{6-1}{2}\right)$ i.e. $\left(3, \frac{5}{2}\right)$ Co-ordinates of point S are $\left(\frac{-1+3}{2}, \frac{-1-1}{2}\right)$ i.e. $(1, -1)$ Co-ordinates of mid point of diagonal QS are $\left(\frac{1+1}{2}, \frac{6-1}{2}\right)$ i.e. $\left(1, \frac{5}{2}\right)$ Co-ordinates of mid point of diagonal PR are $\left(\frac{-1+3}{2}, \frac{\frac{5}{2}+\frac{5}{2}}{2}\right)$ i.e. $\left(1, \frac{5}{2}\right)$ Since coordinates of mid point of QS = coordinates of mid point of PR Therefore, diagonals PR and QS bisect each other.	½ ½ ½ ½ ½ ½

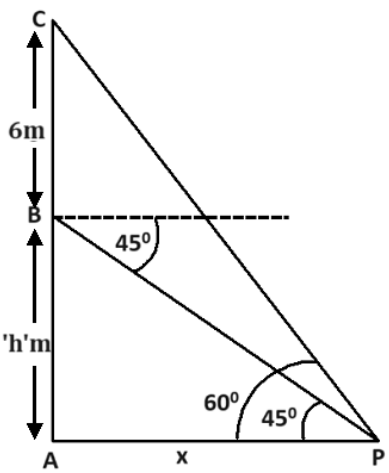
27.	In a teachers' workshop, the number of teachers teaching French, Hindi and English are 48, 80 and 144 respectively. Find the minimum number of rooms required if in each room the same number of teachers are seated and all of them are of the same subject.	
Sol.	Minimum number of rooms required means there should be maximum number of teachers in a room. We have to find HCF of 48, 80 and 144. $48 = 2^4 \times 3$ $80 = 2^4 \times 5$ $144 = 2^4 \times 3^2$ HCF (48, 80, 144) = $2^4 = 16$ Therefore, total number of rooms required = $\frac{48}{16} + \frac{80}{16} + \frac{144}{16} = 17$	 ½ ½ ½ ½ 1
28.	Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \sec\theta \operatorname{cosec}\theta$	
Sol.	LHS = $\frac{\frac{sin\theta}{cos\theta}}{\frac{(\sin\theta - cos\theta)}{sin\theta}} + \frac{\frac{cos\theta}{sin\theta}}{\frac{(\cos\theta - sin\theta)}{cos\theta}}$ $= \frac{1}{(sin\theta - cos\theta)}\left[\frac{sin^2\theta}{cos\theta} - \frac{cos^2\theta}{sin\theta}\right]$ $= \frac{1}{(sin\theta - cos\theta)} \times \frac{(sin\theta - cos\theta)(sin^2\theta + cos^2\theta + sin\theta cos\theta)}{sin\theta cos\theta}$ $= \frac{1}{sin\theta cos\theta} + 1$ $= 1 + sec\theta\ cosec\theta$ = RHS	½ 1 1 ½

29.	Three years ago, Rashmi was thrice as old as Nazma. Ten years later, Rashmi will be twice as old as Nazma. How old are Rashmi and Nazma now ?	
Sol.	Let present age of Rashmi and Nazma be x years and y years respectively.	
	Therefore, $x - 3 = 3(y - 3)$	1
	or $x - 3y + 6 = 0$	
	and $x + 10 = 2(y + 10)$	1
	or $x - 2y - 10 = 0$	
	Solving equations to get $x = 42$, $y = 16$	1
	∴ Present age of Rashmi is 42 years and that of Nazma is 16 years.	
30. (A)	In the given figure, AB is a diameter of the circle with centre O. AQ, BP and PQ are tangents to the circle. Prove that $\angle POQ = 90^o$. 	
Sol.		
	Join OR.	½
	$\Delta AOQ \cong \Delta ROQ \Rightarrow \angle AOQ = \angle ROQ$ ----- (i)	1
	$\Delta BOP \cong \Delta ROP \Rightarrow \angle BOP = \angle ROP$ ----- (ii)	½
	Since $\angle AOR + \angle ROB = 180°$	½
	$\Rightarrow 2\angle QOR + 2\angle ROP = 180°$	
	$\Rightarrow \angle QOR + \angle ROP = \angle POQ = 90°$	½
	OR	

30. (B)	A circle with centre O and radius 8 cm is inscribed in a quadrilateral ABCD in which P, Q, R, S are the points of contact as shown. If AD is perpendicular to DC, BC = 30 cm and BS = 24 cm, then find the length DC. 	
Sol.	Join OP and OQ. BR = BS = 24 cm $\therefore$ CR = 6 cm $\Longrightarrow$ CQ = 6 cm Also, DQ = OP = 8 cm Hence, DC = 8 + 6 = 14 cm 	½ ½ ½ ½ 1
31.	The difference between the outer and inner radii of a hollow right circular cylinder of length 14 cm is 1 cm. If the volume of the metal used in making the cylinder is 176 cm^3, find the outer and inner radii of the cylinder.	
Sol.	Let outer radius be r_2 cm and inner radius be r_1 cm. $\therefore r_2 - r_1 = 1$ ---- (i) Volume of metal used = 176 cm^3 $\Longrightarrow \frac{22}{7} \times 14 \times (r_2^2 - r_1^2) = 176$ $\Longrightarrow r_2 + r_1 = 4$ ---- (ii) Solving (i) and (ii), we get $r_2 = \frac{5}{2}$ or 2.5 , $r_1 = \frac{3}{2}$ or 1.5 Therefore, outer radius = 2.5 cm and inner radius = 1.5 cm	½ 1 ½ 1

	SECTION D This section consists of 4 questions of 5 marks each.	
32.	An arc of a circle of radius 21 cm subtends an angle of 60^o at the centre. Find : (i) the length of the arc. (ii) the area of the minor segment of the circle made by the corresponding chord.	
Sol.	 (i) Length of the arc AB = $2 \times \frac{22}{7} \times 21 \times \frac{60}{360}$ = 22 cm (ii) Area of sector OALB = $\frac{22}{7} \times 21 \times 21 \times \frac{60}{360}$ = 231 cm^2 Area of ΔOAB = $\frac{\sqrt{3}}{4} \times 21 \times 21 = \frac{441\sqrt{3}}{4}$ cm^2 Area of minor segment = $\left(231 - \frac{441\sqrt{3}}{4}\right)$ cm^2 or (231 – 190.95) = 40.05 cm^2	1½ ½ 1 1½ ½
33. (A)	The sum of first and eighth terms of an A.P. is 32 and their product is 60. Find the first term and common difference of the A.P. Hence, also find the sum of its first 20 terms.	
Sol.	$a + a_8 = 32 \Longrightarrow 2a + 7d = 32$ ----- (i) $a \times a_8 = 60 \Longrightarrow a(a + 7d) = 60$ ----- (ii) Solving (i) & (ii), we get a = 2 or a = 30 and d = 4 or d = – 4 First term and common difference of A.P. are 2 and 4 or 30 and – 4 respectively.	1 1 2

	Now, for a = 2 & d = 4 S_{20} = 10 (4 + 76) = 800 and for a = 30 & d = – 4 S_{20} = 10 (60 – 76) = – 160	½ ½
	OR	
33. (B)	In an A.P. of 40 terms, the sum of first 9 terms is 153 and the sum of last 6 terms is 687. Determine the first term and common difference of A.P. Also, find the sum of all the terms of the A.P.	
Sol.	Here n = 40, $S_9 = \frac{9}{2}[2a + 8d] = 153 \Rightarrow a + 4d = 17$ ---- (i) and $S_{40} - S_{34} = 687$ or $a_{35} + a_{36} + a_{37} + a_{38} + a_{39} + a_{40} = 687$ $\Rightarrow 6a + 219d = 687$ or $2a + 73d = 229$ ---- (ii) solving (i) and (ii) to get a = 5, d = 3 Also, $S_{40} = \frac{40}{2}(10 + 39 \times 3) = 2540$	1 2 1 1
34.(A)	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.	
Sol.	Correct figure, given, to prove and construction Correct proof	4×½ = 2 3
	OR	
34. (B)	In the given figure PA, QB and RC are each perpendicular to AC. If AP = x, BQ = y and CR = z, then prove that $\frac{1}{x} + \frac{1}{z} = \frac{1}{y}$  	
Sol.	ΔPAC ~ ΔQBC $\therefore \frac{x}{y} = \frac{AC}{BC}$ or $\frac{y}{x} = \frac{BC}{AC}$ ---- (i)	1 1

	$\Delta RCA \sim \Delta QBA$	1
	$\therefore \frac{z}{y} = \frac{AC}{AB}$ or $\frac{y}{z} = \frac{AB}{AC}$ ---- (ii)	1
	Adding (i) and (ii)	
	$\frac{y}{x} + \frac{y}{z} = \frac{BC+AB}{AC}$	½
	$\Longrightarrow \frac{1}{x} + \frac{1}{z} = \frac{1}{y}$	½
35.	A pole 6m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point P on the ground is 60^o and the angle of depression of the point P from the top of the tower is 45^o. Find the height of the tower and the distance of point P from the foot of the tower. (Use $\sqrt{3} = 1.73$)	
Sol.	Correct figure	1
		
	Let BC be the pole and AB be the tower of height 'h' m.	
	$\tan 45° = 1 = \frac{h}{x}$	1
	$\Longrightarrow h = x$ ---- (i)	½
	$\tan 60° = \sqrt{3} = \frac{h + 6}{x}$	1
	$\Longrightarrow h + 6 = x\sqrt{3}$ ---- (ii)	½

	Solving (i) & (ii) to get $h = 3(\sqrt{3} + 1) = 8.19$ and $x = 8.19$ Therefore, the height of tower is 8.19 m and the distance of point P from the foot of the tower is 8.19 m	½ ½
	SECTION E This section consists of 3 Case-Study Based Questions of 4 marks each.	
36.	A rectangular floor area can be completely tiled with 200 square tiles. If the side length of each tile is increased by 1 unit, it would take only 128 tiles to cover the floor.  (i) Assuming the original length of each side of a tile be x units, make a quadratic equation from the above information. (ii) Write the corresponding quadratic equation in standard form. (iii) (a) Find the value of x, the length of side of a tile by factorisation. **OR** (b) Solve the quadratic equation for x, using quadratic formula.	
Sol.	(i) $200x^2 = 128(x + 1)^2$ (ii) $25x^2 = 16x^2 + 32x + 16$ $\Rightarrow 9x^2 - 32x - 16 = 0$ (iii) (a) $9x^2 - 32x - 16 = 0$ $\Rightarrow (9x + 4)(x - 4) = 0$ $x \neq \frac{-4}{9}$ so, $x = 4$ OR (iii) (b) $x = \frac{32 \pm \sqrt{1024+576}}{18} = \frac{32 \pm 40}{18}$ $x \neq \frac{-4}{9}$ so, $x = 4$	1 1 1 1 1 1 1

37.

BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it.

The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game.

The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Numbers announced	Number of times
0-15	8
15-30	9
30-45	10
45-60	12
60-75	9

Based on the above information, answer the following :

(i) Write the median class.

(ii) When first ball was picked up, what was the probability of calling out an even number ?

(iii) (a) Find median of the given data.

OR

(b) Find mode of the given data.

Sol.

Number announced	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75
Number of times (*f*)	8	9	10	12	9
cf	8	17	27	39	48=N

(i) $\frac{N}{2} = 24$

$\therefore$ median class is 30 – 45 — 1

(ii) P (picking up an even number) = $\frac{37}{75}$ — 1

(iii) (a) Median = $30 + \frac{\left(\frac{48}{2} - 17\right)}{10} \times 15$ — 1

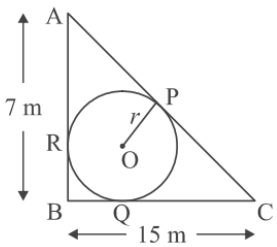
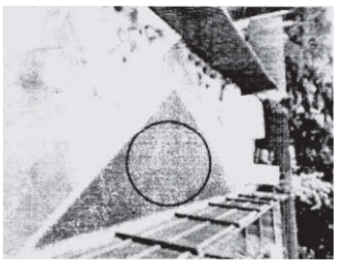
= 40.5 — 1

OR

(iii) (b) Modal class is 45 – 60 — ½

Mode = $45 + \frac{12 - 10}{2 \times 12 - 10 - 9} \times 15$ — 1

= 51 — ½

38.	A backyard is in the shape of a triangle ABC with right angle at B. AB = 7 m and BC = 15 m. A circular pit was dug inside it such that it touches the walls AC, BC and AB at P, Q and R respectively such that AP = x m.   Based on the above information, answer the following questions : (i) Find the length of AR in terms of x. (ii) Write the type of quadrilateral BQOR. (iii) (a) Find the length PC in terms of x and hence find the value of x. **OR** (b) Find x and hence find the radius r of circle.	
Sol.	(i) AR = x m	1
	(ii) Quad. ORBQ is a square.	1
	(iii) (a) PC = 8 + x	½
	$AC^2 = (8 + 2x)^2 = 49 + 225 = 274$	1
	$\Rightarrow 8 + 2x = \sqrt{274}$	
	$\Rightarrow x = \frac{-8+\sqrt{274}}{2}$ or 4.28 approx.	½
	OR	
	(iii) (b) $AC^2 = (8 + 2x)^2 = 49 + 225 = 274$	1
	$\Rightarrow 8 + 2x = \sqrt{274}$	
	$\Rightarrow x = \frac{-8+\sqrt{274}}{2}$ or 4.28 approx.	½
	Hence, radius $r = 7 - x = 7 - \left(-4 + \frac{\sqrt{274}}{2}\right)$	
	$= \left(11 - \frac{\sqrt{274}}{2}\right)$ or 2.72 approx.	½
	Therefore, radius of the circle is $\left(11 - \frac{\sqrt{274}}{2}\right)$ m or 2.72 m approx.	

Series DA2AB/2 SET~1

प्रश्न-पत्र कोड
Q.P. Code **30/2/1**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।

Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।

Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**

Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।

15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
MATHEMATICS (Standard)

*निर्धारित समय : **3** घण्टे* *अधिकतम अंक : **80***

*Time allowed : **3** hours* *Maximum Marks : **80***

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं। **सभी** प्रश्न **अनिवार्य** हैं।*

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है - **क, ख, ग, घ** एवं **ङ**।*

(iii) *खण्ड - **क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं।*

(iv) *खण्ड - **ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं।*

(v) *खण्ड - **ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं।*

(vi) *खण्ड - **घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं।*

(vii) *खण्ड - **ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है। यद्यपि, खण्ड - **ख** के 2 प्रश्नों में, खण्ड - **ग** के 2 प्रश्नों में, खण्ड - **घ** के 2 प्रश्नों में तथा खण्ड-**ङ** के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए। जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है।*

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **FIVE** Sections – **A, B, C, D** and **E**.*

(iii) *In Section–**A** questions number **1** to **18** are Multiple Choice Questions (MCQs) and question number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In Section–**B** questions number **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In Section–**C** questions number **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In Section–**D** questions number **32** to **35** are Long Answer (LA) type questions, carrying **5** marks each.*

(vii) *In Section–**E** question number **36** to **38** are Case Study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section–**B**, 2 questions in Section–**C**, 2 questions in Section–**D** and 3 question in Section–**E**.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **NOT** allowed.*

खण्ड – क

20 × 1 = 20

इस खण्ड में 20 प्रश्न हैं तथा प्रत्येक प्रश्न का 1 अंक है ।

1. k का वह मान जिसके लिए समीकरण निकाय $3x - y + 8 = 0$ तथा $6x - ky + 16 = 0$ के अपरिमित रूप से अनन्त हल हैं, है **1**

(A) -2 (B) 2

(C) $\frac{1}{2}$ (D) $-\frac{1}{2}$

2. बिंदु P, बिंदुओं A(4, –5) तथा B(1, 2) को मिलाने वाले रेखाखण्ड को 5:2 के अनुपात में बाँटता है । बिंदु P के निर्देशांक हैं : **1**

(A) $\left(\frac{5}{2}, \frac{-3}{2}\right)$ (B) $\left(\frac{11}{7}, 0\right)$

(C) $\left(\frac{13}{7}, 0\right)$ (D) $\left(0, \frac{13}{7}\right)$

3. एक समांतर श्रेढ़ी (A.P.) जिसमें $a_{15} - a_{11} = 48$ है, का सार्व अंतर है **1**

(A) 12 (B) 16

(C) –12 (D) –16

4. द्विघात समीकरण $x^2 + x + 1 = 0$ के मूल : **1**

(A) वास्तविक तथा समान हैं । (B) अपरिमेय हैं ।

(C) वास्तविक तथा भिन्न हैं । (D) वास्तविक नही हैं ।

SECTION – A

20 × 1 = 20

This section consists of 20 questions of 1 mark each.

1. The value of k for which the system of equations $3x - y + 8 = 0$ and $6x - ky + 16 = 0$ has infinitely many solutions, is **1**

(A) -2 (B) 2

(C) $\frac{1}{2}$ (D) $-\frac{1}{2}$

2. Point P divides the line segment joining the points A(4, –5) and B(1, 2) in the ratio 5:2. Co-ordinates of point P are **1**

(A) $\left(\frac{5}{2}, \frac{-3}{2}\right)$ (B) $\left(\frac{11}{7}, 0\right)$

(C) $\left(\frac{13}{7}, 0\right)$ (D) $\left(0, \frac{13}{7}\right)$

3. The common difference of an A.P. in which $a_{15} - a_{11} = 48$, is **1**

(A) 12 (B) 16

(C) –12 (D) –16

4. The quadratic equation $x^2 + x + 1 = 0$ has _____ roots. **1**

(A) real and equal (B) irrational

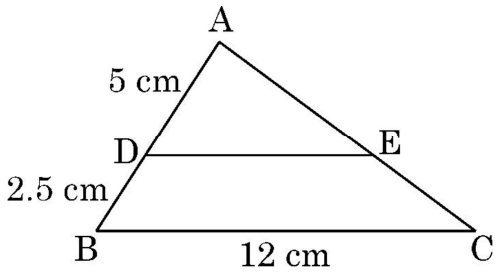
(C) real and distinct (D) not-real

5. यदि HCF (2520, 6600) = 40 और LCM (2520, 6600) = 252 × k है, तो k का मान है : **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

6. दी गई आकृति में ΔABC दिखाया गया है और DE || BC है, यदि AD = 5 cm, DB = 2.5 cm तथा BC = 12 cm है, तो DE बराबर है : **1**



(A) 10 cm (B) 6 cm

(C) 8 cm (D) 7.5 cm

7. यदि $\sin\theta = \cos\theta$, $(0° < \theta < 90°)$ है, तो $(\sec\theta \cdot \sin\theta)$ का मान है : **1**

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$

(C) 1 (D) 0

8. दो पासे एक साथ उछाले गए । दोनों पासों पर आई संख्याओं का योग 10 से अधिक आने की प्रायिकता है : **1**

(A) $\frac{1}{9}$ (B) $\frac{1}{6}$

(C) $\frac{7}{12}$ (D) $\frac{1}{12}$

9. यदि α तथा β बहुपद $5x^2 + 3x - 7$ के शून्यक हैं, तो $\frac{1}{\alpha} + \frac{1}{\beta}$ का मान है : **1**

(A) $-\frac{3}{7}$ (B) $\frac{3}{5}$

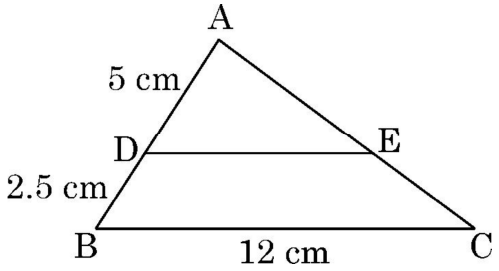
(C) $\frac{3}{7}$ (D) $-\frac{5}{7}$

5. If the HCF (2520, 6600) = 40 and LCM (2520, 6600) = 252 × k, then the value of k is **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

6. In the given figure ΔABC is shown. DE is parallel to BC. If AD = 5 cm, DB = 2.5 cm and BC = 12 cm, then DE is equal to **1**



(A) 10 cm (B) 6 cm

(C) 8 cm (D) 7.5 cm

7. If $\sin\theta = \cos\theta$, $(0° < \theta < 90°)$, then value of $(\sec\theta \cdot \sin\theta)$ is : **1**

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$

(C) 1 (D) 0

8. Two dice are rolled together. The probability of getting the sum of the two numbers to be more than 10, is **1**

(A) $\frac{1}{9}$ (B) $\frac{1}{6}$

(C) $\frac{7}{12}$ (D) $\frac{1}{12}$

9. If α and β are zeroes of the polynomial $5x^2 + 3x - 7$, the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is **1**

(A) $-\frac{3}{7}$ (B) $\frac{3}{5}$

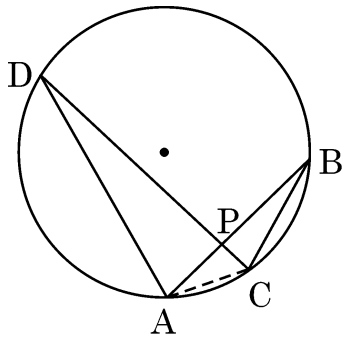
(C) $\frac{3}{7}$ (D) $-\frac{5}{7}$

10. दो समरूप त्रिभुजों ABC तथा PQR के परिमाप क्रमश: 56 cm तथा 48 cm हैं । PQ/AB बराबर है : **1**

(A) $\frac{7}{8}$ (B) $\frac{6}{7}$

(C) $\frac{7}{6}$ (D) $\frac{8}{7}$

11. AB तथा CD एक वृत्त की दो जीवाएँ हैं जो P पर प्रतिच्छेद करती हैं । निम्न में से सही कथन चुनिए : **1**



(A) $\Delta ADP \sim \Delta CBA$ (B) $\Delta ADP \sim \Delta BPC$

(C) $\Delta ADP \sim \Delta BCP$ (D) $\Delta ADP \sim \Delta CBP$

12. यदि किन्हीं आँकड़ों के प्रत्येक प्रेक्षण का मान 2 से बढ़ा दिया जाए, तो नए आँकड़ों का माध्यक **1**

(A) 2 से बढ़ जाएगा । (B) 2n से बढ़ जाएगा ।

(C) वही रहेगा । (D) 2 से कम हो जाएगा ।

13. एक बक्से में कार्ड हैं जिन पर 6 से 55 तक की संख्याएँ अंकित हैं । बक्से में से यादृच्छया एक कार्ड निकालने पर इस पर अंकित संख्या के एक पूर्ण वर्ग संख्या होने की प्रायिकता है : **1**

(A) $\frac{7}{50}$ (B) $\frac{7}{55}$

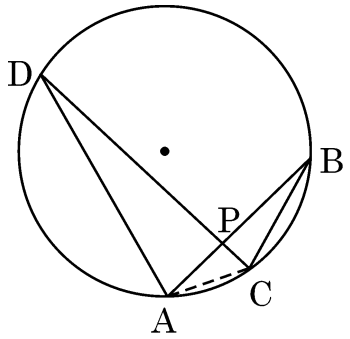
(C) $\frac{1}{10}$ (D) $\frac{5}{49}$

10. The perimeters of two similar triangles ABC and PQR are 56 cm and 48 cm respectively. PQ/AB is equal to **1**

(A) $\frac{7}{8}$ (B) $\frac{6}{7}$

(C) $\frac{7}{6}$ (D) $\frac{8}{7}$

11. AB and CD are two chords of a circle intersecting at P. Choose the correct statement from the following : **1**



(A) $\Delta ADP \sim \Delta CBA$ (B) $\Delta ADP \sim \Delta BPC$

(C) $\Delta ADP \sim \Delta BCP$ (D) $\Delta ADP \sim \Delta CBP$

12. If value of each observation in a data is increased by 2, then median of the new data **1**

(A) increases by 2 (B) increases by 2n

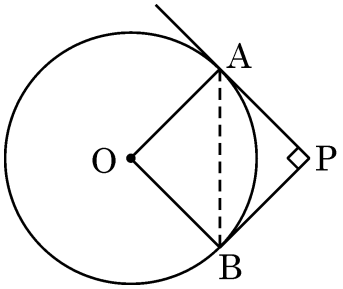
(C) remains same (D) decreases by 2

13. A box contains cards numbered 6 to 55. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square, is **1**

(A) $\frac{7}{50}$ (B) $\frac{7}{55}$

(C) $\frac{1}{10}$ (D) $\frac{5}{49}$

14. दी गई आकृति में, केंद्र O वाले वृत्त पर बिंदु P से परस्पर लंबवत स्पर्श-रेखाएँ PA और PB खींची गई हैं । यदि PA = 5 cm है, तो AB की लंबाई है : **1**



(A) 5 cm (B) $5\sqrt{2}$ cm
(C) $2\sqrt{5}$ cm (D) 10 cm

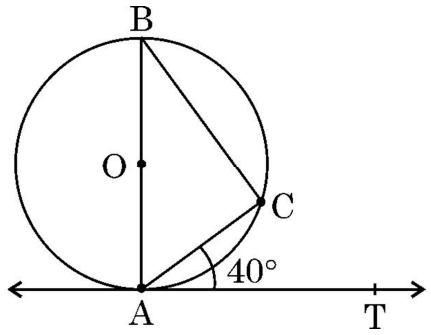
15. XOYZ एक आयत है जिसके शीर्ष X(–3, 0), O(0, 0), Y(0, 4) तथा Z(x, y) हैं । इसके प्रत्येक विकर्ण की लंबाई है : **1**

(A) 5 इकाई (B) $\sqrt{5}$ इकाई
(C) $x^2 + y^2$ इकाई (D) 4 इकाई

16. समांतर श्रेढ़ी (A.P.) –29, –26, –23, ..., 61 का कौन सा पद 16 है ? **1**

(A) 11वाँ (B) 16वाँ
(C) 10वाँ (D) 31वाँ

17. दी गई आकृति में O केंद्र वाले वृत्त पर स्पर्श-रेखा AT है । यदि $\angle CAT = 40°$ है, तो $\angle CBA$ की माप है : **1**

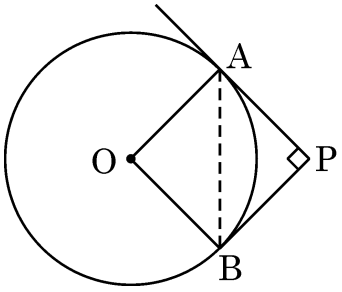


(A) 70° (B) 50°
(C) 65° (D) 40°

18. एक परीक्षा के बाद, अध्यापिका अपनी कक्षा के अधिकतम बच्चों द्वारा प्राप्तांक जानना चाहती है । उसे ज्ञात करना है प्राप्तांकों का **1**

(A) माध्यक (B) बहुलक
(C) माध्य (D) परिसर

14. In the given figure, tangents PA and PB to the circle centred at O, from point P are perpendicular to each other. If PA = 5 cm, then length of AB is equal to **1**



(A) 5 cm (B) $5\sqrt{2}$ cm

(C) $2\sqrt{5}$ cm (D) 10 cm

15. XOYZ is a rectangle with vertices X(–3, 0), O(0, 0), Y(0, 4) and Z(x, y). The length of its each diagonal is **1**

(A) 5 units (B) $\sqrt{5}$ units

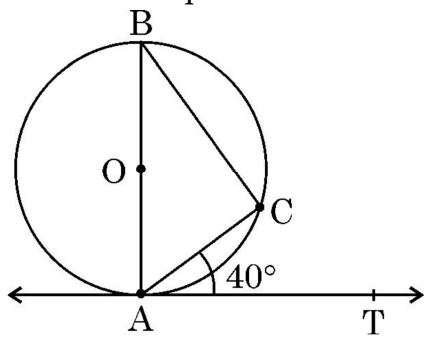
(C) $x^2 + y^2$ units (D) 4 units

16. Which term of the A.P. –29, –26, –23, ..., 61 is 16 ? **1**

(A) 11^{th} (B) 16^{th}

(C) 10^{th} (D) 31^{st}

17. In the given figure, AT is tangent to a circle centred at O. If $\angle CAT = 40°$, then $\angle CBA$ is equal to **1**



(A) 70° (B) 50°

(C) 65° (D) 40°

18. After an examination, a teacher wants to know the marks obtained by maximum number of the students in her class. She requires to calculate _____ of marks. **1**

(A) median (B) mode

(C) mean (D) range

निर्देश : प्रश्न **19** तथा **20** में प्रत्येक प्रश्न में एक **अभिकथन (A)** के बाद एक **तर्क कथन (R)** दिया है । निम्न में से सही विकल्प चुनिए :

(A) दोनों अभिकथन (A) तथा तर्क कथन (R) सत्य हैं । तर्क कथन (R), अभिकथन (A) की व्याख्या करता है ।

(B) दोनों अभिकथन (A) तथा तर्क कथन (R) सत्य हैं । तर्क कथन (R), अभिकथन (A) की व्याख्या नहीं करता है ।

(C) अभिकथन (A) सत्य है परन्तु तर्क कथन (R) असत्य है ।

(D) अभिकथन (A) असत्य है जबकि तर्क कथन (R) सत्य है ।

19. **अभिकथन (A) :** यदि $\sin A = \frac{1}{3}$ $(0° < A < 90°)$ है, तो $\cos A$ का मान $\frac{2\sqrt{2}}{3}$ है । –

तर्क कथन (R) : सभी कोण θ के लिए $\sin^2 \theta + \cos^2 \theta = 1$. **1**

20. **अभिकथन (A) :** 10 cm भुजा वाले दो घनों को किनारे मिलाकर रखने से बने नये घनाभ का संपूर्ण पृष्ठीय क्षेत्रफल 1200 cm^2 है ।

तर्क कथन (R) : घन, जिसकी भुजा 10 cm है, के प्रत्येक फलक का क्षेत्रफल 100 cm^2 है । **1**

खण्ड – ख

इस खण्ड में 5 प्रश्न हैं तथा प्रत्येक के 2 अंक हैं ।

21. क्या संख्या $(15)^n$, एक प्राकृत संख्या n के लिए, अंक 0 पर समाप्त हो सकती है ? कारण दीजिए । **2**

Directions : In Question **19** and **20**, **Assertion (A)** and **Reason (R)** are given. Select the correct option from the following :

(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A).

(C) Assertion (A) is true but Reason (R) is not true.

(D) Assertion (A) is not true but Reason (R) is true.

19. **Assertion (A) :** If $\sin A = \frac{1}{3}$ $(0° < A < 90°)$, then the value of $\cos A$ is $\frac{2\sqrt{2}}{3}$

Reason (R) : For every angle θ, $\sin^2\theta + \cos^2\theta = 1$. **1**

20. **Assertion (A) :** Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm^2.

Reason (R) : Area of each surface of a cube of side 10 cm is 100 cm^2. **1**

SECTION – B

In this section, there are 5 questions of 2 marks each.

21. Can the number $(15)^n$, n being a natural number, end with the digit 0 ? Give reasons. **2**

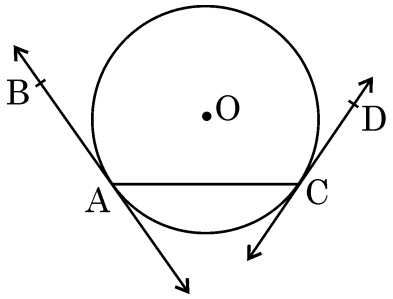
22. ज्ञात कीजिए कि शीर्षों A(1, 0), B(–5, 0) तथा C(–2, 5) से बनी त्रिभुज ABC कैसी त्रिभुज है । **2**

23. (a) $2 \sin^2 30° \sec 60° + \tan^2 60°$ का मान ज्ञात कीजिए । **2**

अथवा

(b) यदि $2 \sin (A + B) = \sqrt{3}$ तथा $\cos (A - B) = 1$ है, तो कोण A तथा B की माप ज्ञात कीजिए, $0 \leq A, B, (A + B) \leq 90°$. **2**

24. दी गई आकृति में, AB तथा CD, केंद्र O वाले वृत्त की दो स्पर्श-रेखाएँ हैं । क्या $\angle BAC = \angle DCA$? अपने उत्तर की पुष्टि कीजिए । **2**



25. (a) बिंदुओं (3, –5) तथा (–1, 6) को मिलाने वाला रेखाखण्ड रेखा $y = x$ द्वारा किस अनुपात में विभाजित होता है ? **2**

अथवा

(b) A(3, 0), B(6, 4) तथा C(–1, 3) एक ΔABC के शीर्ष हैं । माध्यिका BE की लंबाई ज्ञात कीजिए । **2**

खण्ड – ग

इस खण्ड में 6 प्रश्न हैं तथा प्रत्येक के 3 अंक हैं ।

26. (a) यदि एक समांतर श्रेढ़ी (A.P.) के प्रथम m पदों का योगफल इसके प्रथम n पदों ($m \neq n$) के योगफल के समान है, तो दर्शाइए कि इसके प्रथम $(m + n)$ पदों का योगफल शून्य है । **3**

अथवा

(b) एक समांतर श्रेढ़ी के तीन क्रमागत पदों का योगफल 24 है तथा इनके वर्गों का योगफल 194 है । संख्याएँ ज्ञात कीजिए । **3**

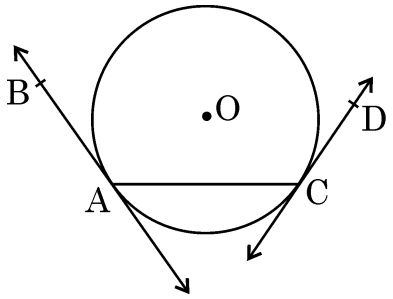
22. Find the type of triangle ABC formed whose vertices are A(1, 0), B(–5, 0) and C(–2, 5). **2**

23. (a) Evaluate : $2 \sin^2 30° \sec 60° + \tan^2 60°$. **2**

OR

(b) If $2 \sin (A + B) = \sqrt{3}$ and $\cos (A - B) = 1$, then find the measures of angles A and B. $0 \leq A, B, (A + B) \leq 90°$. **2**

24. In the given figure, AB and CD are tangents to a circle centred at O. Is $\angle BAC = \angle DCA$? Justify your answer. **2**



25. (a) In what ratio is the line segment joining the points (3, –5) and (–1, 6) divided by the line $y = x$? **2**

OR

(b) A(3, 0), B(6, 4) and C(–1, 3) are vertices of a triangle ABC. Find length of its median BE. **2**

SECTION – C

This section consists of 6 questions of 3 marks each.

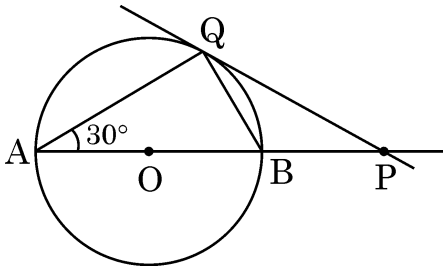
26. (a) If the sum of first m terms of an A.P. is same as sum of its first n terms ($m \neq n$), then show that the sum of its first (m + n) terms is zero. **3**

OR

(b) In an A.P., the sum of three consecutive terms is 24 and the sum of their squares is 194. Find the numbers. **3**

27. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है । **3**

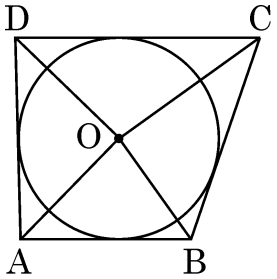
28. (a) दी गई आकृति में, केंद्र O वाले वृत्त की एक स्पर्श-रेखा PQ है तथा $\angle BAQ = 30°$ है, तो दर्शाइए कि $BP = BQ$ । **3**



अथवा

(b) दी गई आकृति में, AB, BC, CD तथा DA केंद्र O वाले वृत्त की स्पर्श-रेखाएँ हैं जो एक चतुर्भुज ABCD बनाती हैं । दर्शाइए कि **3**

$$\angle AOB + \angle COD = 180°$$



29. सिद्ध कीजिए : $\frac{1 + \sec\theta - \tan\theta}{1 + \sec\theta + \tan\theta} = \frac{1 - \sin\theta}{\cos\theta}$. **3**

30. एक परीक्षा में 100 विद्यार्थियों के 50 में से प्राप्त अंक नीचे दिए गए हैं : **3**

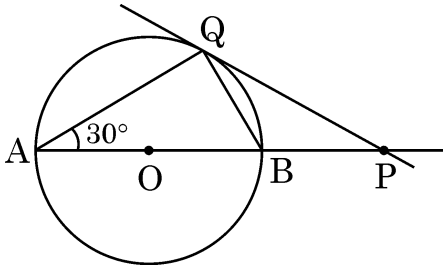
प्राप्तांक :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
विद्यार्थियों की संख्या :	12	23	34	25	6

विद्यार्थियों द्वारा प्राप्त अंकों का माध्य ज्ञात कीजिए ।

31. 2-अंकों की एक संख्या में इकाई का अंक इसके दहाई के अंक से 5 कम है । दोनों अंकों का गुणनफल 36 है । संख्या ज्ञात कीजिए । **3**

27. Prove that $\sqrt{5}$ is an irrational number. **3**

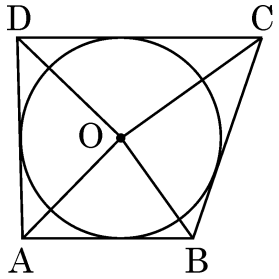
28. (a) In the given figure, PQ is tangent to a circle centred at O and $\angle BAQ = 30°$; show that BP = BQ. **3**



OR

(b) In the given figure, AB, BC, CD and DA are tangents to the circle with centre O forming a quadrilateral ABCD. **3**

Show that $\angle AOB + \angle COD = 180°$



29. Prove that $\frac{1 + \sec\theta - \tan\theta}{1 + \sec\theta + \tan\theta} = \frac{1 - \sin\theta}{\cos\theta}$. **3**

30. In a test, the marks obtained by 100 students (out of 50) are given below : **3**

Marks obtained :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of students :	12	23	34	25	6

Find the mean marks of the students.

31. In a 2-digit number, the digit at the unit's place is 5 less than the digit at the ten's place. The product of the digits is 36. Find the number. **3**

खण्ड – घ

इस खण्ड में 4 प्रश्न हैं । प्रत्येक प्रश्न 5 अंकों का है ।

32. (a) आलेखीय विधि द्वारा निम्न समीकरण निकाय का हल ज्ञात कीजिए : **5**

$3x + y + 4 = 0$ तथा $3x - y + 2 = 0$

अथवा

(b) तारा ने एक परीक्षा में 40 अंक प्राप्त किए जबकि प्रत्येक सही उत्तर के 3 अंक मिले तथा प्रत्येक गलत उत्तर का 1 अंक कटा था । यदि प्रत्येक सही उत्तर के 4 अंक मिलें तथा प्रत्येक गलत उत्तर के 2 अंक कटें, तो उसे 50 अंक मिलेंगे । यह मानते हुए कि उसने सभी प्रश्नों के उत्तर दिए हैं, तो कुल प्रश्नों की संख्या ज्ञात कीजिए । **5**

33. (a) यदि किसी त्रिभुज की एक भुजा के समांतर अन्य दो भुजाओं को भिन्न-भिन्न बिंदुओं पर प्रतिच्छेद करने के लिए एक रेखा खींची जाए, तो सिद्ध कीजिए कि ये अन्य दो भुजाएँ एक ही अनुपात में विभाजित हो जाती हैं । **5**

अथवा

(b) एक त्रिभुज ABC की भुजाएँ AB और AC तथा माध्यिका AD एक अन्य त्रिभुज PQR की भुजाओं PQ और PR तथा माध्यिका PM के क्रमशः समानुपाती हैं । दर्शाइए कि $\Delta ABC \sim \Delta PQR$ । **5**

34. ऊँचाई 45 m वाले एक लाइट हाउस के शिखर से, इसकी विपरीत दिशाओं से आने वाले दो जहाजों के अवनमन कोण 30° तथा 60° पाए गए हैं । यदि जहाजों को मिलान वाली रेखा लाइट हाउस के आधार से गुजरती है, तो जहाजों के बीच की दूरी ज्ञात कीजिए । ($\sqrt{3} = 1.73$ लीजिए ।) **5**

35. 5.6 m त्रिज्या के एक वृत्त के एक त्रिज्यखण्ड का परिमाप 20.0 m है । त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए । **5**

SECTION – D

This section consists of 4 questions of 5 marks each.

32. (a) Using graphical method, solve the following system of equations : **5**

$3x + y + 4 = 0$ and $3x - y + 2 = 0$

OR

(b) Tara scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each wrong answer, then Tara would have scored 50 marks. Assuming that Tara attempted all questions, find the total number of questions in the test. **5**

33. (a) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio. **5**

OR

(b) Sides AB and AC and median AD to ΔABC are respectively proportional to sides PQ and PR and median PM of another triangle PQR. Show that $\Delta ABC \sim \Delta PQR$. **5**

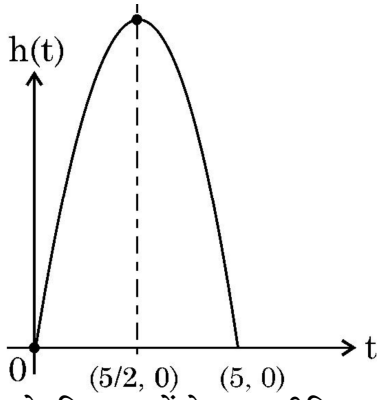
34. From the top of a 45 m high light house, the angles of depression of two ships, on the opposite side of it, are observed to be 30° and 60°. If the line joining the ships passes through the foot of the light house, find the distance between the ships. (Use $\sqrt{3} = 1.73$) **5**

35. The perimeter of a certain sector of a circle of radius 5.6 m is 20.0 m. Find the area of the sector. **5**

खण्ड – ङ

इस खण्ड में 3 प्रकरण आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं ।

36. एक गेंद हवा में इस प्रकार फेंकी गई कि t सेकण्ड के बाद इसकी ऊँचाई, अपने आरम्भिक बिंदु से h मीटर है तथा बहुपद $h = 25t - 5t^2$ द्वारा व्यक्त की गई है ।



बहुपद के ग्राफ का अवलोकन करके निम्न प्रश्नों के उत्तर दीजिए :

(i) दिए गए बहुपद के शून्यक लिखिए । **1**

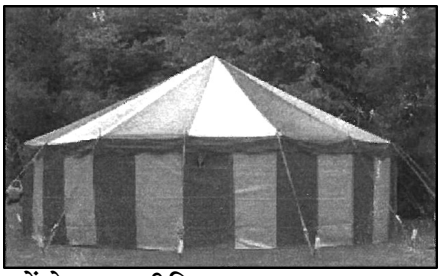
(ii) गेंद द्वारा प्राप्त की गई अधिकतम दूरी ज्ञात कीजिए । **1**

(iii) (a) ऊपर फेंकने के कितने समय के पश्चात् गेंद 30 m की ऊँचाई पर होगी ? **2**

अथवा

(iii) (b) जब गेंद की ऊँचाई 20 m है तो t के दो विभिन्न मान ज्ञात कीजिए । **2**

37. 'सर्कस' शब्द मूलत: सर्कल (वृत्त) के समान ही है । एक बंद गोलाकार क्षेत्र में मानव कौशल और पशु प्रशिक्षण सहित विभिन्न मनोरंजन कार्यक्रम भीड़ के सामने प्रस्तुत किए जाते हैं ।
एक सर्कस का टैंट 8 m की ऊँचाई तक बेलनाकार है तथा इसके ऊपर शंक्वाकार है । आधार का व्यास 28 m है तथा टैंट की कुल ऊँचाई 18.5 m है ।



उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) शंक्वाकार भाग की तिर्यक ऊँचाई ज्ञात कीजिए । **1**

(ii) टैंट के फर्श का क्षेत्रफल ज्ञात कीजिए । **1**

(iii) (a) टैंट बनाने में प्रयोग होने वाले कपड़े का क्षेत्रफल ज्ञात कीजिए । **2**

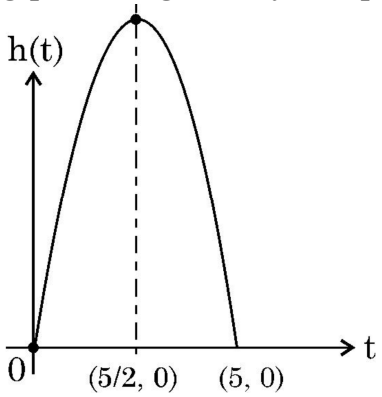
अथवा

(iii) (b) इस खाली टैंट में हवा का कुल आयतन ज्ञात कीजिए । **2**

SECTION – E

This section consists of 3 case based questions of 4 marks each.

36. A ball is thrown in the air so that t seconds after it is thrown, its height h metre above its starting point is given by the polynomial $h = 25t - 5t^2$.



Observe the graph of the polynomial and answer the following questions :

(i) Write zeroes of the given polynomial. **1**

(ii) Find the maximum height achieved by ball. **1**

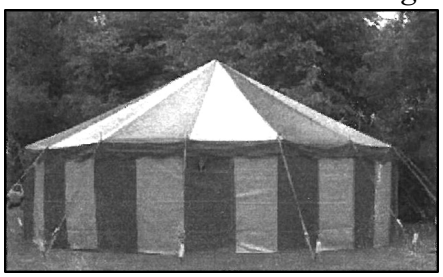
(iii) (a) After throwing upward, how much time did the ball take to reach to the height of 30 m ? **2**

OR

(iii) (b) Find the two different values of t when the height of the ball was 20 m. **2**

37. The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.

A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.



Based on the above, answer the following questions :

(i) Find slant height of the conical part. **1**

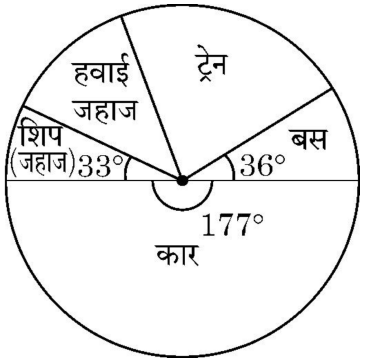
(ii) Determine the floor area of the tent. **1**

(iii) (a) Find area of the cloth used for making tent. **2**

OR

(iii) (b) Find total volume of air inside an empty tent. **2**

38. छुट्टियों के दिनों के एक सर्वे में 120 व्यक्तियों से अपनी पिछली छुट्टियों में प्रयोग किए गए वाहन के प्रकार के बारे में पूछा गया । निम्न पाई–चार्ट इस सर्वे के परिणाम बताता है ।



पाई–चार्ट के अवलोकन से निम्न प्रश्नों के उत्तर दीजिए :

(i) यदि यादृच्छया एक व्यक्ति चुना गया, तो उसके बस अथवा शिप (जहाज) द्वारा यात्रा करने की प्रायिकता ज्ञात कीजिए । **1**

(ii) सबसे अधिक प्रचलित/पसंदीदा परिवहन का साधन कौन सा है और कितने लोगों ने इसका उपयोग किया ? **1**

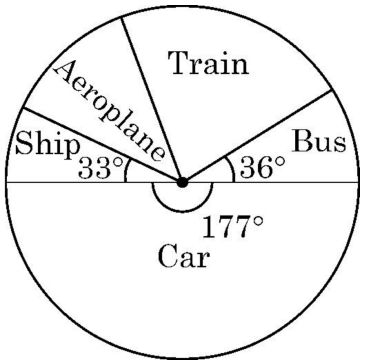
(iii) (a) एक यादृच्छया चुने गए व्यक्ति के ट्रेन द्वारा न जाने की प्रायिकता 4/5 है तो ज्ञात कीजिए कितने लोगों ने ट्रेन का प्रयोग किया ? **2**

अथवा

(iii) (b) एक यादृच्छया चुने गए व्यक्ति द्वारा हवाई जहाज के प्रयोग करने की प्रायिकता 7/60 है, तो हवाई कम्पनी द्वारा अर्जित आय ज्ञात कीजिए, यदि उन्होंने प्रति व्यक्ति ₹ 5,000 लिए । **2**

———————

38. In a survey on holidays, 120 people were asked to state which type of transport they used on their last holiday. The following pie chart shows the results of the survey.



Observe the pie chart and answer the following questions :

(i) If one person is selected at random, find the probability that he/she travelled by bus or ship. **1**

(ii) Which is most favourite mode of transport and how many people used it ? **1**

(iii) (a) A person is selected at random. If the probability that he did not use train is 4/5, find the number of people who used train. **2**

OR

(iii) (b) The probability that randomly selected person used aeroplane is 7/60. Find the revenue collected by air company at the rate of ₹ 5,000 per person. **2**

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/2/1

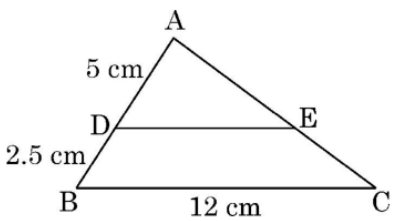
General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. Its' leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class- X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (√) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

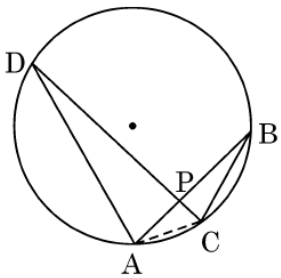
9	**<u>In Q1-Q20, if a candidate attempts the question more than once (without canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".</u>**
10	**<u>In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".</u>**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past :- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

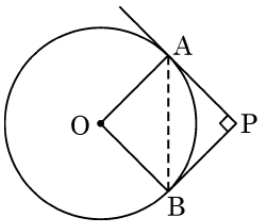
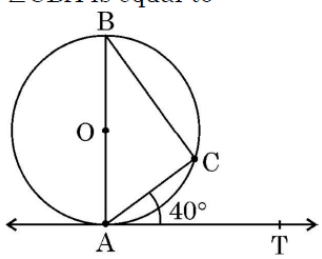
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/2/1)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section consists of 20 questions of 1 mark each.**	
1.	The value of k for which the system of equations $3x - y + 8 = 0$ and $6x - ky + 16 = 0$ has infinitely many solutions, is (A) -2 (B) 2 (C) $\frac{1}{2}$ (D) $-\frac{1}{2}$	
Sol.	(B) 2	**1**
2.	Point P divides the line segment joining the points A(4, –5) and B(1, 2) in the ratio 5:2. Co-ordinates of point P are (A) $\left(\frac{5}{2}, \frac{-3}{2}\right)$ (B) $\left(\frac{11}{7}, 0\right)$ (C) $\left(\frac{13}{7}, 0\right)$ (D) $\left(0, \frac{13}{7}\right)$	
Sol.	(C) $\left(\frac{13}{7}, 0\right)$	**1**

3.	The common difference of an A.P. in which $a_{15} - a_{11} = 48$, is (A) 12 (B) 16 (C) –12 (D) –16	
Sol.	(A) 12	**1**
4.	The quadratic equation $x^2 + x + 1 = 0$ has _____ roots. (A) real and equal (B) irrational (C) real and distinct (D) not-real	
Sol.	(D) not-real	**1**
5.	If the HCF (2520, 6600) = 40 and LCM (2520, 6600) = 252 × k, then the value of k is (A) 1650 (B) 1600 (C) 165 (D) 1625	
Sol.	(A) 1650	**1**
6.	In the given figure ΔABC is shown. DE is parallel to BC. If AD = 5 cm, DB = 2.5 cm and BC = 12 cm, then DE is equal to  (A) 10 cm (B) 6 cm (C) 8 cm (D) 7.5 cm	
Sol.	(C) 8 cm	**1**

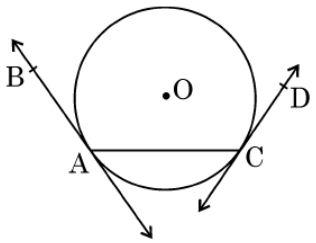
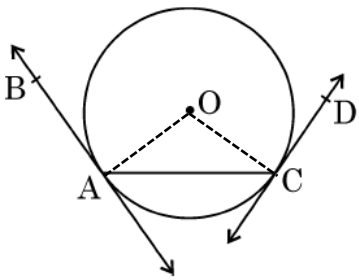
7.	If $\sin\theta = \cos\theta$, $(0° < \theta < 90°)$, then value of $(\sec\theta \cdot \sin\theta)$ is : (A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$ (C) 1 (D) 0	
Sol.	(C) 1	**1**
8.	Two dice are rolled together. The probability of getting the sum of the two numbers to be more than 10, is (A) $\frac{1}{9}$ (B) $\frac{1}{6}$ (C) $\frac{7}{12}$ (D) $\frac{1}{12}$	
Sol.	(D) $\mathbf{\frac{1}{12}}$	**1**
9.	If α and β are zeroes of the polynomial $5x^2 + 3x - 7$, the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is (A) $-\frac{3}{7}$ (B) $\frac{3}{5}$ (C) $\frac{3}{7}$ (D) $-\frac{5}{7}$	
Sol.	(C) $\mathbf{\frac{3}{7}}$	**1**
10.	The perimeters of two similar triangles ABC and PQR are 56 cm and 48 cm respectively. PQ/AB is equal to (A) $\frac{7}{8}$ (B) $\frac{6}{7}$ (C) $\frac{7}{6}$ (D) $\frac{8}{7}$	
Sol.	(B) $\mathbf{\frac{6}{7}}$	**1**

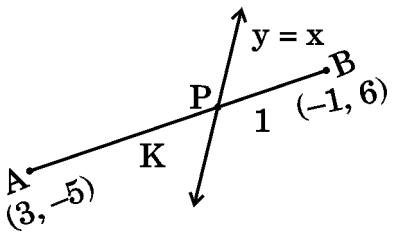
11.	AB and CD are two chords of a circle intersecting at P. Choose the correct statement from the following :  (A) $\Delta ADP \sim \Delta CBA$ (B) $\Delta ADP \sim \Delta BPC$ (C) $\Delta ADP \sim \Delta BCP$ (D) $\Delta ADP \sim \Delta CBP$	
Sol.	(D) $\Delta ADP \sim \Delta CBP$	**1**
12.	If value of each observation in a data is increased by 2, then median of the new data (A) increases by 2 (B) increases by 2n (C) remains same (D) decreases by 2	
Sol.	(A) increases by 2	**1**
13.	A box contains cards numbered 6 to 55. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square, is (A) $\frac{7}{50}$ (B) $\frac{7}{55}$ (C) $\frac{1}{10}$ (D) $\frac{5}{49}$	
Sol.	(C) $\mathbf{\frac{1}{10}}$	**1**

14.	In the given figure, tangents PA and PB to the circle centred at O, from point P are perpendicular to each other. If PA = 5 cm, then length of AB is equal to  (A) 5 cm (B) $5\sqrt{2}$ cm (C) $2\sqrt{5}$ cm (D) 10 cm	
Sol.	(B) $5\sqrt{2}$ cm	**1**
15.	XOYZ is a rectangle with vertices X(–3, 0), O(0, 0), Y(0, 4) and Z(x, y). The length of its each diagonal is (A) 5 units (B) $\sqrt{5}$ units (C) $x^2 + y^2$ units (D) 4 units	
Sol.	(A) 5 units	**1**
16.	Which term of the A.P. –29, –26, –23, ..., 61 is 16 ? (A) 11^{th} (B) 16^{th} (C) 10^{th} (D) 31^{st}	
Sol.	(B) 16^{th}	**1**
17.	In the given figure, AT is tangent to a circle centred at O. If ∠CAT = 40°, then ∠CBA is equal to  (A) 70° (B) 50° (C) 65° (D) 40°	
Sol.	(D) 40°	**1**

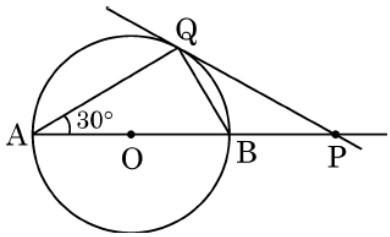
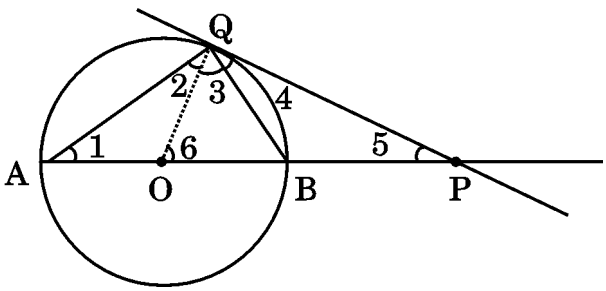
18.	After an examination, a teacher wants to know the marks obtained by maximum number of the students in her class. She requires to calculate _____ of marks. (A) median (B) mode (C) mean (D) range	
Sol.	(B) mode	**1**
	Directions : In Question **19** and **20**, **Assertion (A)** and **Reason (R)** are given. Select the correct option from the following : (A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A). (C) Assertion (A) is true but Reason (R) is not true. (D) Assertion (A) is not true but Reason (R) is true.	
19.	**Assertion (A) :** If $\sin A = \frac{1}{3}$ $(0° < A < 90°)$, then the value of cos A is $\frac{2\sqrt{2}}{3}$ **Reason (R) :** For every angle θ, $\sin^2\theta + \cos^2\theta = 1$.	
Sol.	(A) Both Assertion (A) and (R) are true. Reason (R) is the correct explanation of Assertion (A)	**1**
20.	**Assertion (A) :** Two cubes each of edge length 10 cm are joined together. The total surface area of newly formed cuboid is 1200 cm^2. **Reason (R) :** Area of each surface of a cube of side 10 cm is 100 cm^2.	
Sol.	(D) Assertion (A) is not true but Reason (R) is true.	**1**

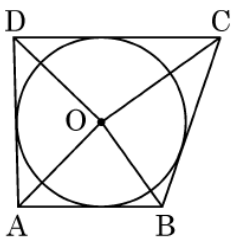
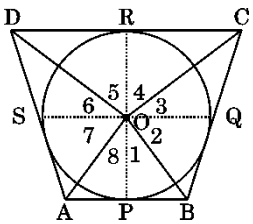
	SECTION B **In this section, there are 5 questions of 2 marks each.**	
21.	Can the number $(15)^n$, n being a natural number, end with the digit 0 ? Give reasons.	
Sol.	$\mathbf{15^n = 5^n \times 3^n}$ A number ends with zero if it has two prime factors 2 and 5 both. Since $\mathbf{15^n}$ does not have 2 as a prime factor, so it can't end with zero	**1** **1**
22.	Find the type of triangle ABC formed whose vertices are A(1, 0), B(–5, 0) and C(–2, 5).	
Sol.	A $(1, 0)$ B $(-5, 0)$ C$(-2, 5)$ $AB = \sqrt{(-5-1)^2 + (0-0)^2} = 6$ $BC = \sqrt{(-5+2)^2 + (0-5)^2} = \sqrt{34}$ $CA = \sqrt{(1+2)^2 + (0-5)^2} = \sqrt{34}$ $\therefore BC = CA$ So, ΔABC is isosceles.	½ ½ ½ ½
23(a).	Evaluate : $2 \sin^2 30° \sec 60° + \tan^2 60°$.	
Sol.	$2sin^2 30° \sec 60° + tan^2 60°$ $= 2 \times \left(\frac{1}{2}\right)^2 \times 2 + \left(\sqrt{3}\right)^2$ $= 4$	**1½** ½
	OR	
23(b).	If $2 \sin (A + B) = \sqrt{3}$ and $\cos (A - B) = 1$, then find the measures of angles A and B. $0 \leq A, B, (A + B) \leq 90°$.	
Sol.	$\sin(A + B) = \frac{\sqrt{3}}{2} \Rightarrow A + B = 60° \ldots (1)$	½

	$\cos(A - B) = 1 \Rightarrow A - B = 0° \ldots (2)$ Solving (1) and (2), we get $A = B = 30°$	½ **1**
24.	In the given figure, AB and CD are tangents to a circle centred at O. Is $\angle BAC = \angle DCA$? Justify your answer.  	
Sol.	 Join OA and OC $OA = OC$ $\angle OAC = \angle OCA$ Also, $\angle OAB = \angle OCD$ $\Rightarrow \angle OAC + \angle OAB = \angle OCA + \angle OCD$ $\Rightarrow \angle BAC = \angle DCA$	 ½ ½ ½ ½

25(a).	In what ratio is the line segment joining the points (3, –5) and (–1, 6) divided by the line y = x ?	
Sol.	 Let the required ratio be K:1 Coordinates of point P are $\left(\frac{-K+3}{K+1}, \frac{6K-5}{K+1}\right)$ Point P lies on line y = x $\Rightarrow \frac{-K+3}{K+1} = \frac{6K-5}{K+1}$ Solving, we get K = $\frac{8}{7}$ ∴ Required ratio is 8: 7	**1** ½ ½
	OR	
25(b).	A(3, 0), B(6, 4) and C(–1, 3) are vertices of a triangle ABC. Find length of its median BE.	
Sol.	Mid-point of AC is $E\left(1, \frac{3}{2}\right)$ Length of median BE $= \sqrt{(6-1)^2 + (4-\frac{3}{2})^2} = \sqrt{\frac{125}{4}}$ or $\frac{5\sqrt{5}}{2}$	**1** **1**
	SECTION C **This section consists of 6 questions of 3 marks each.**	

26(a).	If the sum of first m terms of an A.P. is same as sum of its first n terms ($m \neq n$), then show that the sum of its first $(m + n)$ terms is zero.	
Sol.	$\mathbf{S_m = S_n}$ $\mathbf{\Rightarrow \frac{m}{2}[2a + (m-1)d = \frac{n}{2}[2a + (n-1)d]}$ $\mathbf{\Rightarrow 2a(m-n) = d(n^2 - m^2) - d(n-m)}$ $\mathbf{\Rightarrow 2a = -d(m+n-1)}$ $\mathbf{or\ 2a + (m+n-1)d = 0}$ $\mathbf{i.e., S_{m+n} = \frac{m+n}{2}[2a + (m+n-1)d] = 0}$	**1** **1** ½ ½
	OR	
26(b).	In an A.P., the sum of three consecutive terms is 24 and the sum of their squares is 194. Find the numbers.	
Sol.	Let the numbers be $a - d, a, a + d$ $\therefore a - d + a + a + d = 24$ $\Rightarrow a = 8$ Also, $(a-d)^2 + a^2 + (a+d)^2 = 194$ $\Rightarrow (8-d)^2 + 8^2 + (8+d)^2 = 194$ $\Rightarrow d^2 = 1 \Rightarrow d = \pm 1$ $\therefore$ Numbers are 7, 8, 9 or 9,8,7	½ ½ **1** ½ ½
27.	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\mathbf{\sqrt{5}}$ be a rational number. $\therefore \mathbf{\sqrt{5} = \frac{p}{q}}$, where $q \neq 0$ and let p & q be co-prime. $5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5 ----- (i) $\Rightarrow p = 5a$, where 'a' is some integer $25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-prime. $\therefore \mathbf{\sqrt{5}}$ is an irrational number.	½ **1** **1** ½

28(a).	In the given figure, PQ is tangent to a circle centred at O and $\angle BAQ = 30°$; show that BP = BQ.  	
Sol.	 	
	Join OQ	½
	OQ=OA	
	$\Rightarrow \angle 2 = 30^0$	½
	$\angle 3 = 90^0 - 30^0 = 60^0$	½
	$\angle 4 = 90^0 - 60^0 = 30^0$	½
	$\angle 6 = \angle 1 + \angle 2 = 60^0$	½
	Hence $\angle 5 = 90^0 - 60^0 = 30^0 = \angle 4$	½
	$\therefore$ BP=BQ	
	OR	

28(b).	In the given figure, AB, BC, CD and DA are tangents to the circle with centre O forming a quadrilateral ABCD. Show that $\angle AOB + \angle COD = 180°$  	
Sol.	 Join OP, OQ, OR and OS $\Delta POB \cong \Delta QOB$ $\Rightarrow \angle 1 = \angle 2$ Similarly $\angle 3 = \angle 4, \angle 5 = \angle 6, \angle 7 = \angle 8$ Now, $\angle 1+\angle 2+\angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360°$ $\Rightarrow 2(\angle 1+\angle 8 + \angle 4 + \angle 5) = 360°$ $\therefore \angle AOB + \angle COD = 180°$	½ **1** ½ ½ ½

29.

Prove that $\frac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta}=\frac{1-\sin\theta}{\cos\theta}$.

Sol.

$$\text{LHS} = \frac{(\sec^2\theta-\tan^2\theta)+(\sec\theta-\tan\theta)}{1+\sec\theta+\tan\theta}$$

$$= \frac{(\sec\theta-\tan\theta)(\sec\theta+\tan\theta+1)}{1+\sec\theta+\tan\theta}$$

$$= \sec\theta-\tan\theta$$

$$= \frac{1}{\cos\theta}-\frac{\sin\theta}{\cos\theta}$$

$$= \frac{1-\sin\theta}{\cos\theta} = \text{RHS}$$

1

1

1

30.

In a test, the marks obtained by 100 students (out of 50) are given below :

Marks obtained :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of students :	12	23	34	25	6

Find the mean marks of the students.

Sol.

Marks Obtained	Number of students ($\mathbf{f_i}$)	$\mathbf{x_i}$	$\mathbf{f_ix_i}$
0 – 10	12	5	60
10 – 20	23	15	345
20 – 30	34	25	850
30 – 40	25	35	875
40 – 50	6	45	270
Total	100		2400

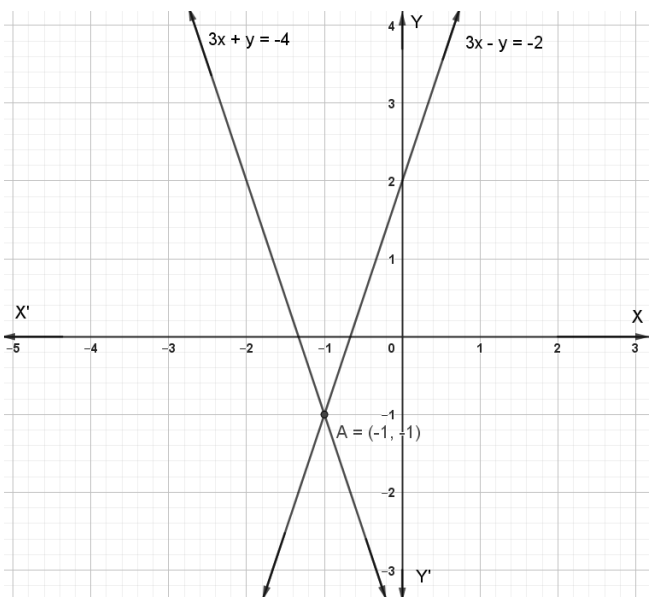
1½ marks for correct table

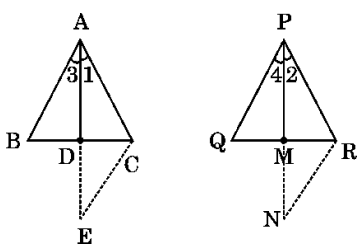
$$\text{Mean} = \frac{2400}{100}$$

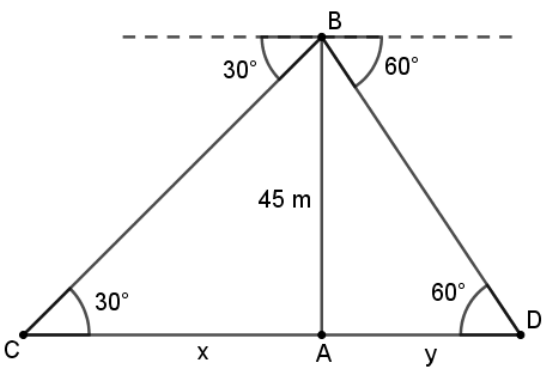
$$= 24$$

1

½

31.	In a 2-digit number, the digit at the unit's place is 5 less than the digit at the ten's place. The product of the digits is 36. Find the number.	
Sol.	Let digit at ten's place be x then digit at unit's place = $\mathbf{x-5}$ $x(x-5) = 36$ $\Rightarrow x^2 - 5x - 36 = 0$ $(x-9)(x+4) = 0$ $x \neq -4$ so, $x = 9$ $\therefore$ Required number is 94	½ ½ ½ ½ ½ ½
	SECTION D **This section consists of 4 questions of 5 marks each.**	
32(a).	Using graphical method, solve the following system of equations : $3x + y + 4 = 0$ and $3x - y + 2 = 0$	
Sol.	 Correct solution $\mathbf{x = -1, y = -1}$	**2 marks for each correct line** **1**
	OR	

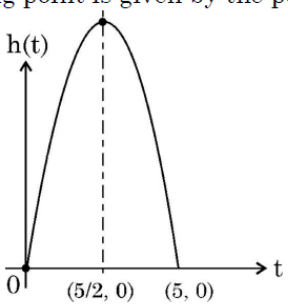
32(b).	Tara scored 40 marks in a test, getting 3 marks for each right answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each wrong answer, then Tara would have scored 50 marks. Assuming that Tara attempted all questions, find the total number of questions in the test.	
Sol.	Let number of correct answers be x and number of incorrect answers be y $3x - y = 40$ $4x - 2y = 50$ Solving, we get $x = 15$, $y = 5$ $\therefore$ Total number of questions = 20	 **1½** **1½** **1** **1**
33(a).	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.	
Sol.	Correct Given, to prove, figure, construction Correct proof	**½ ×4=2** **3**
	OR	
33(b).	Sides AB and AC and median AD to ΔABC are respectively proportional to sides PQ and PR and median PM of another triangle PQR. Show that $\Delta ABC \sim \Delta PQR$.	
Sol.	 Correct figure	 **1**

	Produce AD to E such that AD = DE and join EC Produce PM to N such that PM = MN and join NR $\Delta ADB \cong \Delta EDC$ $\therefore$ AB = EC Similarly, PQ=NR Since, $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$ $\Rightarrow \frac{EC}{NR} = \frac{AC}{PR} = \frac{\frac{AE}{2}}{\frac{PN}{2}}$ $\therefore \Delta AEC \sim \Delta PNR$ $\Rightarrow \angle 1 = \angle 2$ Similarly, $\angle 3 = \angle 4$ Hence $\angle 1 + \angle 3 = \angle 2 + \angle 4$ or $\angle A = \angle P$ Also, $\frac{AB}{PQ} = \frac{AC}{PR}$ $\therefore \Delta ABC \sim \Delta PQR$	½ **1** **1** ½ ½ ½
34.	From the top of a 45 m high light house, the angles of depression of two ships, on the opposite side of it, are observed to be 30° and 60°. If the line joining the ships passes through the foot of the light house, find the distance between the ships. (Use $\sqrt{3} = 1.73$)	
Sol.	 Let AB be the light house and C and D be positions of ships.	**1 mark for correct figure**

	$\tan 60° = \sqrt{3} = \frac{45}{y}$ $\Rightarrow y = 15\sqrt{3}$ $\tan 30° = \frac{1}{\sqrt{3}} = \frac{45}{x}$ $\Rightarrow x = 45\sqrt{3}$ Distance between two ships = x+y = $60\sqrt{3}$ $= 60 \times 1.73 = 103.8$ m	**1** **½** **1** **½** **1**
35.	The perimeter of a certain sector of a circle of radius 5.6 m is 20.0 m. Find the area of the sector.	
Sol.	$2r + \frac{2\pi r\theta}{360} = 20$ $\Rightarrow 11.2 + 2 \times \frac{22}{7} \times 5.6 \times \frac{\theta}{360} = 20$ Solving, we get $\theta = 90°$ $\therefore$ Area of sector = $\frac{22}{7} \times 5.6 \times 5.6 \times \frac{90}{360}$ $= 24.64\ m^2$	**2** **1** **1** **1**
	SECTION E **This section consists of 3 case based questions of 4 marks each.**	

36.

A ball is thrown in the air so that t seconds after it is thrown, its height h metre above its starting point is given by the polynomial $h = 25t - 5t^2$.



Observe the graph of the polynomial and answer the following questions :

(i) Write zeroes of the given polynomial. **1**

(ii) Find the maximum height achieved by ball. **1**

(iii) (a) After throwing upward, how much time did the ball take to reach to the height of 30 m ? **2**

OR

(iii) (b) Find the two different values of t when the height of the ball was 20 m. **2**

Sol.

(i) Zeroes of the polynomial are 0 and 5 **1**

(ii) Maximum height achieved by ball

$= 25 \times \frac{5}{2} - 5 \times \left(\frac{5}{2}\right)^2$ ½

$= \frac{125}{4}$ or 31.25 m ½

(iii) (a) $-5t^2 + 25t = 30$ ½

$\Rightarrow t^2 - 5t + 6 = 0$ ½

$\Rightarrow (t-2)(t-3) = 0$ ½

$t \neq 3,\ t = 2$ ½

OR

(iii) (b) $-5t^2 + 25t = 20$ ½

$\Rightarrow t^2 - 5t + 4 = 0$ ½

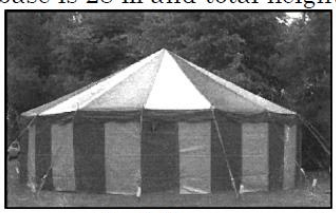
$\Rightarrow (t-4)(t-1) = 0$ ½

$\Rightarrow t = 4, 1$ ½

37.

The word 'circus' has the same root as 'circle'. In a closed circular area, various entertainment acts including human skill and animal training are presented before the crowd.

A circus tent is cylindrical upto a height of 8 m and conical above it. The diameter of the base is 28 m and total height of tent is 18.5 m.



Based on the above, answer the following questions :

(i) Find slant height of the conical part. **1**

(ii) Determine the floor area of the tent. **1**

(iii) (a) Find area of the cloth used for making tent. **2**

OR

(iii) (b) Find total volume of air inside an empty tent. **2**

Sol.

(i) Height of conical part $= 18.5 - 8 = 10.5$ m **½**

Radius of conical part $= 14$ m

Slant height $= \sqrt{(10.5)^2 + (14)^2} = 17.5$ m **½**

(ii) Floor area $= \frac{22}{7} \times 14 \times 14 = 616\ \text{m}^2$ **1**

(iii) (a) Area of cloth used

$= 2 \times \frac{22}{7} \times 14 \times 8 + \frac{22}{7} \times 14 \times 17.5$ **1**

$= 1474\ \text{m}^2$ **1**

OR

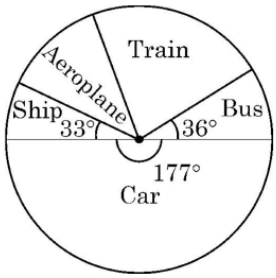
(iii) (b) Volume of air inside the tent

$= \frac{22}{7} \times 14 \times 14 \times 8 + \frac{1}{3} \times \frac{22}{7} \times 14 \times 14 \times 10.5$ **1**

$= 7084\ \text{m}^3$ **1**

38.

In a survey on holidays, 120 people were asked to state which type of transport they used on their last holiday. The following pie chart shows the results of the survey.



Observe the pie chart and answer the following questions :

(i) If one person is selected at random, find the probability that he/she travelled by bus or ship. **1**

(ii) Which is most favourite mode of transport and how many people used it ? **1**

(iii) (a) A person is selected at random. If the probability that he did not use train is 4/5, find the number of people who used train. **2**

OR

(iii) (b) The probability that randomly selected person used aeroplane is 7/60. Find the revenue collected by air company at the rate of ₹ 5,000 per person. **2**

Sol.

(i) P (travelling by bus or ship) = $\frac{36+33}{360} = \frac{69}{360}$ or $\frac{23}{120}$ **1**

(ii) Car **½**

Number of people who used car = $\frac{177}{360} \times 120 = 59$ **½**

(iii) (a) P (person used train)= $1 - \frac{4}{5} = \frac{1}{5}$ **1**

∴ Number of people who used train = $\frac{120}{5} = 24$ **1**

OR

(iii) (b) Number of people who used aeroplane = $\frac{7}{60} \times 120 = 14$ **1**

∴ Revenue generated= $14 \times 5000 = ₹\ 70{,}000$ **1**

Series CD1BA/3 **SET~1**

प्रश्न–पत्र कोड
Q.P. Code **30/3/1**

रोल नं. **Roll No.**							

परीक्षार्थी प्रश्न–पत्र कोड को उत्तर–पुस्तिका के मुख–पृष्ठ पर अवश्य लिखें ।

Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न–पत्र में मुद्रित पृष्ठ **23** हैं ।

Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न–पत्र में **38** प्रश्न हैं ।

Please check that this question paper contains **38** questions.

(iii) प्रश्न–पत्र में दाहिने हाथ की ओर दिए गए प्रश्न–पत्र कोड को परीक्षार्थी उत्तर–पुस्तिका के मुख–पृष्ठ पर लिखें ।

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर–पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**

Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न–पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न–पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक परीक्षार्थी केवल प्रश्न–पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर–पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।

15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the candidates will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
MATHEMATICS (Standard)

*निर्धारित समय : **3** घण्टे* *अधिकतम अंक : **80***

*Time allowed : **3** hours* *Maximum Marks : **80***

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं । **सभी** प्रश्न **अनिवार्य** हैं ।*

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित हैं – खण्ड **क, ख, ग, घ** तथा **ङ** ।*

(iii) *खण्ड – **क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं ।*

(iv) *खण्ड – **ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं ।*

(v) *खण्ड – **ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं ।*

(vi) *खण्ड – **घ** में प्रश्न संख्या **32** से **35** तक दीर्घ उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं ।*

(vii) *खण्ड – **ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड-**ख** के 2 प्रश्नों में, खण्ड-**ग** के 2 प्रश्नों में, खण्ड-**घ** के 2 प्रश्नों में तथा खण्ड-**ङ** के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए । यदि आवश्यक हो तो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है ।*

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This Question Paper is divided into **FIVE** Sections – **Section A, B, C, D** and **E**.*

(iii) *In Section–**A**, questions number **1** to **18** are Multiple Choice Questions (MCQs) and question number **19** & **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In Section–**B**, questions number **21** to **25** are Very Short-Answer (VSA) type questions, carrying **2** marks each.*

(v) *In Section–**C**, questions number **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In Section–**D**, questions number **32** to **35** are Long Answer (LA) type questions, carrying **5** marks each.*

(vii) *In Section–**E**, questions number **36** to **38** are Case Study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case-study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section–**B**, 2 questions in Section–**C**, 2 questions in Section–**D** and 3 questions in Section–**E**.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculators is **not** allowed.*

खण्ड – क

20 × 1 = 20

इस खण्ड में **20** प्रश्न हैं तथा प्रत्येक का **1** अंक है ।

1. रैखिक समीकरण युग्म $x + 2y + 5 = 0$ तथा $-3x = 6y - 1$ का/के **1**

(A) अद्वितीय हल है ।

(B) मात्र दो हल हैं ।

(C) अपरिमित रूप से अनेक हल हैं ।

(D) कोई हल नहीं है ।

2. समांतर श्रेढ़ी $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}$ ..... का सार्व अंतर है : **1**

(A) $-2x$ (B) -2

(C) 2 (D) $2x$

3. दो पासों को एक साथ उछाला गया । उन पर भिन्न संख्याएँ आने की प्रायिकता है : **1**

(A) 1/6 (B) 5/6

(C) 1/3 (D) 2/3

4. किसी परीक्षा के एक प्रश्न के सही उत्तर का अनुमान लगाने की प्रायिकता $\frac{x}{6}$ है । यदि अनुमान द्वारा इसके सही न होने की प्रायिकता $\frac{2}{3}$ है, तो x का मान है : **1**

(A) 2 (B) 3

(C) 4 (D) 6

SECTION – A

20 × 1 = 20

This section consists of **20** questions of **1** mark each.

1. The pair of linear equations $x + 2y + 5 = 0$ and $-3x = 6y - 1$ has **1**

(A) unique solution (B) exactly two solutions

(C) infinitely many solutions (D) no solution

2. The common difference of the A.P. **1**

$\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}$, ...is :

(A) $-2x$ (B) -2

(C) 2 (D) $2x$

3. Two dice are thrown together. The probability that they show different numbers is : **1**

(A) 1/6 (B) 5/6

(C) 1/3 (D) 2/3

4. The probability of guessing the correct answer to a certain test question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is : **1**

(A) 2 (B) 3

(C) 4 (D) 6

5. यदि $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ तथा LCM (a, b, c) = 3780 है, तो x का मान है : **1**

(A) 1 (B) 2

(C) 3 (D) 0

6. द्विघात बहुपद $2x^2 - 3x - 9$ के शून्यक हैं : **1**

(A) $3, \frac{-3}{2}$ (B) $-3, \frac{-3}{2}$

(C) $-3, \frac{3}{2}$ (D) $3, \frac{3}{2}$

7. भूमि पर स्थित एक बिंदु, जो एक सीधी खड़ी मीनार के पाद से 30 m की दूरी पर है, से मीनार के शिखर का उन्नयन कोण 60° है, तो मीनार की ऊँचाई (मीटरों में) है : **1**

(A) $10\sqrt{3}$ (B) $30\sqrt{3}$

(C) 60 (D) 30

8. यदि $\cos\theta = \frac{\sqrt{3}}{2}$ तथा $\sin\phi = \frac{1}{2}$ है, तो $\tan(\theta + \phi)$ है : **1**

(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$

(C) 1 (D) परिभाषित नहीं

9. दो अलग-अलग बिंदुओं पर प्रतिच्छेद करने वाले दो वृत्तों पर खींची जा सकने वाली उभयनिष्ठ स्पर्श-रेखाओं की अधिकतम संख्या है : **1**

(A) 4 (B) 3

(C) 2 (D) 1

5. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to **1**

(A) 1 (B) 2

(C) 3 (D) 0

6. The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are : **1**

(A) $3, \frac{-3}{2}$ (B) $-3, \frac{-3}{2}$

(C) $-3, \frac{3}{2}$ (D) $3, \frac{3}{2}$

7. From a point on the ground, which is 30 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is : **1**

(A) $10\sqrt{3}$ (B) $30\sqrt{3}$

(C) 60 (D) 30

8. If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta + \phi)$ is : **1**

(A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$

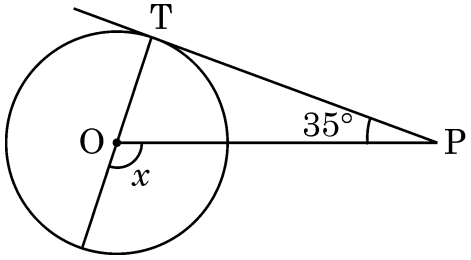
(C) 1 (D) not defined

9. Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is : **1**

(A) 4 (B) 3

(C) 2 (D) 1

10. दी गई आकृति में, केंद्र O वाले वृत्त की एक स्पर्श-रेखा PT यदि इस प्रकार है कि $\angle TPO = 35°$, तो $\angle x$ की माप है : **1**



(A) 110° (B) 115°

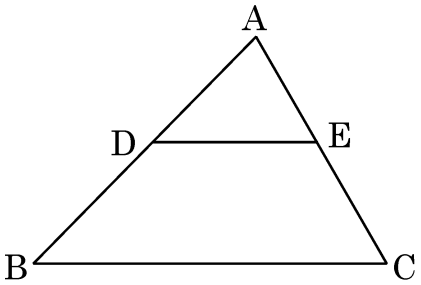
(C) 120° (D) 125°

11. यदि एक चतुर्भुज के विकर्ण एक दूसरे को समानुपात में विभाजित करते हैं, तो यह चतुर्भुज है : **1**

(A) समांतर चतुर्भुज (B) आयत

(C) वर्ग (D) समलंब

12. दी गई आकृति में, ΔABC में $DE \parallel BC$ है । यदि AD = 2 cm, BD = 3 cm तथा BC = 7.5 cm है, तो DE की लंबाई (cm में) है : **1**



(A) 2.5 (B) 3

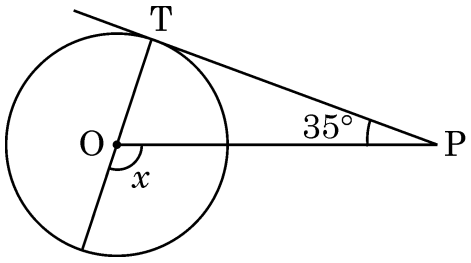
(C) 5 (D) 6

13. दिया है कि HCF (2520, 6600) = 40 तथा LCM (2520, 6600) = 252 × k है, तो k का मान है : **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

10. In the given figure, if PT is a tangent to a circle with centre O and $\angle TPO = 35°$, then the measure of $\angle x$ is : **1**



(A) 110° (B) 115°

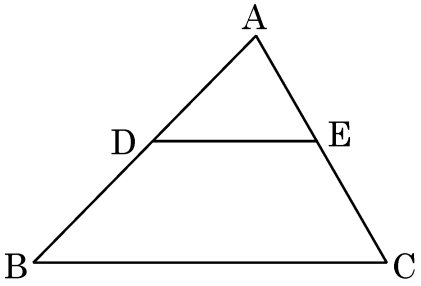
(C) 120° (D) 125°

11. If the diagonals of a quadrilateral divide each other proportionally, then it is a : **1**

(A) parallelogram (B) rectangle

(C) square (D) trapezium

12. In Δ ABC, DE || BC (as shown in the figure). If AD = 2 cm, BD = 3 cm, BC = 7.5 cm, then the length of DE (in cm) is : **1**



(A) 2.5 (B) 3

(C) 5 (D) 6

13. Given HCF (2520, 6600) = 40, LCM (2520, 6600) = 252 × k, then the value of k is : **1**

(A) 1650 (B) 1600

(C) 165 (D) 1625

14. अपरिमेय संख्याओं का एक युग्म जिनका गुणनफल परिमेय है, है : **1**

(A) $(\sqrt{16}, \sqrt{4})$ (B) $(\sqrt{5}, \sqrt{2})$

(C) $(\sqrt{3}, \sqrt{27})$ (D) $(\sqrt{36}, \sqrt{2})$

15. यदि संख्याओं 1, 2, 3, 4, 5, 6, 7, 8, 9 में से यादृच्छया एक संख्या चुनी गई तो एक विषम अभाज्य संख्या के चुने जाने की प्रायिकता है : **1**

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$

(C) $\frac{4}{9}$ (D) $\frac{5}{9}$

16. पाँच प्रेक्षणों का माध्य 15 है । यदि इनमें प्रथम तीन प्रेक्षणों का माध्य 14 है तथा आखिरी तीन प्रेक्षणों का माध्य 17 है, तो तीसरा प्रेक्षण है : **1**

(A) 20 (B) 19

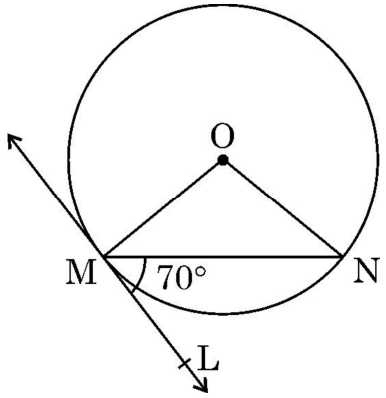
(C) 18 (D) 17

17. 7 cm त्रिज्या वाले एक वृत्त के उस त्रिज्यखण्ड, जो केंद्र पर 90° का कोण अंतरित करता है, का परिमाप है : **1**

(A) 35 cm (B) 11 cm

(C) 22 cm (D) 25 cm

18. दी गई आकृति में, O वृत्त का केंद्र है । MN एक जीवा है तथा बिंदु M पर स्पर्श-रेखा ML इस प्रकार है कि यह MN के साथ 70° का कोण बनाती है । ∠MON का माप है : **1**



(A) 120° (B) 140°

(C) 70° (D) 90°

14. A pair of irrational numbers whose product is a rational number is : **1**

(A) $(\sqrt{16}, \sqrt{4})$ (B) $(\sqrt{5}, \sqrt{2})$

(C) $(\sqrt{3}, \sqrt{27})$ (D) $(\sqrt{36}, \sqrt{2})$

15. If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is : **1**

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$

(C) $\frac{4}{9}$ (D) $\frac{5}{9}$

16. The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is **1**

(A) 20 (B) 19

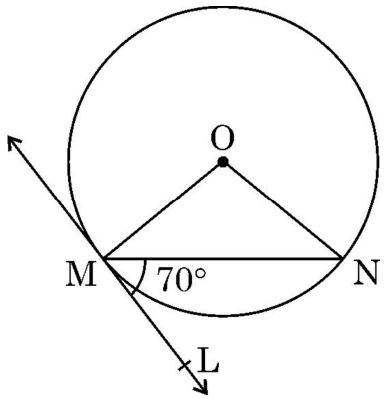
(C) 18 (D) 17

17. Perimeter of a sector of a circle whose central angle is 90° and radius 7 cm is : **1**

(A) 35 cm (B) 11 cm

(C) 22 cm (D) 25 cm

18. In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of $\angle MON$ is : **1**



(A) 120° (B) 140°

(C) 70° (D) 90°

निर्देश : प्रश्न **19** तथा **20** अभिकथन तथा तर्क आधारित प्रश्न हैं । प्रत्येक प्रश्न में एक अभिकथन (A) के बाद एक तर्क (R) कथन दिया है । विकल्पों (A), (B), (C) तथा (D) में से सही उत्तर का विकल्प चुनिए ।

(A) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं तथा तर्क (R), अभिकथन (A) की पूरी व्याख्या करता है ।

(B) अभिकथन (A) तथा तर्क (R) दोनों सत्य हैं परन्तु तर्क (R) अभिकथन (A) की व्याख्या नहीं करता ।

(C) अभिकथन (A) सत्य है, परन्तु तर्क (R) असत्य है ।

(D) अभिकथन (A) असत्य है, जबकि तर्क (R) सत्य है ।

19. **अभिकथन (A)** : बिंदुओ A (1, 2) तथा B(–1, 1) को मिलाने वाले रेखाखण्ड को आंतरिक रूप से 1 : 2 में विभाजन करने वाला बिंदु $\left(\frac{-1}{3}, \frac{5}{3}\right)$ है । **1**

तर्क (R) : बिंदुओं $A(x_1, y_1)$ तथा $B(x_2, y_2)$ को मिलाने वाले रेखाखण्ड को $m_1 : m_2$ में विभाजित करने वाले बिंदु के निदेशांक $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$ हैं ।

20. **अभिकथन (A)** : एक क्रिकेट मैच में एक बल्लेबाज, खेली गई 45 गेंदों में से 9 गेंदों पर चौका मारता है । एक दिए गए बॉल पर चौका न मारने की प्रायकिता $\frac{4}{5}$ है । **1**

तर्क (R) : P(E) + P(E नहीं) = 1

Directions : Questions number **19** and **20** are Assertion and Reason based questions carrying **1** mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below :

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. **Assertion (A)** : The point which divides the line segment joining the points A (1, 2) and B(–1, 1) internally in the ratio 1 : 2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$ **1**

Reason (R) : The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$

20. **Assertion (A)** : In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is $\frac{4}{5}$. **1**

Reason (R) : P(E) + P(not E) = 1

खण्ड – ख

इस खण्ड में **5** प्रश्न हैं तथा प्रत्येक के **2** अंक हैं ।

21. 52 पत्तों की अच्छी प्रकार से फेंटी गई ताश की गड्डी में से यादृच्छया एक पत्ता निकाला गया । प्रायिकता ज्ञात कीजिए कि निकाला गया पत्ता (i) पान की बेगम है (ii) गुलाम वाला पत्ता नहीं है । **1 + 1**

22. (a) यदि $2x + y = 13$ तथा $4x - y = 17$ है, तो $(x - y)$ का मान ज्ञात कीजिए । **2**

अथवा

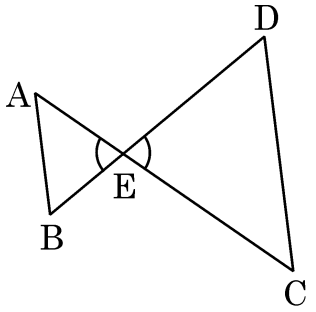
(b) दो संख्याओं का योगफल 105 है तथा उनका अंतर 45 है । संख्याएँ ज्ञात कीजिए । **2**

23. (a) यदि बिंदु P(x, y), बिंदुओं A(7, 1) तथा B(3, 5) से समदूरस्थ है, तो x तथा y के बीच का संबंध ज्ञात कीजिए । **2**

अथवा

(b) बिंदु A(–1, y) तथा B(5, 7), केंद्र O(2, –3y) वाले वृत्त पर स्थित दो ऐसे बिंदु हैं कि AB वृत्त का एक व्यास है । y का मान ज्ञात कीजिए । वृत्त की त्रिज्या भी ज्ञात कीजिए । **2**

24. दी गई आकृति में $\frac{EA}{EC} = \frac{EB}{ED}$ है, सिद्ध कीजिए कि $\Delta EAB \sim \Delta ECD$ **2**



25. मान ज्ञात कीजिए : $\frac{\cos 45° + \sin 60°}{\sec 30° + \text{cosec } 30°}$. **2**

SECTION – B

This section consists of **5** questions of **2** marks each.

21. One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn

(i) is queen of hearts;

(ii) is not a jack. **1 + 1**

22. (a) If $2x + y = 13$ and $4x - y = 17$, find the value of $(x - y)$. **2**

OR

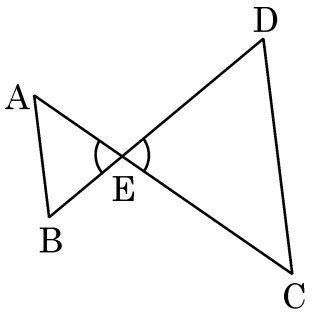
(b) Sum of two numbers is 105 and their difference is 45. Find the numbers. **2**

23. (a) Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7, 1) and B(3, 5). **2**

OR

(b) Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle. **2**

24. In the given figure, $\frac{EA}{EC} = \frac{EB}{ED}$, prove that $\Delta EAB \sim \Delta ECD$ **2**



25. Evaluate : $\frac{\cos 45° + \sin 60°}{\sec 30° + \text{cosec } 30°}$. **2**

खण्ड – ग

इस खण्ड में **6** प्रश्न हैं जिनमें प्रत्येक के **3** अंक हैं ।

26. (a) यदि एक समांतर श्रेढ़ी के प्रथम 7 पदों का योग 49 है तथा इसके प्रथम 17 पदों का योग 289 है, तो इसके प्रथम 20 पदों का योग ज्ञात कीजिए । **3**

अथवा

(b) एक समांतर श्रेढ़ी के 10वें तथा 30वें पदों में 1 : 3 का अनुपात है जबकि इसके प्रथम छः पदों का योग 42 है । इस समांतर श्रेढ़ी का प्रथम पद तथा सार्व अंतर ज्ञात कीजिए । **3**

27. द्विघात बहुपद $x^2 - 15$ के शून्यक ज्ञात कीजिए । शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध का सत्यापन कीजिए । **3**

28. निम्न रैखिक समीकरण निकाय का ग्राफ द्वारा हल ज्ञात कीजिए : **3**

$$x - y + 1 = 0$$
$$x + y = 5$$

29. (a) वह अनुपात ज्ञात कीजिए जिसमें बिंदुओं (5, 3) तथा (–1, 6) को मिलाने वाला रेखाखण्ड Y-अक्ष द्वारा विभाजित होता है । **3**

अथवा

(b) P(–2, 5) तथा Q(3, 2) दो बिंदु हैं । रेखाखण्ड PQ पर स्थित बिंदु R के निर्देशांक ज्ञात कीजिए ताकि $PR = 2QR$ हो । **3**

30. सिद्ध कीजिए : $\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta.$ **3**

31. सिद्ध कीजिए कि वृत्त की किसी जीवा के सिरों पर खींची गईं स्पर्श–रेखाएँ, जीवा के साथ समान कोण बनाती हैं । **3**

SECTION – C

This section consists of **6** questions of **3** marks each.

26. (a) If the sum of first 7 terms of an A.P. is 49 and that of first 17 terms is 289, find the sum of its first 20 terms. **3**

OR

(b) The ratio of the 10^{th} term to its 30^{th} term of an A.P. is 1 : 3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P. **3**

27. Find the zeroes of the quadratic polynomial $x^2 - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial. **3**

28. Solve the following system of linear equations graphically : **3**

$x - y + 1 = 0$

$x + y = 5$

29. (a) Find the ratio in which the line segment joining the points (5, 3) and (–1, 6) is divided by Y-axis. **3**

OR

(b) P(–2, 5) and Q(3, 2) are two points. Find the coordinates of the point R on line segment PQ such that PR = 2QR. **3**

30. Prove that $\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$. **3**

31. Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord. **3**

खण्ड – घ

इस खण्ड में **4** प्रश्न हैं तथा प्रत्येक के **5** अंक हैं ।

32. (a) 2800 km की एक हवाई यात्रा के दौरान, खराब मौसम के कारण वायुयान की औसत चाल को 100 km/h कम कर दिया गया जिससे यात्रा का समय 30 मिनट बढ़ गया । हवाई यात्रा का मूल समय ज्ञात कीजिए । **5**

अथवा

(b) एक भिन्न का हर इसके अंश के दुगुने से एक अधिक है । यदि भिन्न और इसके व्युत्क्रम का योग $2\frac{16}{21}$ है, तो भिन्न ज्ञात कीजिए । **5**

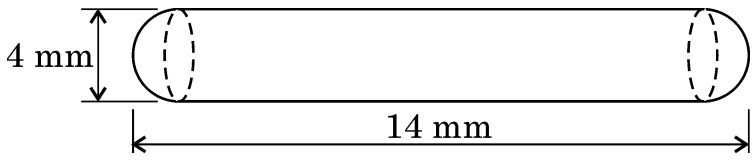
33. आधारभूत समानुपातिकता प्रमेय का कथन लिखिए तथा इसे सिद्ध कीजिए । **5**

34. भूमि के एक बिंदु से एक 20 m ऊँचे भवन के शिखर पर लगी एक संचार मीनार के तल और शिखर के उन्नयन कोण क्रमशः 45° और 60° हैं । मीनार की ऊँचाई ज्ञात कीजिए । **5**

35. (a) ऊँचाई 200 cm और आधार व्यास 28 cm वाले एक ठोस बेलन, जिस पर ऊँचाई 50 cm और त्रिज्या 7 cm वाला एक अन्य बेलन आरोपित है, से लोहे का एक ठोस स्तंभ बना है । इस स्तम्भ का द्रव्यमान ज्ञात कीजिए, जबकि दिया है कि 1 cm^3 लोहे का द्रव्यमान 8 g होता है । **5**

अथवा

(b) दवा का एक कैप्सूल एक बेलन के आकार का है जिसके दोनों सिरों पर एक अर्धगोला लगा हुआ है । पूरे कैप्सूल की लंबाई 14 mm है और व्यास 4 mm है । इसका पृष्ठीय क्षेत्रफल ज्ञात कीजिए । इसका आयतन भी ज्ञात कीजिए । **5**



SECTION – D

This section consists of **4** questions of **5** marks each.

32. (a) In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the flight. **5**

OR

(b) The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction. **5**

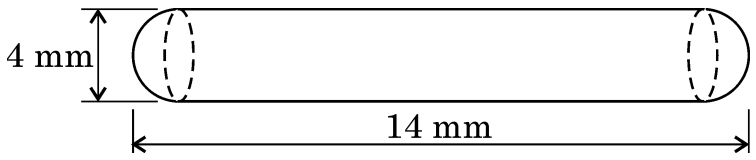
33. State and prove Basic Proportionality theorem. **5**

34. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower. **5**

35. (a) A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass. **5**

OR

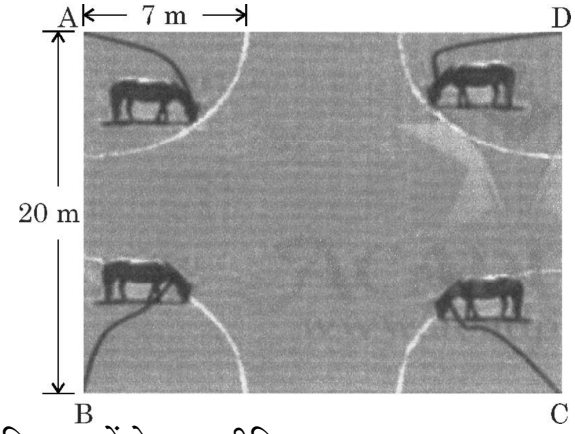
(b) A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume. **5**



खण्ड – ङ

इस खण्ड में **तीन** प्रकरण आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं :

36. एक अस्तबल के मालिक के पास 4 घोड़े हैं । वह आमतौर पर इन घोड़ों को अपने खेत में चराने के लिए 20 मीटर लंबे वर्गाकार घास के मैदान के प्रत्येक कोने पर 7 m. लंबी रस्सी के खूँटों से बाँधता है । लेकिन कई बार रस्सी से बाँधने से उसके घोड़ों को चोट भी लग जाती है । इसलिए उसने उस क्षेत्र के चारों ओर बाढ़ बनाने का निर्णय लिया जहाँ घोड़ा चर सकता है ।



उपरोक्त के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) वर्गाकार घास के मैदान का क्षेत्रफल ज्ञात कीजिए । **1**

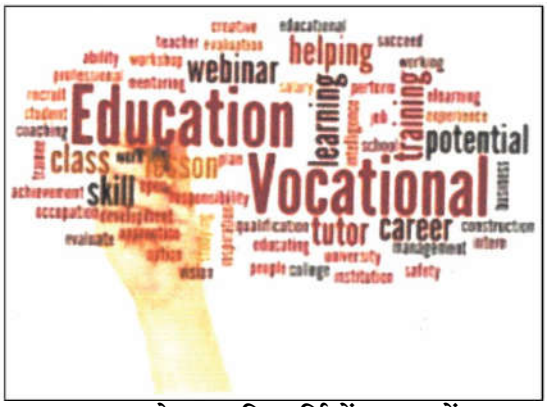
(ii) (a) उस कुल क्षेत्र का क्षेत्रफल ज्ञात कीजिए जिसमें यह घोड़े चर सकते हैं । **2**

अथवा

(b) यदि प्रत्येक घोड़े की रस्सी को 7 m से बढ़ाकर 10 m कर दिया जाए, तो एक घोड़े द्वारा चर सकने वाले क्षेत्र का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3.14$ लीजिए) **2**

(iii) यदि प्रत्येक घोड़े की रस्सी 7 cm लंबी है, तो खेत का कितना क्षेत्रफल चरे बिना रह जाएगा ? **1**

37. व्यावसायिक प्रशिक्षण व्यावहारिक कौशल और अनुभव प्रदान करते हुए पारंपरिक शिक्षा का पूरक है । शिक्षा जहाँ व्यक्तियों के व्यापक ज्ञान आधार से सुसज्जित करती है, व्यावसायिक प्रशिक्षण नौकरी विशिष्ट कौशल पर ध्यान केंद्रित करता है तथा रोज़गार क्षमता को बढ़ाता है, जिससे छात्र आत्मनिर्भर बनता है ।

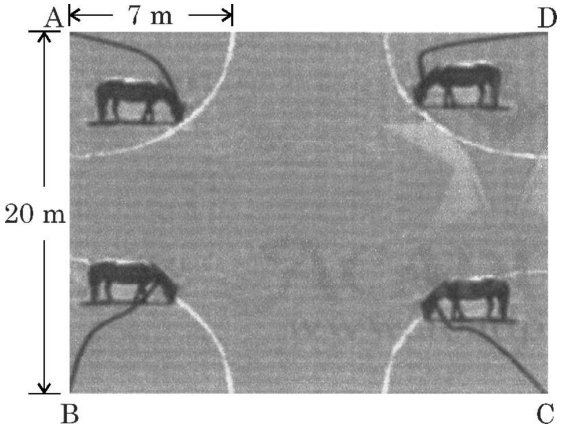


उपरोक्त के आधार पर एक अध्यापक ने, उन विद्यार्थियों/वयस्कों का आवृत्ति वितरण देकर निम्न सारिणी बनाई जो प्रशिक्षण संस्था से व्यावसायिक प्रशिक्षण ले रहे हैं :

SECTION – E

This section consists of **3** case study based questions of **4** marks each :

36. A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.



Based on the above, answer the following questions :

(i) Find the area of the square shaped grass field. **1**

(ii) (a) Find the area of the total field in which these horses can graze. **2**

OR

(b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$) **2**

(iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm ? **1**

37. Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table giving the frequency distribution of students/adults undergoing vocational training from the training institute.

आयु (वर्षों में)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
भाग लेने वालों की संख्या	62	132	96	37	13	11	10	4

उपरोक्त से निम्न प्रश्नों के उत्तर दीजिए :

(i) ऊपर दिए गए आँकड़ों में बहुलक वर्ग की निचली सीमा क्या है ? **1**

(ii) (a) उपरोक्त आँकड़ों से माध्यक वर्ग ज्ञात कीजिए । **2**

अथवा

(b) 50 वर्ष से छोटे उन भाग लेने वालों की संख्या ज्ञात कीजिए जो व्यावसायिक प्रशिक्षण ले रहे हैं । **2**

(iii) माध्य, माध्यक तथा बहुलक में आनुभविक संबंध लिखिए । **1**

38. गतिविधियों के माध्यम से गणित पढ़ाना एक शक्तिशाली दृष्टिकोण है जो छात्रों की समझ और जुड़ाव को बढ़ाता है । इसे ध्यान में रखते हुए, सुश्री मुक्ता ने कक्षा 5 के छात्रों के लिए एक अभाज्य संख्या खेल की योजना बनाई । उसने कक्षा के पहले छात्र को संख्या 2 को किसी अभाज्य संख्या से गुणा करके अगले छात्र को दे दें । दूसरा छात्र भी इसे किसी अभाज्य संख्या से गुणा कर इसे तीसरे छात्र को दे दें । इसी प्रकार अभाज्य संख्याओं से गुणा करते करते आखिरी छात्र को गुणा करने के पश्चात् 173250 प्राप्त हुआ ।

अब मुक्ता ने छात्रों से निम्न कुछ प्रश्न पूछे :

(i) छात्रों द्वारा प्रयोग की गई सबसे छोटी अभाज्य संख्या कौन सी है ? **1**

(ii) (a) कक्षा में कितने छात्र हैं ? **2**

अथवा

(b) छात्रों द्वारा बड़ी से बड़ी अभाज्य संख्या कौन सी प्रयोग की गई है ? **2**

(iii) कौन सी अभाज्य संख्या अधिकतम बार प्रयोग की गई है ? **1**

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Number of participants	62	132	96	37	13	11	10	4

From the above answer the following questions :

(i) What is the lower limit of the modal class of the above data ? **1**

(ii) (a) Find the median class of the above data. **2**

OR

(b) Find the number of participants of age less than 50 years who undergo vocational training. **2**

(iii) Give the empirical relationship between mean, median and mode. **1**

38. Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250.

Now, Mukta asked some questions as given below to the students :

(i) What is the least prime number used by students ? **1**

(ii) (a) How many students are in the class ? **2**

OR

(b) What is the highest prime number used by students ? **2**

(iii) Which prime number has been used maximum times ? **1**

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/3/1

General Instructions: -

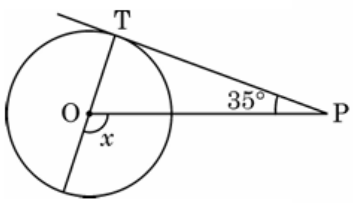
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

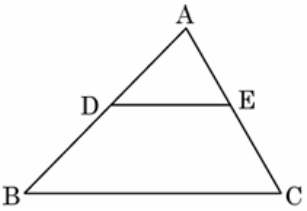
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

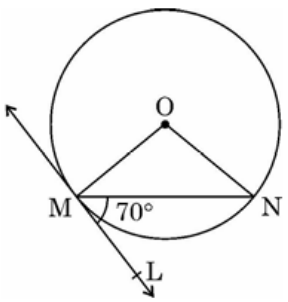
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/3/1)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section consists of 20 questions of 1 marks each.	
1.	The pair of linear equations $x + 2y + 5 = 0$ and $-3x = 6y - 1$ has (A) unique solution (B) exactly two solutions (C) infinitely many solutions (D) no solution	
Sol.	(D) no solution	1
2.	The common difference of the A.P. $\frac{1}{2x}, \frac{1-4x}{2x}, \frac{1-8x}{2x}$ .....is : (A) $-2x$ (B) -2 (C) 2 (D) $2x$	
Sol.	(B) -2	1
3.	Two dice are thrown together. The probability that they show different numbers is : (A) 1/6 (B) 5/6 (C) 1/3 (D) 2/3	
Sol.	(B) 5/6	1

4.	The probability of guessing the correct answer to a certain test question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is : (A) 2 (B) 3 (C) 4 (D) 6	
Sol.	(A) 2	1
5.	If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and LCM (a, b, c) = 3780, then x is equal to (A) 1 (B) 2 (C) 3 (D) 0	
Sol.	(C) 3	1
6.	The zeroes of the quadratic polynomial $2x^2 - 3x - 9$ are : (A) $3, \frac{-3}{2}$ (B) $-3, \frac{-3}{2}$ (C) $-3, \frac{3}{2}$ (D) $3, \frac{3}{2}$	
Sol.	(A) $3, \frac{-3}{2}$	1
7.	From a point on the ground, which is 30 m away from the foot of a vertical tower, the angle of elevation of the top of the tower is found to be 60°. The height (in metres) of the tower is : (A) $10\sqrt{3}$ (B) $30\sqrt{3}$ (C) 60 (D) 30	
Sol.	(B) $30\sqrt{3}$	1

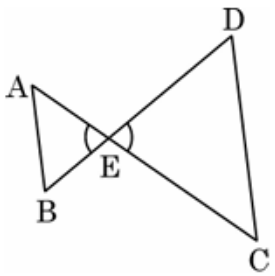
8.	If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, then $\tan(\theta + \phi)$ is : (A) $\sqrt{3}$ (B) $\frac{1}{\sqrt{3}}$ (C) 1 (D) not defined	
Sol.	(A) $\sqrt{3}$	1
9.	Maximum number of common tangents that can be drawn to two circles intersecting at two distinct points is : (A) 4 (B) 3 (C) 2 (D) 1	
Sol.	(C) 2	1
10.	In the given figure, if PT is a tangent to a circle with centre O and $\angle TPO = 35°$, then the measure of $\angle x$ is :  (A) 110° (B) 115° (C) 120° (D) 125°	
Sol.	(D) 125°	1
11.	If the diagonals of a quadrilateral divide each other proportionally, then it is a : (A) parallelogram (B) rectangle (C) square (D) trapezium	
Sol.	(D) trapezium	1

12.	In Δ ABC, DE $\|\|$ BC (as shown in the figure). If AD = 2 cm, BD = 3 cm, BC = 7.5 cm, then the length of DE (in cm) is :  (A) 2.5 (B) 3 (C) 5 (D) 6	
Sol.	(B) 3	1
13.	Given HCF (2520, 6600) = 40, LCM (2520, 6600) = 252 × k, then the value of k is : (A) 1650 (B) 1600 (C) 165 (D) 1625	
Sol.	(A) 1650	1
14.	A pair of irrational numbers whose product is a rational number is : (A) $(\sqrt{16}, \sqrt{4})$ (B) $(\sqrt{5}, \sqrt{2})$ (C) $(\sqrt{3}, \sqrt{27})$ (D) $(\sqrt{36}, \sqrt{2})$	
Sol.	(C) $(\sqrt{3}, \sqrt{27})$	1
15.	If a digit is chosen at random from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9; then the probability that this digit is an odd prime number is : (A) $\frac{1}{3}$ (B) $\frac{2}{3}$ (C) $\frac{4}{9}$ (D) $\frac{5}{9}$	
Sol.	(A) $\frac{1}{3}$	1
16.	The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is (A) 20 (B) 19 (C) 18 (D) 17	
Sol.	(C) 18	1

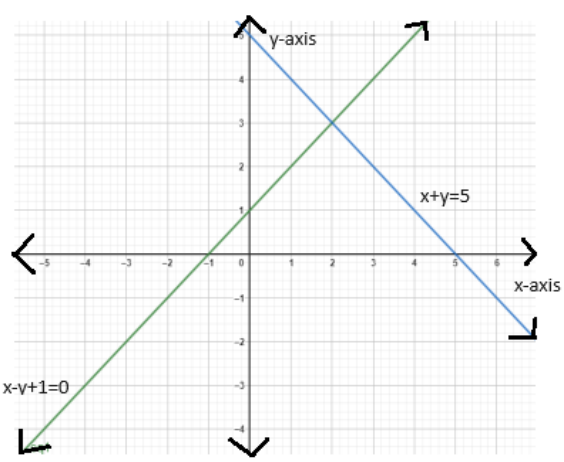
17.	Perimeter of a sector of a circle whose central angle is 90° and radius 7 cm is : (A) 35 cm (B) 11 cm (C) 22 cm (D) 25 cm	
Sol.	(D) 25 cm	1
18.	In the given figure, O is the centre of the circle. MN is the chord and the tangent ML at point M makes an angle of 70° with MN. The measure of ∠MON is :  (A) 120° (B) 140° (C) 70° (D) 90°	
Sol.	(B)140°	1
	Directions : Questions number **19** and **20** are Assertion and Reason based questions carrying **1** mark each. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	

19.	**Assertion (A)** : The point which divides the line segment joining the points A (1, 2) and B(–1, 1) internally in the ratio 1 : 2 is $\left(\frac{-1}{3}, \frac{5}{3}\right)$ **Reason (R)** : The coordinates of the point which divides the line segment joining the points A (x_1, y_1) and B(x_2, y_2) in the ratio $m_1 : m_2$ are $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right)$	
Sol.	(D) Assertion (A) is false , but Reason(R) is true.	1
20.	**Assertion (A)** : In a cricket match, a batsman hits a boundary 9 times out of 45 balls he plays. The probability that in a given ball, he does not hit the boundary is $\frac{4}{5}$. **Reason (R)** : P(E) + P(not E) = 1	
Sol.	(A) Both Assertion (A) and Reason(R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
	SECTION B This section consists of 5 questions of 2 marks each.	
21.	One card is drawn at random from a well shuffled deck of 52 cards. Find the probability that the card drawn (i) is queen of hearts; (ii) is not a jack.	
Sol.	Total outcomes = 52 (i) P (card is queen of hearts) = $\frac{1}{52}$ (ii) P (not a jack) = $\frac{48}{52}$ or $\frac{12}{13}$	1 1
22(a).	If $2x + y = 13$ and $4x - y = 17$, find the value of $(x - y)$.	
Sol.	$2x + y = 13$ ---- (i) $4x - y = 17$ ---- (ii)	

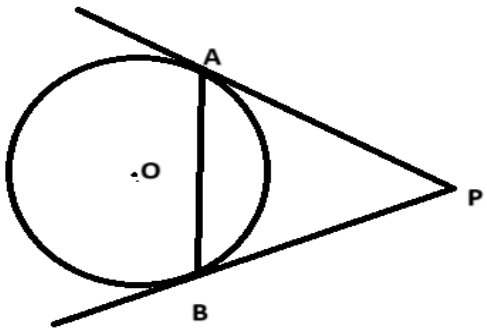
	Solving (i) and (ii) x = 5 & y = 3 x – y = 2	 1½ ½
	OR	
22(b).	Sum of two numbers is 105 and their difference is 45. Find the numbers.	
Sol.	Let the numbers be x, y (x > y) x + y = 105 ……. (i) x – y = 45 ……. (ii) on solving (i) and (ii) $\Rightarrow$ x = 75 & y = 30 $\therefore$ Numbers are 75, 30	 ½ ½ 1
23(a)	Find a relation between x and y such that the point P(x, y) is equidistant from the points A(7, 1) and B(3, 5).	
Sol.	PA= PB $\Rightarrow PA^2 = PB^2$ $(x-7)^2 + (y-1)^2 = (x-3)^2 + (y-5)^2$ $\Rightarrow -8x + 8y + 16 = 0$ or $x - y - 2 = 0$	 1 1
23(b).	Points A(–1, y) and B(5, 7) lie on a circle with centre O(2, –3y) such that AB is a diameter of the circle. Find the value of y. Also, find the radius of the circle.	
Sol.	Centre O (2, – 3y) is the mid point of AB $\therefore \frac{y+7}{2} = -3y$ $\Rightarrow y = -1$ Radius = OB = $\sqrt{(5-2)^2 + (7-3)^2} = 5$	 ½ ½ 1

24.	In the given figure, $\frac{EA}{EC}=\frac{EB}{ED}$, prove that $\Delta EAB \sim \Delta ECD$  	
Sol.	In ΔEAB and ΔECD $\frac{EA}{EC}=\frac{EB}{ED}$ $\angle AEB=\angle CED$ $\Delta EAB \sim \Delta ECD$	 1 1
25.	Evaluate : $\frac{\cos 45°+\sin 60°}{\sec 30°+\operatorname{cosec} 30°}$.	
Sol.	$\frac{cos45^{\circ}+sin60^{\circ}}{sec30^{\circ}+cosec30^{\circ}}$ $=\frac{\frac{1}{\sqrt{2}}+\frac{\sqrt{3}}{2}}{\frac{2}{\sqrt{3}}+2}$ $=\frac{2\sqrt{3}+3\sqrt{2}}{4\sqrt{2}(1+\sqrt{3})}$	 1½ ½

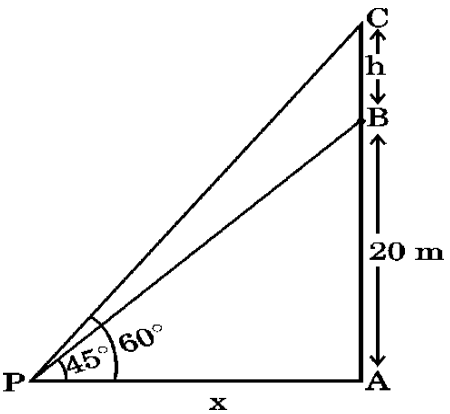
	SECTION C This section consists of 6 questions of 3 marks each.	
26(a).	If the sum of first 7 terms of an A.P. is 49 and that of first 17 terms is 289, find the sum of its first 20 terms.	
Sol.	Let a be the first term and d be the common difference. $\frac{7}{2}(2a + 6d) = 49$ $a + 3d = 7$.....(i) $S_{17} = 289$ $\frac{17}{2}(2a + 16d) = 289$ $a + 8d = 17$.....(ii) solving (i) and (ii) $d = 2$ & $a = 1$ $S_{20} = \frac{20}{2}[2(1)+19(2)]$ $= 400$	½ ½ 1 ½ ½
	OR	
26(b).	The ratio of the 10th term to its 30th term of an A.P. is 1 : 3 and the sum of its first six terms is 42. Find the first term and the common difference of A.P.	
Sol.	Let a be the first term and d be the common difference. $\frac{a + 9d}{a + 29d} = \frac{1}{3}$ $\Longrightarrow a = d$ .....(i) $\frac{6}{2}(2a + 5d) = 42$ $\Rightarrow 2a + 5d = 14$ ……..(ii) Solving (i) and (ii)	½ ½ ½ ½

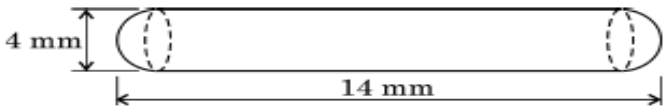
	a = 2 and d = 2	½ + ½
27.	Find the zeroes of the quadratic polynomial $x^2 - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial.	
Sol.	Let $P(x) = x^2 - 15$ $= (x - \sqrt{15})(x + \sqrt{15})$ $\therefore$ Zeroes of P(x) are $-\sqrt{15}$ and $\sqrt{15}$ Verification- Sum of zeroes = $-\sqrt{15} + \sqrt{15} = \frac{0}{1} = \frac{-\text{ coefficient of x}}{\text{coefficient of } x^2}$ Product of zeroes = $-\sqrt{15} \times \sqrt{15} = -15 = \frac{-15}{1} = \frac{\text{costant term}}{\text{coefficient of } x^2}$	1 1 ½ ½
28.	Solve the following system of linear equations graphically : $x - y + 1 = 0$ $x + y = 5$	
Sol.	 Correct graph Solution is x = 2, y = 3	2 1

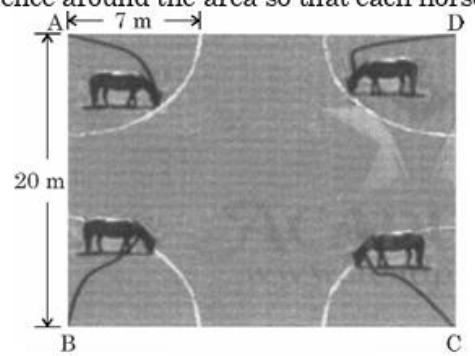
29(a).	Find the ratio in which the line segment joining the points (5, 3) and (–1, 6) is divided by Y-axis.	
Sol.	Let the line segment divides y-axis at (0, y). Let the required ratio be k : 1 $\therefore \quad 0 = \frac{(-1)k+5(1)}{k+1}$ $\Rightarrow \quad k = 5$ Hence ratio is 5 : 1	½ 1 1 ½
	OR	
29(b).	P(–2, 5) and Q(3, 2) are two points. Find the coordinates of the point R on line segment PQ such that PR = 2QR.	
Sol.	Let coordinates of R be (x, y) . PR : RQ = 2 : 1 $x = \frac{2(3)+1(-2)}{2+1} = \frac{4}{3}$ $y = \frac{2(2)+1(5)}{2+1} = 3$ $\therefore$ Cordinates of the point R $(\frac{4}{3}, 3)$	 ½ 1 1 ½
30.	Prove that $\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta} = \tan\theta$.	

Sol.	L.H.S = $\frac{\sin\theta-2\sin^3\theta}{2\cos^3\theta-\cos\theta}$ $= \frac{\sin\theta(1-2\sin^2\theta)}{\cos\theta(2\cos^2\theta-1)}$ $= \frac{\tan\theta(1-2\sin^2\theta)}{[2(1-\sin^2\theta)-1]}$ $= \frac{\tan\theta(1-2\sin^2\theta)}{(1-2\sin^2\theta)}$ $= \tan\theta$ = R.H.S.	 ½ 1 1 ½
31.	Prove that the tangents drawn at the end points of a chord of a circle makes equal angles with the chord.	
Sol.	Correct figure  Let AB be the chord of circle. In ΔPAB PA = PB ∠PAB = ∠PBA	1 1 1
	SECTION D This section consists of 4 questions of 5 marks each.	
32(a).	In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the flight.	

Sol.	Let original speed of aircraft be x km/hr. A.T.Q. $\frac{2800}{x-100} - \frac{2800}{x} = \frac{1}{2}$ $\Longrightarrow x^2 - 100x - 560000 = 0$ $\Longrightarrow (x - 800)(x + 700) = 0$ $x \neq -700$ So, $x = 800$ Original Duration $= \frac{2800}{800} = \frac{7}{2}$ hrs or 3 hrs 30 min.	 2 ½ 1 ½ 1
	OR	
32(b).	The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction.	
Sol.	Let numerator be x , then denominator be (2x + 1) Fraction = $\frac{x}{2x+1}$ A.T.Q. $\frac{x}{2x+1} + \frac{2x+1}{x} = \frac{58}{21}$ $\Longrightarrow \quad 11x^2 - 26x - 21 = 0$ $\Longrightarrow (x - 3)(11x + 7) = 0$ $x \neq -\frac{7}{11}$ So, $x = 3$ $\therefore$ Fraction = $\frac{3}{7}$	 ½ ½ 1½ ½ 1 ½ ½
33.	State and prove Basic Proportionality theorem.	
Sol.	For correct statement For correct given, to prove, construction and figure For correct Proof	1 4×½ = 2 2

34.	From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.	
Sol.	 Correct Figure. In ΔBPA $\tan 45° = 1 = \frac{20}{x}$ $\Rightarrow$ x = 20 m ……(i) Now, In ΔCPA $\tan 60° = \sqrt{3} = \frac{h+20}{x}$ $\Rightarrow$ $h + 20 = x\sqrt{3}$ ……..(ii) Solving (i) and (ii) $h = 20(\sqrt{3} - 1)$ m ∴ Height of the tower is $20(\sqrt{3} - 1)$ m.	1 1 ½ 1 ½ 1
35(a).	A solid iron pole consists of a solid cylinder of height 200 cm and base diameter 28 cm, which is surmounted by another cylinder of height 50 cm and radius 7 cm. Find the mass of the pole, given that 1 cm^3 of iron has approximately 8 g mass.	
Sol.	Radius of lower cylinder = 14 cm Volume of pole = $\frac{22}{7} \times 14 \times 14 \times 200 + \frac{22}{7} \times 7 \times 7 \times 50$ = 130900 cm^3	½ 1+1 1 1

	Mass of the pole= 8 ×130900 =1047200 gm or 1047.2 kg	½
	OR	
35(b).	A medicine capsule is in the shape of a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 4 mm, find its surface area. Also, find its volume.  	
Sol.	Radius of hemisphere= radius of cylinder = 2 mm Length of cylindrical part = 14 – 4 = 10 mm. Surface area of the capsule = CSA of cylinder + 2(CSA of hemisphere) $= 2\times \frac{22}{7} \times 2 \times 10 + 2\times 2 \times \frac{22}{7} \times 2 \times 2$ $= 176\ mm^2$ Volume of the capsule = volume of cylinder + 2(volume of hemisphere) $= \frac{22}{7} \times 2 \times 2 \times 10 + 2 \times \frac{2}{3} \times \frac{22}{7} \times 2 \times 2 \times 2$ $= \frac{3344}{21}\ mm^3$ or $159.24\ mm^3$	½ ½ 1 1 1 1
	SECTION E This section consists of 3 case-study based questions of 4 marks each.	

36.	A stable owner has four horses. He usually tie these horses with 7 m long rope to pegs at each corner of a square shaped grass field of 20 m length, to graze in his farm. But tying with rope sometimes results in injuries to his horses, so he decided to build fence around the area so that each horse can graze.  Based on the above, answer the following questions : (i) Find the area of the square shaped grass field. (ii) (a) Find the area of the total field in which these horses can graze. **OR** (b) If the length of the rope of each horse is increased from 7 m to 10 m, find the area grazed by one horse. (Use $\pi = 3.14$) (iii) What is area of the field that is left ungrazed, if the length of the rope of each horse is 7 cm ?	
Sol.	(i) Area of square shaped grass field = 400 m^2 (ii) (a) area of total field that horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$ = 154 m^2 OR (ii) (b) area grazed by one horse = $\frac{1}{4} \times 3.14 \times 10 \times 10$ = 78.5 m^2 (iii) Area of the field left ungrazed = area of square field - area of field in which horses can graze. Area of field in which horses can graze = $4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$ = 154 cm^2 Area of the field left ungrazed = 400 – 0.0154 = 399.9846 m^2	1 1 1 1 1 ½ ½

37.	Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table giving the frequency distribution of students/adults undergoing vocational training from the training institute.  	

Age (in years)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54
Number of participants	62	132	96	37	13	11	10	4

From the above answer the following questions :

(i) What is the lower limit of the modal class of the above data ?

(ii) (a) Find the median class of the above data.

OR

(b) Find the number of participants of age less than 50 years who undergo vocational training.

(iii) Give the empirical relationship between mean, median and mode.

Sol.	(i) Modal class is 19.5 – 24.5 Lowe limit =19.5	1

(ii) (a)

Age (in years)	14.5-19.5	19.5-24.5	24.5-29.5	29.5-34.5	34.5-39.5	39.5-44.5	44.5-49.5	49.5-54.5
Number of participants	62	132	96	37	13	11	10	4
cf	62	194	290	327	340	351	361	365

Correct table 1

$\frac{n}{2} = \frac{365}{2} = 182.5$ ½

median class = 19.5 – 24.5 ½

OR

(ii) (b) 62 + 132 + 96 + 37 + 13 + 11 + 10 = 361 2

(iii) 3median = mode + 2 mean 1

38.

	Teaching Mathematics through activities is a powerful approach that enhances students' understanding and engagement. Keeping this in mind, Ms. Mukta planned a prime number game for class 5 students. She announces the number 2 in her class and asked the first student to multiply it by a prime number and then pass it to second student. Second student also multiplied it by a prime number and passed it to third student. In this way by multiplying to a prime number, the last student got 173250. Now, Mukta asked some questions as given below to the students : (i) What is the least prime number used by students ? (ii) (a) How many students are in the class ? **OR** (b) What is the highest prime number used by students ? (iii) Which prime number has been used maximum times ?	
Sol.	$173250= 2 \times 5^3 \times 3^2 \times 7 \times 11$ (i) 3 (ii) (a) $173250= 2 \times 5^3 \times 3^2 \times 7 \times 11$ Number of students in the class = 3 + 2 + 1 + 1 = 7 OR (ii) (b) $173250= 2 \times 5^3 \times 3^2 \times 7 \times 11$ Highest prime number used by students = 11 (iii) 5	1 1 1 1 1 1

Series C4ABD/4 **SET~1**

प्रश्न–पत्र कोड
Q.P. Code **30/4/1**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।
Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।
Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
MATHEMATICS (STANDARD)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में* ***38*** *प्रश्न हैं । **सभी** प्रश्न **अनिवार्य** हैं ।*

(ii) *यह प्रश्न-पत्र* ***पाँच*** *खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ** ।*

(iii) ***खण्ड क*** *में प्रश्न संख्या* ***1*** *से* ***18*** *तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या* ***19*** *एवं* ***20*** *अभिकथन एवं तर्क आधारित* ***1*** *अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख*** *में प्रश्न संख्या* ***21*** *से* ***25*** *तक अति लघु-उत्तरीय (VSA) प्रकार के* ***2*** *अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग*** *में प्रश्न संख्या* ***26*** *से* ***31*** *तक लघु-उत्तरीय (SA) प्रकार के* ***3*** *अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ*** *में प्रश्न संख्या* ***32*** *से* ***35*** *तक दीर्घ-उत्तरीय (LA) प्रकार के* ***5*** *अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ*** *में प्रश्न संख्या* ***36*** *से* ***38*** *तक प्रकरण अध्ययन आधारित* ***4*** *अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प* ***2*** *अंकों के प्रश्न में दिया गया है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए । जहाँ आवश्यक हो* $\pi = \frac{22}{7}$ *लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग* ***वर्जित*** *है ।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है । *20×1=20*

1. यदि $ax + by = a^2 - b^2$ तथा $bx + ay = 0$ है, तो $x + y$ का मान है :

(A) $a^2 - b^2$ (B) $a + b$

(C) $a - b$ (D) $a^2 + b^2$

2. दो संख्याओं 65 तथा 104 का म.स. (HCF) 13 है । यदि 65 तथा 104 का ल.स. (LCM) $40x$ है, तो x का मान है :

(A) 5 (B) 13

(C) 40 (D) 8

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculators is **not** allowed.*

SECTION A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each. *20×1=20*

1. If $ax + by = a^2 - b^2$ and $bx + ay = 0$, then the value of $x + y$ is :

(A) $a^2 - b^2$ (B) $a + b$

(C) $a - b$ (D) $a^2 + b^2$

2. The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is :

(A) 5 (B) 13

(C) 40 (D) 8

3. यदि एक बहुपद $p(x) = x^2 - 5x + 6$ है, तो $p(1) + p(4)$ का मान है :

(A) 0 (B) 4

(C) 2 (D) – 4

4. यदि द्विघात समीकरण $3x^2 - 2x + c = 0$ का विविक्तकर 16 है, तो c का मान है :

(A) 1 (B) 0

(C) – 1 (D) $\sqrt{2}$

5. यदि वृत्त की एक चाप वृत्त केंद्र पर 90° का कोण अंतरित करती है, तो इस चाप की लंबाई तथा वृत्त की परिधि में अनुपात है :

(A) 2 : 3 (B) 1 : 4

(C) 4 : 1 (D) 1 : 3

6. 12 cm त्रिज्या वाले एक वृत्त के एक त्रिज्यखण्ड का क्षेत्रफल 60π cm^2 है । इस त्रिज्यखण्ड के केंद्रीय कोण की माप है :

(A) 120° (B) 6°

(C) 75° (D) 150°

7. यदि किन्हीं आँकड़ों के बहुलक तथा माध्यक का अंतर 24 है, तो इनके माध्यक और माध्य का अंतर है :

(A) 12 (B) 24

(C) 8 (D) 36

8. दो पासों को एक साथ उछाला गया । दोनों पासों पर विषम संख्याएँ प्राप्त होने की प्रायिकता है :

(A) $\frac{6}{36}$ (B) $\frac{3}{36}$

(C) $\frac{12}{36}$ (D) $\frac{9}{36}$

9. एक ठोस अर्धगोले के संपूर्ण पृष्ठीय क्षेत्रफल तथा इसकी त्रिज्या के वर्ग के बीच का अनुपात है :

(A) $2\pi : 1$ (B) $4\pi : 1$

(C) $3\pi : 1$ (D) $1 : 4\pi$

3. If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of $p(1) + p(4)$ is :

(A) 0 (B) 4

(C) 2 (D) – 4

4. If the discriminant of the quadratic equation $3x^2 - 2x + c = 0$ is 16, then the value of c is :

(A) 1 (B) 0

(C) – 1 (D) $\sqrt{2}$

5. If an arc subtends an angle of 90° at the centre of a circle, then the ratio of its length to the circumference of the circle is :

(A) 2 : 3 (B) 1 : 4

(C) 4 : 1 (D) 1 : 3

6. The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is :

(A) 120° (B) 6°

(C) 75° (D) 150°

7. If the difference of mode and median of a data is 24, then the difference of its median and mean is :

(A) 12 (B) 24

(C) 8 (D) 36

8. Two dice are tossed simultaneously. The probability of getting odd numbers on both the dice is :

(A) $\frac{6}{36}$ (B) $\frac{3}{36}$

(C) $\frac{12}{36}$ (D) $\frac{9}{36}$

9. The ratio of total surface area of a solid hemisphere to the square of its radius is :

(A) $2\pi : 1$ (B) $4\pi : 1$

(C) $3\pi : 1$ (D) $1 : 4\pi$

10. यदि $\sin\theta = 1$ है, तो $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ का मान है :

(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$

(C) $\frac{1}{2}$ (D) 0

11. दी गई दो रेखाएँ परस्पर समांतर हैं । इनमें से एक रेखा का समीकरण $5x - 3y = 2$ है । तो दूसरी रेखा का समीकरण हो सकता है :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

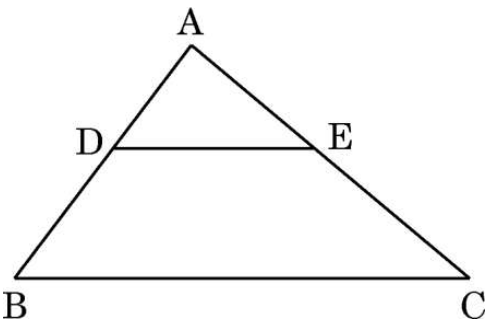
(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

12. तीन संख्याएँ जो एक समांतर श्रेढ़ी में हैं, का योगफल 30 है । इसका मध्य पद क्या है ?

(A) 4 (B) 10

(C) 16 (D) 8

13. एक Δ ABC में, DE || BC है (जैसा कि आकृति में दर्शाया गया है) । यदि AD = 4 cm, AB = 9 cm तथा AC = 13·5 cm है, तो EC की लंबाई है :



(A) 6 cm (B) 7·5 cm

(C) 9 cm (D) 5·7 cm

14. दिन में किसी समय, एक मीनार की छाया की लंबाई इसकी ऊँचाई के बराबर होती है । तो उस समय सूर्य का उन्नतांश है :

(A) 30° (B) 45°

(C) 60° (D) 90°

10. If $\sin\theta = 1$, then the value of $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ is :

(A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$

(C) $\frac{1}{2}$ (D) 0

11. Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be :

(A) $-15x - 9y = 5$ (B) $15x + 9y = 5$

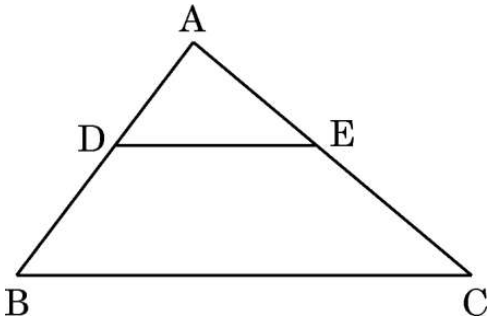
(C) $9x - 15y = 6$ (D) $-15x + 9y = 5$

12. Three numbers in A.P. have the sum 30. What is its middle term ?

(A) 4 (B) 10

(C) 16 (D) 8

13. In Δ ABC, DE || BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :



(A) 6 cm (B) 7·5 cm

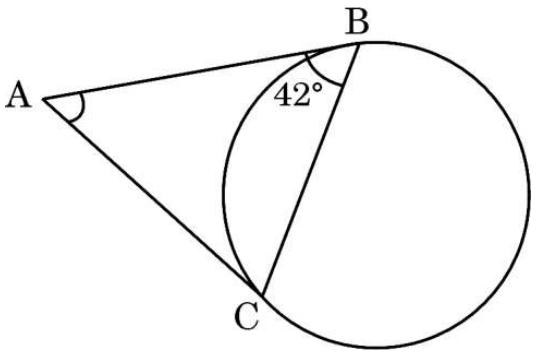
(C) 9 cm (D) 5·7 cm

14. At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is :

(A) 30° (B) 45°

(C) 60° (D) 90°

15. दी गई आकृति में, AB तथा AC एक वृत्त पर खींची गई स्पर्श-रेखाएँ हैं । यदि $\angle ABC = 42°$ है, तो $\angle BAC$ की माप है :



(A) 96° (B) 42°

(C) 106° (D) 86°

16. एक समांतर चतुर्भुज ABCD के तीन शीर्ष A(– 2, 3), B(6, 7) तथा C(8, 3) हैं, तो इसका चौथा शीर्ष D है :

(A) (0, 1) (B) (0, –1)

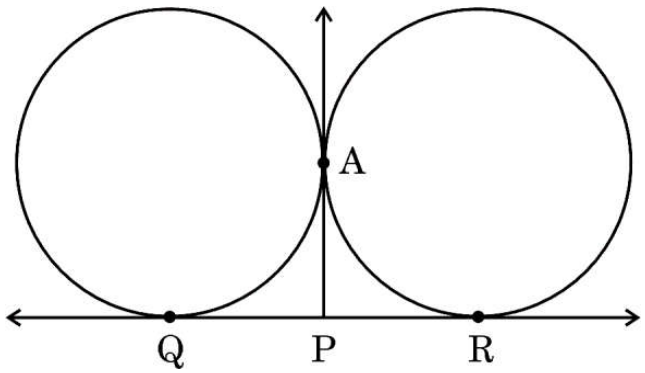
(C) (–1, 0) (D) (1, 0)

17. किसी घटना E के लिए, यदि $P(E) + P(\overline{E}) = q$ है, तो $q^2 - 4$ का मान है :

(A) – 3 (B) 3

(C) 5 (D) – 5

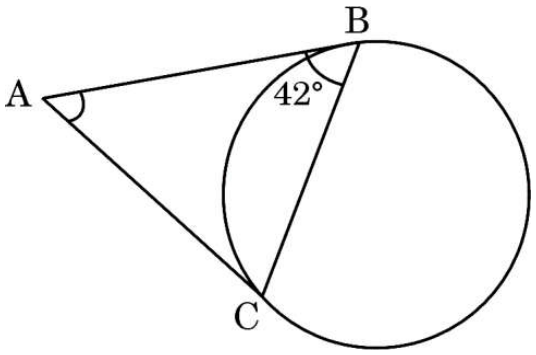
18. दी गई आकृति में, बिंदु A पर बाह्य स्पर्श करने वाले दो वृत्तों की एक उभयनिष्ठ स्पर्श-रेखा QR है । बिंदु A पर खींची गई स्पर्श-रेखा QR को P पर मिलती है । यदि AP = 4·2 cm है, तो QR की लंबाई है :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

15. In the given figure, AB and AC are tangents to the circle. If $\angle$ ABC = 42°, then the measure of $\angle$ BAC is :



(A) 96° (B) 42°

(C) 106° (D) 86°

16. The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is :

(A) (0, 1) (B) (0, – 1)

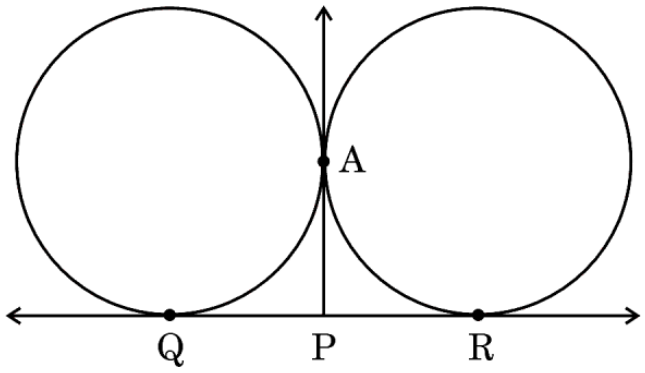
(C) (– 1, 0) (D) (1, 0)

17. For an event E, if P(E) + $P(\overline{E})$ = q, then the value of $q^2 - 4$ is :

(A) – 3 (B) 3

(C) 5 (D) – 5

18. In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :



(A) 4·2 cm (B) 2·1 cm

(C) 8·4 cm (D) 6·3 cm

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* एक रेखाखण्ड का मध्य-बिंदु इसे 1 : 1 के अनुपात में विभाजित करता है ।

तर्क (R) : बिंदु $(-3, k)$, बिंदुओं $(-5, 4)$ तथा $(-2, 3)$ को मिलाने वाले रेखाखण्ड को 1 : 2 के अनुपात में विभाजित करता है ।

20. *अभिकथन (A) :* यदि एक वृत्त की परिधि 176 cm है, तो इसकी त्रिज्या 28 cm है ।

तर्क (R) : वृत्त की परिधि = $2\pi \times$ त्रिज्या

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं । $5 \times 2 = 10$

21. तीन घंटियाँ क्रमशः 9, 12 तथा 15 मिनट के अंतराल पर बजती हैं । यदि वह एक साथ बजना शुरू करती हैं, तो कितने समय के बाद वह दोबारा एक साथ बजेंगी ?

22. (a) एक घड़ी की मिनट वाली सुई की लंबाई 14 cm है । 5 मिनट में इसके द्वारा घड़ी के तल पर रचित क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) 42 cm त्रिज्या वाले वृत्त की उस चाप की लंबाई ज्ञात कीजिए जो वृत्त के केंद्र पर $60°$ का कोण अंतरित करती है ।

23. (a) मान ज्ञात कीजिए : $\dfrac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

अथवा

(b) यदि $\sin(A - B) = \dfrac{1}{2}$, $\cos(A + B) = \dfrac{1}{2}$; $0 < A + B \leq 90°$, $A > B$ है; तो $\angle A$ तथा $\angle B$ ज्ञात कीजिए ।

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1.

Reason (R) : The ratio in which the point $(-3, k)$ divides the line segment joining the points $(-5, 4)$ and $(-2, 3)$ is 1 : 2.

20. *Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm.

Reason (R): Circumference = $2\pi \times$ radius of a circle.

SECTION B

This section comprises Very Short Answer (VSA) type questions of 2 marks each. *5×2=10*

21. Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?

22. (a) The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.

OR

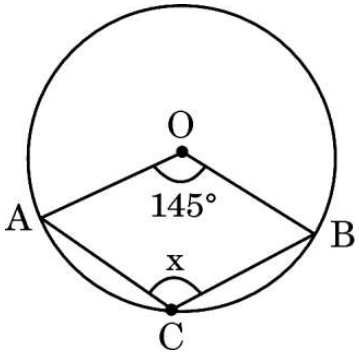
(b) Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.

23. (a) Evaluate : $\dfrac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$

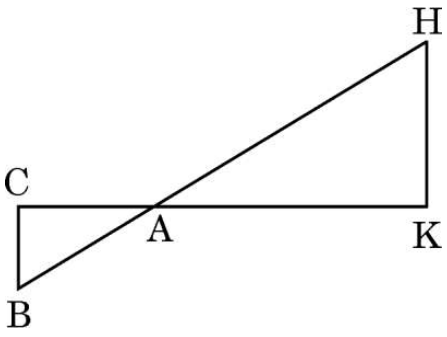
OR

(b) If $\sin(A - B) = \dfrac{1}{2}$, $\cos(A + B) = \dfrac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find $\angle A$ and $\angle B$.

24. दी गई आकृति में, O वृत्त का केंद्र है । यदि $\angle AOB = 145°$ है, तो x का मान ज्ञात कीजिए ।



25. दी गई आकृति में, $\Delta AHK \sim \Delta ABC$ है । यदि AK = 8 cm, BC = 3·2 cm तथा HK = 6·4 cm है, तो AC की लंबाई ज्ञात कीजिए ।



खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं । *6×3=18*

26. सिद्ध कीजिए : $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

27. (a) तीन सिक्कों को एक साथ उछाला गया । निम्न के प्राप्त होने की प्रायिकता क्या है ?

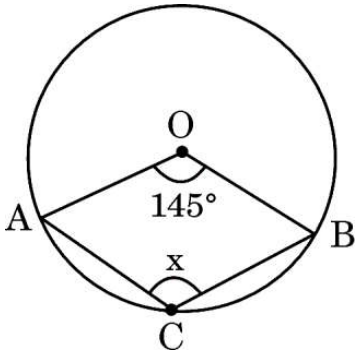
(i) कम-से-कम एक चित

(ii) मात्र दो पट

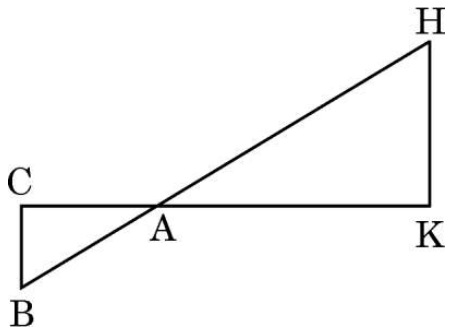
(iii) अधिक-से-अधिक एक पट

अथवा

24. In the given figure, O is the centre of the circle. If $\angle$ AOB = 145°, then find the value of x.



25. In the given figure, Δ AHK $\sim$ Δ ABC. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.



SECTION C

This section comprises Short Answer (SA) type questions of 3 marks each. *6×3=18*

26. Prove that $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$

27. (a) Three coins are tossed simultaneously. What is the probability of getting

(i) at least one head ?

(ii) exactly two tails ?

(iii) at most one tail ?

OR

(b) एक पेटी में 90 डिस्क (discs) हैं, जिन पर 1 से 90 तक संख्याएँ अंकित हैं । यदि इस पेटी में से एक डिस्क यादृच्छया निकाला जाता है, तो इसकी प्रायिकता ज्ञात कीजिए कि इस डिस्क पर अंकित होगी :

(i) दो अंकों की संख्या जो 40 से कम है ।

(ii) 5 से भाज्य वह संख्या जो 50 से बड़ी है ।

(iii) एक पूर्ण वर्ग संख्या ।

28. रेहाना ₹ 2,000 निकालने के लिए एक बैंक गई तथा उसने खजांची (कैशियर) को केवल ₹ 50 और ₹ 100 के नोट देने के लिए कहा । रेहाना को कुल 25 नोट प्राप्त हुए । ज्ञात कीजिए कि उसे ₹ 50 तथा ₹ 100 के कितने-कितने नोट मिले ।

29. (a) बहुपद $4x^2 + 4x - 3$ के शून्यक ज्ञात कीजिए तथा शून्यकों तथा बहुपद के गुणांकों के बीच के संबंध की जाँच कीजिए ।

अथवा

(b) यदि α तथा β बहुपद $x^2 + x - 2$ के शून्यक हैं, तो $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ का मान ज्ञात कीजिए ।

30. दिया गया है कि $\sqrt{3}$ एक अपरिमेय संख्या है, तो सिद्ध कीजिए कि $\frac{2-\sqrt{3}}{5}$ एक अपरिमेय संख्या है ।

31. सिद्ध कीजिए कि किसी वृत्त के परिगत समांतर चतुर्भुज समचतुर्भुज होता है ।

(b) A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a :

(i) 2-digit number less than 40.

(ii) number divisible by 5 and greater than 50.

(iii) a perfect square number.

28. Rehana went to a bank to withdraw ₹ 2,000. She asked the cashier to give her ₹ 50 and ₹ 100 notes only. Rehana got 25 notes in all. Find how many notes of ₹ 50 and ₹ 100 did she receive.

29. (a) Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.

OR

(b) If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

30. Prove that $\frac{2 - \sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.

31. Prove that the parallelogram circumscribing a circle is a rhombus.

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं । *4×5=20*

32. एक 100 m चौड़ी सड़क के दोनों ओर आमने-सामने, समान लंबाई वाले दो खंभे लगे हुए हैं । इन दोनों खंभों के बीच सड़क के एक बिंदु से खंभों के शिखर के उन्नयन कोण क्रमशः 60° और 30° हैं । प्रत्येक खंभे की लंबाई और खंभों से सड़क के बिंदु की दूरी ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 प्रयोग कीजिए)

33. (a) एक समांतर चतुर्भुज ABCD की बढ़ाई गई भुजा AD पर बिंदु E इस प्रकार है कि BE, भुजा CD को F पर काटती है । दर्शाइए कि Δ ABE ~ Δ CFB.

अथवा

(b) Δ ABC की भुजाएँ AB, BC तथा माध्यिका AD क्रमशः Δ PQR की भुजाओं PQ, QR तथा माध्यिका PM के समानुपाती हैं । सिद्ध कीजिए कि Δ ABC ~ Δ PQR.

34. (a) एक रेलगाड़ी 90 km की दूरी एक स्थिर चाल से चलती है । यदि इसकी चाल 15 km/h अधिक होती, तो इसे यह यात्रा पूरी करने में 30 मिनट कम लगते । रेलगाड़ी की मूल चाल ज्ञात कीजिए ।

अथवा

(b) 'c' का वह मान ज्ञात कीजिए, जिसके लिए द्विघात समीकरण

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ c \neq -1$$

के मूल वास्तविक तथा समान हों ।

35. निम्नलिखित सारणी, एक अस्पताल में पूरे वर्ष में आए रोगियों की आयु दर्शाती है :

आयु (वर्षों में)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
रोगियों की संख्या	6	11	21	23	14	5

उपर्युक्त प्रदत्त आँकड़ों का बहुलक तथा माध्य ज्ञात कीजिए ।

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each. *4×5=20*

32. Two pillars of equal lengths stand on either side of a road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillars, the angles of elevation of the tops of the pillars are 60° and 30°. Find the length of each pillar and distance of the point on the road from the pillars. (Use $\sqrt{3}$ = 1·732)

33. (a) E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.

OR

(b) Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.

34. (a) A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train.

OR

(b) Find the value of 'c' for which the quadratic equation

$$(c + 1)\,x^2 - 6\,(c + 1)\,x + 3\,(c + 9) = 0;\ c \neq -1$$

has real and equal roots.

35. The following table shows the ages of the patients admitted in a hospital during a year :

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
Number of patients	6	11	21	23	14	5

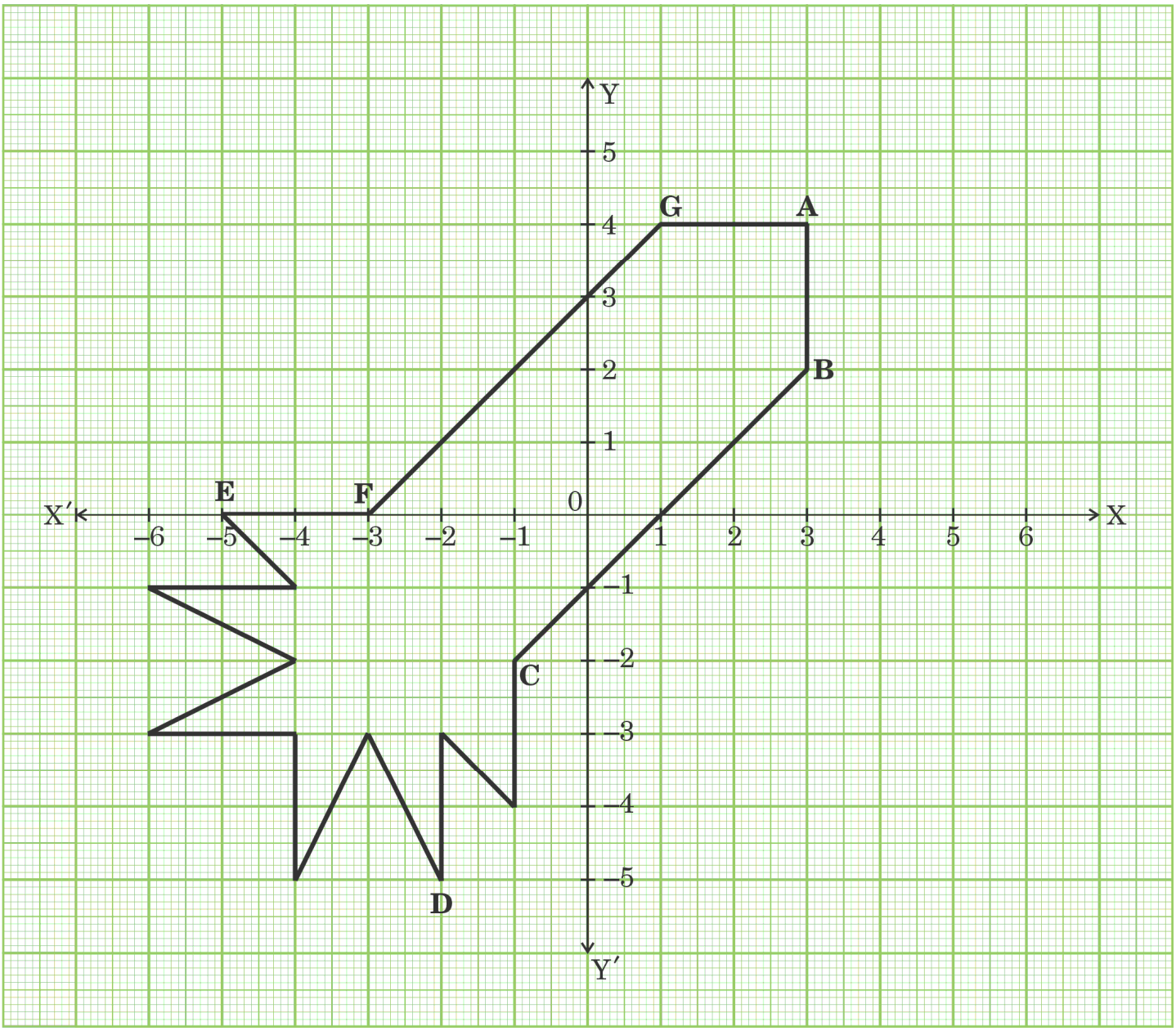
Find the mode and mean of the data given above.

खण्ड ङ

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं । *3×4=12*

प्रकरण अध्ययन – 1

36. रेयान को छोटी उम्र से ही तारों की जगमगाहट और अंतरिक्ष की विशालता बहुत आकर्षित करती थी । वह हमेशा एक दिन अंतरिक्ष-यात्री बनने का सपना देखता था । इसलिए उसने ग्राफ पेपर पर अपने राकेट डिज़ाइन को स्केच करना शुरू कर दिया । ऐसा एक डिज़ाइन नीचे दिया गया है :



उपर्युक्त पर आधारित, निम्नलिखित प्रश्नों के उत्तर दीजिए :

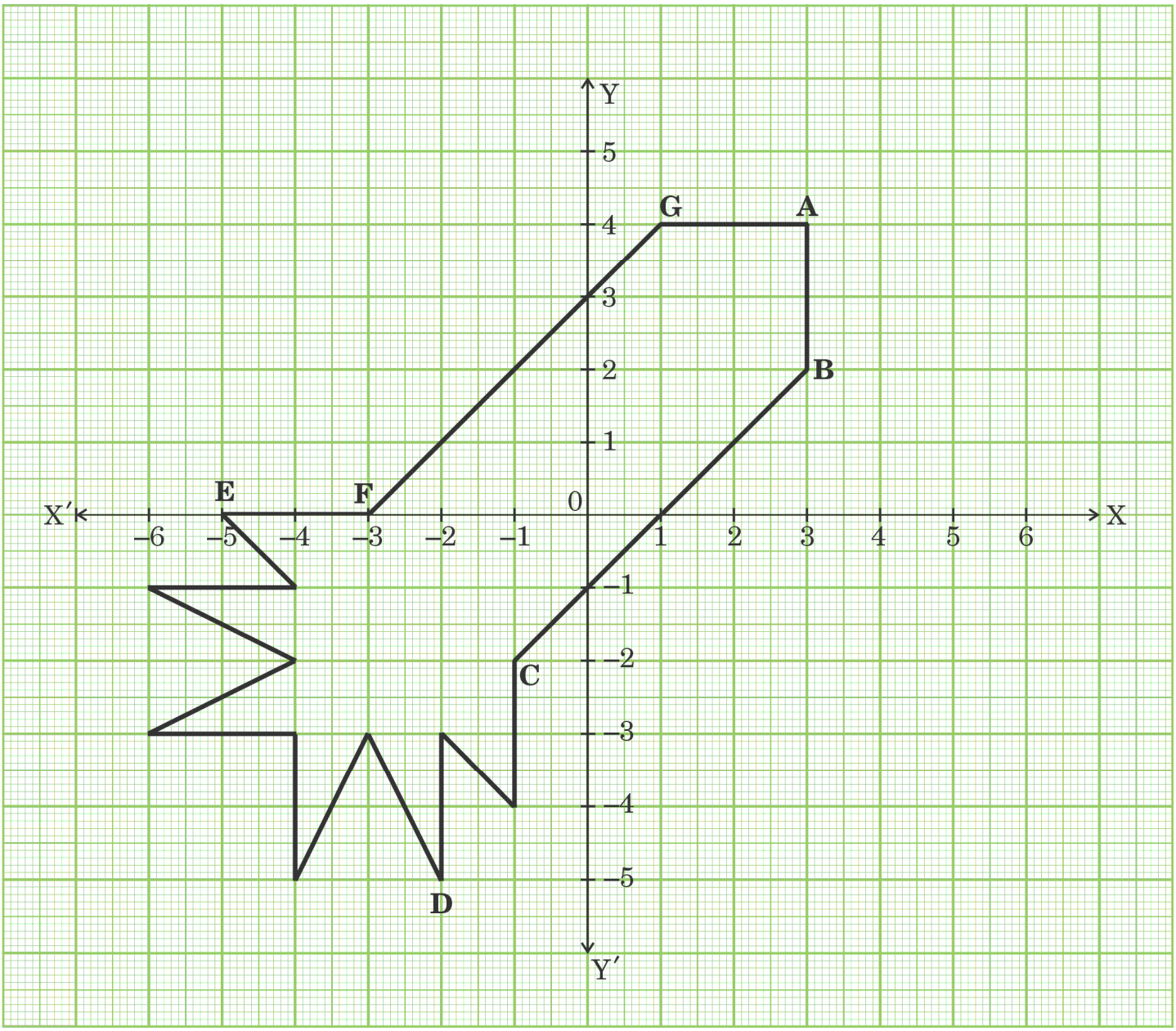
(i) F तथा G को मिलाने वाले रेखाखण्ड का मध्य-बिंदु ज्ञात कीजिए । *1*

SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

Case Study – 1

36. Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :



Based on the above, answer the following questions :

(i) Find the mid-point of the segment joining F and G. *1*

(ii) (a) बिंदुओं A तथा C के बीच की दूरी कितनी है ? *2*

अथवा

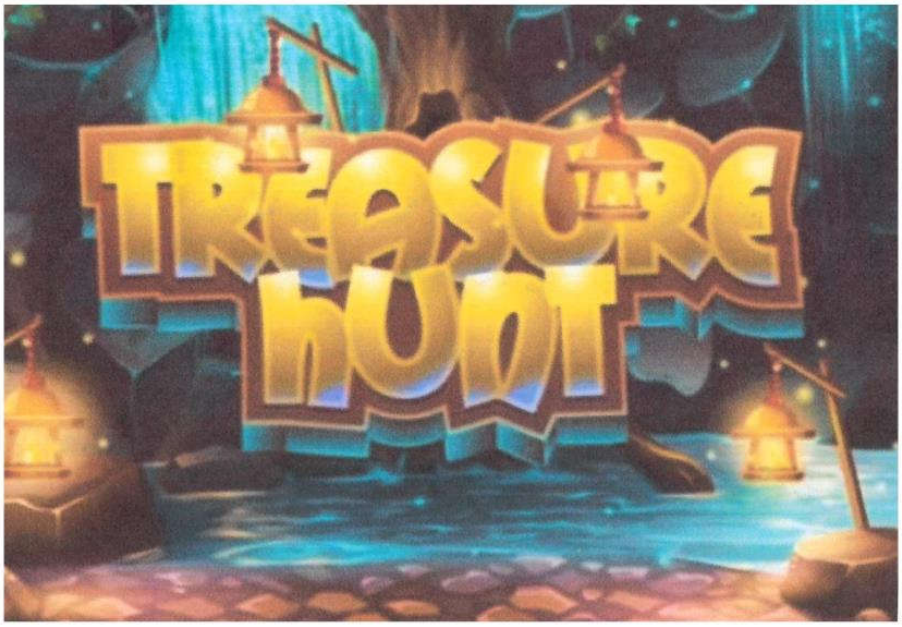
(b) बिंदुओं A तथा B को मिलाने वाले रेखाखण्ड को 1 : 3 के अनुपात में अंतः विभाजन करने वाले बिंदु के निर्देशांक ज्ञात कीजिए । *2*

(iii) बिंदु D के निर्देशांक क्या हैं ? *1*

प्रकरण अध्ययन – 2

37. ट्रेजर हंट एक रोमांचक और साहसिक खेल है, जहाँ प्रतिभागी छिपे हुए खजाने को खोजने के लिए सुरागों/संख्याओं/मानचित्रों की एक शृंखला का अनुसरण करते हैं । खिलाड़ी प्रतिष्ठित पुरस्कार का स्थान जानने के लिए एक रोमांचक खोज में लगे रहते हैं, समस्याओं और पहेलियों को सुलझाते हैं ।

एक ट्रेजर हंट खेल खेलते समय कुछ सुराग (संख्याएँ) विभिन्न स्थानों में छिपे होते हैं जो सामूहिक रूप में एक A.P. बनाते हैं । यदि nवें स्थान पर संख्या 20 + 4n है, तो खिलाड़ियों की मदद के लिए निम्नलिखित प्रश्नों के उत्तर दीजिए :



(i) पहले स्थान पर कौन-सी संख्या है ? *1*

(ii) (a) कौन-सा स्थान 112 क्रमांकित है ? *2*

अथवा

(b) पहले 10 स्थानों की सभी संख्याओं का योगफल क्या है ? *2*

(iii) कौन-सी संख्या (n – 2)वें स्थान पर है ? *1*

(ii) (a) What is the distance between the points A and C ? *2*

OR

(b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally. *2*

(iii) What are the coordinates of the point D ? *1*

Case Study – 2

37. Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize.

While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the n^{th} spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :

(i) Which number is on first spot ? *1*

(ii) (a) Which spot is numbered as 112 ? *2*

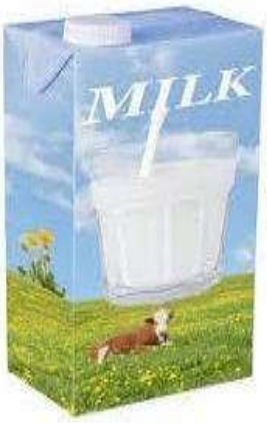
OR

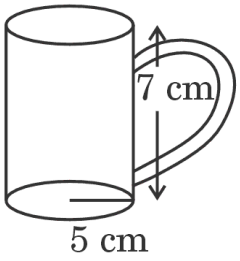
(b) What is the sum of all the numbers on the first 10 spots ? *2*

(iii) Which number is on the $(n - 2)^{th}$ spot ? *1*

प्रकरण अध्ययन – 3

38. टैम्पर-प्रूफ टेट्रा-पैक दूध ताज़गी और सुरक्षा दोनों की गारंटी देता है । यह दूध बेजोड़ गुणवत्ता सुनिश्चित करता है, इसमें निहित पोषण मूल्यों को संरक्षित करता है और इसे स्वास्थ्य के प्रति जागरूक व्यक्तियों के लिए एक विश्वसनीय विकल्प बनाता है ।





500 mL दूध 15 cm × 8 cm × 5 cm आयाम के घनाभाकार पैकेट में पैक हैं तथा यह दूध के पैकेट 30 cm × 32 cm × 15 cm के घनाभाकार कार्टन (डिब्बे) में रखे हैं ।

उपर्युक्त दी गई जानकारी के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) घनाभाकार कार्टन (डिब्बे) का आयतन ज्ञात कीजिए । *1*

(ii) (a) दूध के एक पैकेट का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *2*

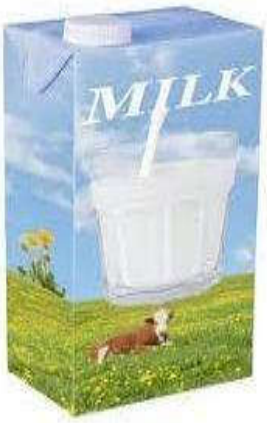
अथवा

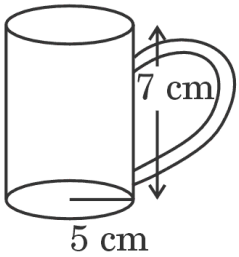
(b) एक कार्टन (डिब्बे) में कितने दूध के पैकेट आ सकते हैं ? *2*

(iii) आकृति में दिखाए गए कप में कितना दूध आ सकता है ? *1*

Case Study – 3

38. Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.





500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm.

Based on the above given information, answer the following questions :

(i) Find the volume of the cuboidal carton. *1*

(ii) (a) Find the total surface area of a milk packet. *2*

OR

(b) How many milk packets can be filled in a carton ? *2*

(iii) How much milk can the cup (as shown in the figure) hold ? *1*

Marking Scheme
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MATHEMATICS PAPER CODE 30/4/1

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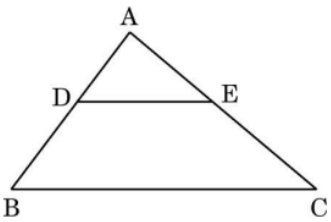
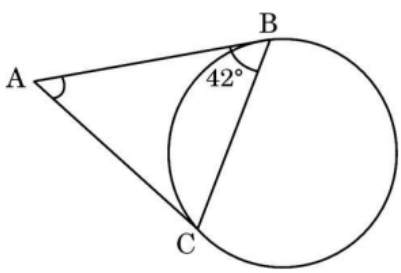
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class - X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

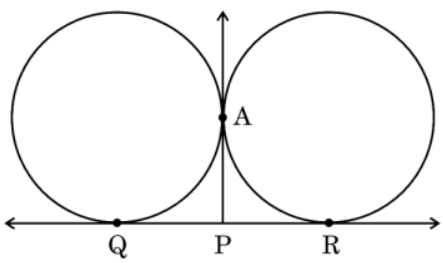
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/4/1)

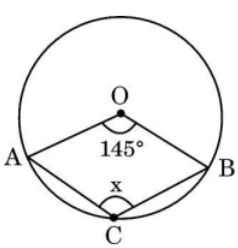
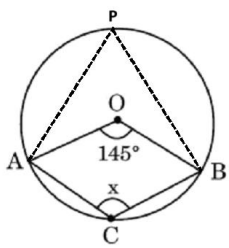
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section comprises Multiple Choice Questions (MCQs) of 1 mark each	
1.	If $ax + by = a^2 - b^2$ and $bx + ay = 0$, then the value of $x + y$ is : (A) $a^2 - b^2$ (B) $a + b$ (C) $a - b$ (D) $a^2 + b^2$	
Sol.	(C) a – b	1
2.	The HCF of two numbers 65 and 104 is 13. If LCM of 65 and 104 is 40x, then the value of x is : (A) 5 (B) 13 (C) 40 (D) 8	
Sol.	(B) 13	1
3.	If a polynomial p(x) is given by $p(x) = x^2 - 5x + 6$, then the value of $p(1) + p(4)$ is : (A) 0 (B) 4 (C) 2 (D) – 4	
Sol.	(B) 4	1
4.	If the discriminant of the quadratic equation $3x^2 - 2x + c = 0$ is 16, then the value of c is : (A) 1 (B) 0 (C) – 1 (D) $\sqrt{2}$	
Sol.	(C) -1	1
5.	If an arc subtends an angle of 90° at the centre of a circle, then the ratio of its length to the circumference of the circle is : (A) 2 : 3 (B) 1 : 4 (C) 4 : 1 (D) 1 : 3	
Sol.	(B) 1:4	1

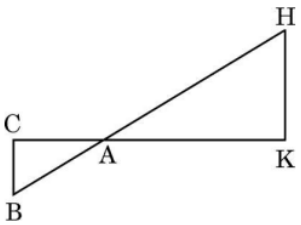
6.	The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is : (A) 120° (B) 6° (C) 75° (D) 150°	
Sol.	(D) 150°	1
7.	If the difference of mode and median of a data is 24, then the difference of its median and mean is : (A) 12 (B) 24 (C) 8 (D) 36	
Sol.	(A) 12	1
8.	Two dice are tossed simultaneously. The probability of getting odd numbers on both the dice is : (A) $\frac{6}{36}$ (B) $\frac{3}{36}$ (C) $\frac{12}{36}$ (D) $\frac{9}{36}$	
Sol.	(D) $\frac{9}{36}$	1
9.	The ratio of total surface area of a solid hemisphere to the square of its radius is : (A) $2\pi : 1$ (B) $4\pi : 1$ (C) $3\pi : 1$ (D) $1 : 4\pi$	
Sol.	(C) $3\pi:1$	1
10.	If $\sin\theta = 1$, then the value of $\frac{1}{2}\sin\left(\frac{\theta}{2}\right)$ is : (A) $\frac{1}{2\sqrt{2}}$ (B) $\frac{1}{\sqrt{2}}$ (C) $\frac{1}{2}$ (D) 0	
Sol.	(A) $\frac{1}{2\sqrt{2}}$	1
11.	Two lines are given to be parallel. The equation of one of these lines is $5x - 3y = 2$. The equation of the second line can be : (A) $-15x - 9y = 5$ (B) $15x + 9y = 5$ (C) $9x - 15y = 6$ (D) $-15x + 9y = 5$	
Sol.	(D) $-15x + 9y = 5$	1

12.	Three numbers in A.P. have the sum 30. What is its middle term ? (A) 4 (B) 10 (C) 16 (D) 8	
Sol.	(B) 10	1
13.	In Δ ABC, DE $\|\|$ BC (as shown in the figure). If AD = 4 cm, AB = 9 cm and AC = 13·5 cm, then the length of EC is :  (A) 6 cm (B) 7·5 cm (C) 9 cm (D) 5·7 cm	
Sol.	(B) 7.5 cm	1
14.	At some time of the day, the length of the shadow of a tower is equal to its height. Then, the Sun's altitude at that time is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(B) 45°	1
15.	In the given figure, AB and AC are tangents to the circle. If $\angle$ ABC = 42°, then the measure of $\angle$ BAC is :  (A) 96° (B) 42° (C) 106° (D) 86°	
Sol.	(A) 96°	1

16.	The fourth vertex D of a parallelogram ABCD whose three vertices are A(– 2, 3), B(6, 7) and C(8, 3) is : (A) (0, 1) (B) (0, –1) (C) (–1, 0) (D) (1, 0)	
Sol.	(B) (0,-1)	1
17.	For an event E, if P(E) + P($\overline{E}$) = q, then the value of $q^2 - 4$ is : (A) – 3 (B) 3 (C) 5 (D) – 5	
Sol.	(A) -3	1
18.	In the given figure, QR is a common tangent to the two given circles touching externally at A. The tangent at A meets QR at P. If AP = 4·2 cm, then the length of QR is :  (A) 4·2 cm (B) 2·1 cm (C) 8·4 cm (D) 6·3 cm	
Sol.	(C) 8.4 cm	1
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19.	*Assertion (A) :* Mid-point of a line segment divides the line segment in the ratio 1 : 1. *Reason (R) :* The ratio in which the point (– 3, k) divides the line segment joining the points (– 5, 4) and (– 2, 3) is 1 : 2.	
Sol.	(C) Assertion (A) is true but Reason (R) is false	1

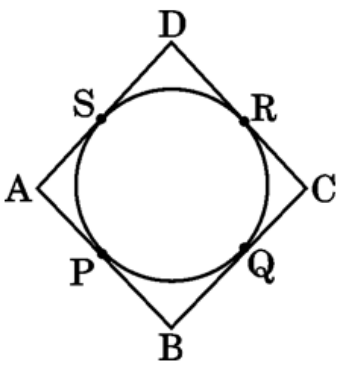
20.	*Assertion (A) :* If the circumference of a circle is 176 cm, then its radius is 28 cm. *Reason (R):* Circumference = $2\pi \times$ radius of a circle.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
	SECTION B This section comprises Very Short Answer (VSA) type questions of 2 marks each.	
21.	Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they start tolling together, after what time will they next toll together ?	
Sol.	$9 = 3^2$ $12 = 2^2 \times 3$ $15 = 3 \times 5$ L.C.M = $2^2 \times 3^2 \times 5 = 180$ Three bells will toll together after 180 min.	1 1
22. (a)	The minute hand of a clock is 14 cm long. Find the area on the face of the clock described by the minute hand in 5 minutes.	
Sol.	Angle subtended in 5 min. = 30° Area described by minute hand = $\frac{30}{360} \times \frac{22}{7} \times 14 \times 14$ $= \frac{154}{3}$ cm^2 or 51.33 cm^2 approx.	½ 1 ½
	OR	
22. (b)	Find the length of the arc of a circle which subtends an angle of 60° at the centre of the circle of radius 42 cm.	
Sol.	Length of arc = $2 \times \frac{22}{7} \times 42 \times \frac{60}{360}$ = 44 cm	1½ ½

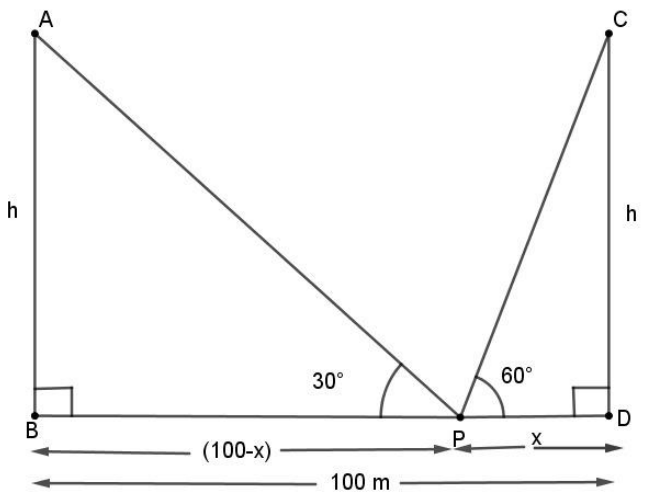
23. (a)	Evaluate : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$	
Sol.	$\frac{5\left(\frac{1}{2}\right)^2+4\left(\frac{2}{\sqrt{3}}\right)^2-(1)^2}{\left(\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$ $= \frac{67}{12}$	1½ ½
	OR	
23.(b)	If $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$; $0 < A + B \leq 90°$, $A > B$; find $\angle A$ and $\angle B$.	
Sol.	$\sin(A - B) = \sin 30°$ $A - B = 30°$ --------(i) $\cos(A+B) = \cos 60°$ $A + B = 60°$ ---------(ii) Solving (i) and (ii) $A = 45°$, $B = 15°$	½ ½ 1
24.	In the given figure, O is the centre of the circle. If $\angle AOB = 145°$, then find the value of x. 	
Sol.	 Take a point P on circumference and join AP & BP.	½

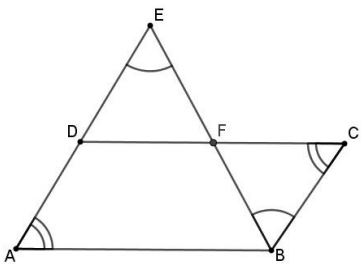
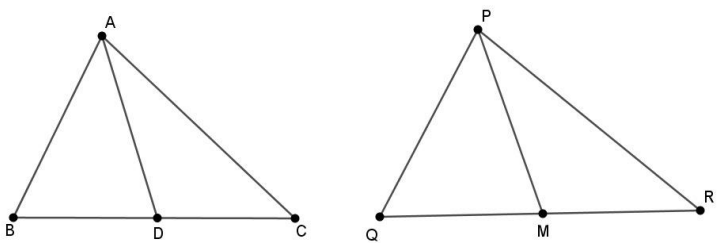
	$\angle APB = \frac{1}{2} \times 145° = 72.5°$ $\angle APB + \angle ACB = 180°$ $\Rightarrow \angle ACB = 107.5°$ or $x = 107.5°$	½ ½ ½
25.	In the given figure, Δ AHK ~ Δ ABC. If AK = 8 cm, BC = 3·2 cm and HK = 6·4 cm, then find the length of AC.  	
Sol.	$\because \Delta AHK \sim \Delta ABC$ (given) $\therefore \frac{HK}{BC} = \frac{AK}{AC}$ $\Rightarrow \frac{6.4}{3.2} = \frac{8.0}{AC}$ $\Rightarrow$ AC = 4 cm	 1 1
	SECTION C This section comprises Short Answer (SA) type questions of 3 marks each.	
26.	Prove that $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$	
Sol.	L.H.S = $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$ Divide Numerator and Denominator by cos θ. $= \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$ $= \frac{\tan\theta - 1 + \sec\theta}{(\tan\theta - \sec\theta) + (\sec^2\theta - \tan^2\theta)}$ $= \frac{\tan\theta - 1 + \sec\theta}{(\sec\theta - \tan\theta)(\tan\theta + \sec\theta - 1)}$ $= \frac{1}{\sec\theta - \tan\theta}$ = R.H.S	 1 1 ½ ½

27.(a)	Three coins are tossed simultaneously. What is the probability of getting (i) at least one head ? (ii) exactly two tails ? (iii) at most one tail ?	
Sol.	Total number of outcomes = 8 (i) P (at least one head) = $\frac{7}{8}$ (ii) P (exactly 2 tails) = $\frac{3}{8}$ (iii) P (at most one tail) = $\frac{4}{8}$ or $\frac{1}{2}$	 1 1 1
	OR	
27.(b)	A box contains 90 discs which are numbered 1 to 90. If one disc is drawn at random from the box, find the probability that it bears a : (i) 2-digit number less than 40. (ii) number divisible by 5 and greater than 50. (iii) a perfect square number.	
Sol.	Total outcomes = 90 (i) P (2 digit number less than 40) = $\frac{30}{90}$ or $\frac{1}{3}$ (ii) P (a number divisible by 5 and greater than 50) = $\frac{8}{90}$ or $\frac{4}{45}$ (iii) P (a perfect square number) = $\frac{9}{90}$ or $\frac{1}{10}$	 1 1 1
28	Rehana went to a bank to withdraw ₹ 2,000. She asked the cashier to give her ₹ 50 and ₹ 100 notes only. Rehana got 25 notes in all. Find how many notes of ₹ 50 and ₹ 100 did she receive.	
Sol.	Let number of ₹50 notes = x and number of ₹100 notes = y Here x + y = 25 ------(i) 50x + 100y = 2000 or x + 2y = 40 -------(ii)	 1 1

	Solving eq.(i) and eq.(ii), we get x = 10 and y = 15 Therefore 10 notes of ₹50 and 15 notes of ₹100 are received.	½ + ½
29.(a)	Find the zeroes of the polynomial $4x^2 + 4x - 3$ and verify the relationship between zeroes and coefficients of the polynomial.	
Sol.	$P(x) = 4x^2 + 4x - 3$ $= (2x + 3)(2x - 1)$ $\therefore$ Zeroes of the polynomial are $\frac{-3}{2}$, $\frac{1}{2}$ Sum of Zeroes = $\frac{-3}{2} + \frac{1}{2} = \frac{-3+1}{2} = -1 = \frac{-4}{4} = \frac{-(\text{coefficient of } x)}{(\text{coefficient of } x^2)}$ Product of Zeroes = $\frac{-3}{2} \times \frac{1}{2} = \frac{-3}{4} = \frac{\text{constant term}}{\text{coefficient of } x^2}$	1 1 ½ ½
	OR	
29(b).	If α and β are the zeroes of the polynomial $x^2 + x - 2$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	Here $\alpha + \beta = -1$ and $\alpha\beta = -2$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$ $= \frac{(-1)^2 - 2(-2)}{-2} = -\frac{5}{2}$	1 1 1
30.	Prove that $\frac{2-\sqrt{3}}{5}$ is an irrational number, given that $\sqrt{3}$ is an irrational number.	
Sol.	Assuming $\frac{2-\sqrt{3}}{5}$ to be a rational number. $\Rightarrow \frac{2-\sqrt{3}}{5} = \frac{p}{q}$,where p and q are integers & $q \neq 0$ $\Rightarrow \sqrt{3} = \frac{2q-5p}{q}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong.	½ 1 ½ ½

	Hence $\frac{2-\sqrt{3}}{5}$ is an irrational number.	½
31.	**Prove that the parallelogram circumscribing a circle is a rhombus.**	
Sol.	Correct figure 	½
	AP = AS -----(i) BP = BQ -----(ii) CR = CQ -----(iii) DR = DS -----(iv)	1
	Adding (i), (ii), (iii) & (iv) AP + BP + CR + DR = AS + BQ + CQ + DS $\Rightarrow$ AB + CD = AD + BC	1
	But ABCD is a parallelogram $\Rightarrow$AB = CD and AD = BC $\therefore$ 2AB = 2AD or AB = AD	½
	Hence, ABCD is a rhombus.	

	SECTION D This section comprises Long Answer (LA) type questions of 5 marks each.	
32.	Two pillars of equal lengths stand on either side of a road which is 100 m wide, exactly opposite to each other. At a point on the road between the pillars, the angles of elevation of the tops of the pillars are 60° and 30°. Find the length of each pillar and distance of the point on the road from the pillars. (Use $\sqrt{3}$ = 1·732)	
Sol.	Correct figure  Let AB and CD are two pillars of equal length h m and let P be the point on road x m away from pillar CD. In ΔCDP $\tan 60° = \sqrt{3} = \frac{h}{x}$ $\Rightarrow h = \sqrt{3}\, x$ ------(i) In ΔABP, $\tan 30° = \frac{1}{\sqrt{3}} = \frac{h}{100-x}$ $\Rightarrow h = \frac{100-x}{\sqrt{3}}$ -------(ii) Solving eq.(i) and eq.(ii) x = 25	1 1 ½ 1 ½ ½

	and h = $25\sqrt{3}$ = 25 × 1.732 = 43.3 The length of each pillar is 43.3 m and the distance of the point on the road from pillars is 75 m and 25 m respectively.	½
33.(a)	**E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. Show that Δ ABE ~ Δ CFB.**	
Sol.	Correct figure  In ΔABE and ΔCFB ∠EAB = ∠BCF ∠AEB = ∠CBF ⇒ ΔABE ~ ΔCFB	2 1 1 1
	OR	
33.(b)	**Sides AB, BC and the median AD of Δ ABC are respectively proportional to sides PQ, QR and the median PM of another Δ PQR. Prove that Δ ABC ~ Δ PQR.**	
Sol.	Correct figure  $\because \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AD}{PM}$ $\therefore \frac{AB}{PQ} = \frac{2BD}{2QM} = \frac{AD}{PM}$	1 1

	$\Rightarrow \frac{AB}{PQ} = \frac{BD}{QM} = \frac{AD}{PM}$ -------(i)	
	$\Rightarrow \Delta ABD \sim \Delta PQM$	1
	$\Rightarrow \angle B = \angle Q$ -----(ii)	1
	In ΔABC and ΔPQR	
	$\frac{AB}{PQ} = \frac{BC}{QR}$	
	$\angle B = \angle Q$	
	$\therefore \Delta ABC \sim \Delta PQR$	1
34(a).	A train travels a distance of 90 km at a constant speed. Had the speed been 15 km/h more, it would have taken 30 minutes less for the journey. Find the original speed of the train.	
Sol.	Let the original speed be x km/h	
	New speed = (x + 15) km/h	½
	A.T.Q.	
	$\frac{90}{x} - \frac{90}{x+15} = \frac{1}{2}$	1½
	$\Rightarrow x^2 + 15x - 2700 = 0$	1
	$\Rightarrow$(x + 60) (x - 45) = 0	1
	$x \neq -60$, x = 45	1
	The original speed of the train = 45km/h	
	OR	
34(b).	Find the value of 'c' for which the quadratic equation $(c + 1)x^2 - 6(c + 1)x + 3(c + 9) = 0;\ c \neq -1$ has real and equal roots.	
Sol.	For real and equal roots,	
	$\{-6(c+1)\}^2 - 4(c+1) \times 3(c+9) = 0$	2
	$\Rightarrow$ 12(c + 1) (2c – 6) = 0	2
	$c \neq -1$ So, c = 3	1

35.

The following table shows the ages of the patients admitted in a hospital during a year :

Age (in years)	5 – 15	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65
Number of patients	6	11	21	23	14	5

Find the mode and mean of the data given above.

Sol.

Age (in years)	No. of patients (f_i)	Mid point (x_i)	$x_i f_i$
5 – 15	6	10	60
15 - 25	11	20	220
25 - 35	21	30	630
35 - 45	23	40	920
45 - 55	14	50	700
55 - 65	5	60	300
Total	80		2830

Correct table 1½

$\Rightarrow$ Mean $= \frac{2830}{80}$ ½

$= 35.375$ ½

Modal class = (35 - 45) ½

$\Rightarrow Mode = 35 + (\frac{23-21}{2\times23-21-14}) \times h$ 1

$= 36.81$ 1

Therefore, mode and mean of given data are 36.81 years and 35.375 years respectively.

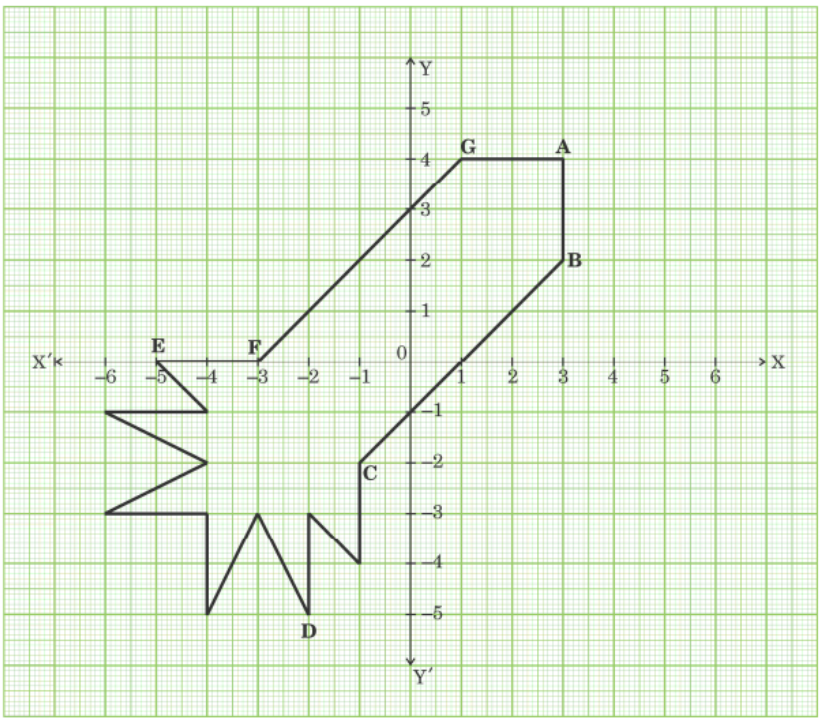
SECTION E

This section comprises 3 case-study based questions of 4 marks each.

36.

Case Study - 1

Ryan, from a very young age, was fascinated by the twinkling of stars and the vastness of space. He always dreamt of becoming an astronaut one day. So he started to sketch his own rocket designs on the graph sheet. One such design is given below :



Based on the above, answer the following questions :

(i) Find the mid-point of the segment joining F and G.

(ii) (a) What is the distance between the points A and C ?

OR

(b) Find the coordinates of the point which divides the line segment joining the points A and B in the ratio 1 : 3 internally.

(iii) What are the coordinates of the point D ?

Sol.

(i) Mid point of FG is $\left(\frac{-3+1}{2}, \frac{0+4}{2}\right) = (-1,2)$ 1

(ii) (a) AC = $\sqrt{(-1-3)^2 + (-2-4)^2}$ 1

= $\sqrt{52}$ or $2\sqrt{13}$ 1

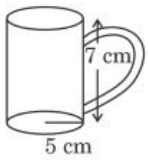
OR

(ii) (b) The coordinates of required point are $\left(\frac{1\times3+3\times3}{1+3}, \frac{1\times2+3\times4}{1+3}\right)$ 1

i.e. $\left(3, \frac{7}{2}\right)$ 1

(iii) D(-2, -5) 1

37.	**Case Study – 2** Treasure Hunt is an exciting and adventurous game where participants follow a series of clues/numbers/maps to discover hidden treasures. Players engage in a thrilling quest, solving puzzles and riddles to unveil the location of the coveted prize. While playing a treasure hunt game, some clues (numbers) are hidden in various spots collectively forming an A.P. If the number on the n^{th} spot is $20 + 4n$, then answer the following questions to help the players in spotting the clues :  (i) Which number is on first spot ? (ii) (a) Which spot is numbered as 112 ? **OR** (b) What is the sum of all the numbers on the first 10 spots ? (iii) Which number is on the $(n - 2)^{th}$ spot ?	
Sol.	(i) Number on the first spot = $20 + 4 \times 1 = 24$ (ii) (a) $20 + 4n = 112$ $\Rightarrow n = 23$ OR (ii) (b) $d = 4$ $S_{10} = \frac{10}{2}[2 \times 24 + 9 \times 4]$ $= 420$ (iii) Number on the $(n - 2)^{th}$ spot $= 20 + 4(n - 2)$ $= 12 + 4n$	1 1 1 ½ 1 ½ 1

38.	**Case Study – 3** Tamper-proof tetra-packed milk guarantees both freshness and security. This milk ensures uncompromised quality, preserving the nutritional values within and making it a reliable choice for health-conscious individuals.    500 mL milk is packed in a cuboidal container of dimensions 15 cm × 8 cm × 5 cm. These milk packets are then packed in cuboidal cartons of dimensions 30 cm × 32 cm × 15 cm. Based on the above given information, answer the following questions : (i) Find the volume of the cuboidal carton. (ii) (a) Find the total surface area of a milk packet. **OR** (b) How many milk packets can be filled in a carton ? (iii) How much milk can the cup (as shown in the figure) hold ?	
Sol.	(i) Volume of cuboidal carton = 30×32×15 = 14400 cm^3 (ii)(a) Total surface area of milk packet = 2(15×8+8×5+5×15) = 470 cm^2 OR (ii) (b) Number of milk packets in carton = $\frac{30\times32\times15}{15\times8\times5}$ = 24 (iii) Capacity of the cup = $\frac{22}{7}$ × 5 × 5 × 7 = 550 cm^3 or 550 ml	½ ½ 1 1 1 1 ½ ½

Series C5ABD/5 **SET~1**

प्रश्न–पत्र कोड **30/5/1**
Q.P. Code

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।
Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।
Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
MATHEMATICS (STANDARD)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं । **सभी** प्रश्न **अनिवार्य** हैं ।*

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ** ।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए । जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है ।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है । *20×1=20*

1. समांतर श्रेढ़ी (A.P.) $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots$ का अगला (चौथा) पद है :

(A) $\sqrt{128}$ (B) $\sqrt{140}$

(C) $\sqrt{162}$ (D) $\sqrt{200}$

2. यदि $\frac{x}{3} = 2 \sin A, \frac{y}{3} = 2 \cos A$ है, तो $x^2 + y^2$ का मान है :

(A) 36 (B) 9

(C) 6 (D) 18

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A, B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **not** allowed.*

SECTION A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each. *20×1=20*

1. The next (4^{th}) term of the A.P. $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... is :

(A) $\sqrt{128}$ (B) $\sqrt{140}$

(C) $\sqrt{162}$ (D) $\sqrt{200}$

2. If $\frac{x}{3} = 2 \sin A$, $\frac{y}{3} = 2 \cos A$, then the value of $x^2 + y^2$ is :

(A) 36 (B) 9

(C) 6 (D) 18

3. यदि $4 \sec \theta - 5 = 0$ है, तो $\cot \theta$ का मान है :

(A) $\frac{3}{4}$ (B) $\frac{4}{5}$

(C) $\frac{5}{3}$ (D) $\frac{4}{3}$

4. समीकरण निकाय $3x + 4y = 5$ तथा $6x + 8y = 7$ द्वारा निम्नलिखित में से किस प्रकार की सरल रेखाएँ निरूपित हो रही हैं ?

(A) समांतर

(B) प्रतिच्छेदी

(C) संपाती

(D) एक-दूसरे के लंबवत्

5. द्विघात समीकरण $5x^2 - 6x + 21 = 0$ के मूलों के योगफल तथा गुणनफल में अनुपात है :

(A) 5 : 21 (B) 2 : 7

(C) 21 : 5 (D) 7 : 2

6. यदि आँकड़ों $2, 9, x + 6, 2x + 3, 5, 10, 5;$ का माध्य 7 है, तो x का मान है :

(A) 9 (B) 6

(C) 5 (D) 3

7. एक थैला, जिसमें 1 से 40 तक अंकित टिकटें हैं, में से यादृच्छया एक टिकट निकाली जाती है । निकाली गई टिकट की अंकित संख्या के 7 का गुणज होने की प्रायिकता है :

(A) $\frac{1}{7}$ (B) $\frac{1}{8}$

(C) $\frac{1}{5}$ (D) $\frac{7}{40}$

8. 21 cm त्रिज्या वाले वृत्त के उस त्रिज्यखण्ड, जो वृत्त के केन्द्र पर $60°$ का कोण अंतरित करता है, का परिमाप है :

(A) 22 cm (B) 43 cm

(C) 64 cm (D) 462 cm

3. If $4 \sec \theta - 5 = 0$, then the value of $\cot \theta$ is :

(A) $\frac{3}{4}$ (B) $\frac{4}{5}$

(C) $\frac{5}{3}$ (D) $\frac{4}{3}$

4. Which out of the following type of straight lines will be represented by the system of equations $3x + 4y = 5$ and $6x + 8y = 7$?

(A) Parallel

(B) Intersecting

(C) Coincident

(D) Perpendicular to each other

5. The ratio of the sum and product of the roots of the quadratic equation $5x^2 - 6x + 21 = 0$ is :

(A) 5 : 21 (B) 2 : 7

(C) 21 : 5 (D) 7 : 2

6. For the data 2, 9, $x + 6$, $2x + 3$, 5, 10, 5; if the mean is 7, then the value of x is :

(A) 9 (B) 6

(C) 5 (D) 3

7. One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number which is a multiple of 7 is :

(A) $\frac{1}{7}$ (B) $\frac{1}{8}$

(C) $\frac{1}{5}$ (D) $\frac{7}{40}$

8. The perimeter of the sector of a circle of radius 21 cm which subtends an angle of $60°$ at the centre of circle, is :

(A) 22 cm (B) 43 cm

(C) 64 cm (D) 462 cm

9. 12 cm त्रिज्या वाले वृत्त की एक चाप 10π cm लंबी है । इस चाप द्वारा वृत्त के केंद्र पर अंतरित कोण है :

(A) $120°$ (B) $6°$

(C) $75°$ (D) $150°$

10. वह बड़ी-से-बड़ी संख्या जो 281 तथा 1249 को भाग करने पर क्रमश: 5 तथा 7 शेषफल देती है, है :

(A) 23 (B) 276

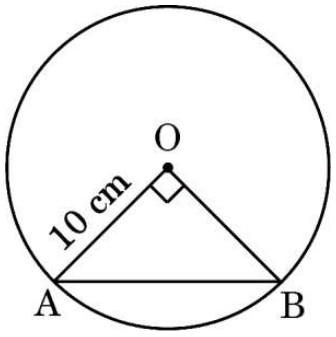
(C) 138 (D) 69

11. समांतर श्रेढ़ी 3, 6, 9, 12, ..., 111 के पदों की संख्या है :

(A) 36 (B) 40

(C) 37 (D) 30

12. 10 cm त्रिज्या वाले एक वृत्त की एक जीवा, वृत्त के केंद्र पर समकोण अंतरित करती है । तो जीवा की लंबाई (cm में) है :



(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

(C) $\frac{5}{\sqrt{2}}$ (D) 5

13. तीन संख्याओं 28, 44, 132 का ल.स. (LCM) है :

(A) 258 (B) 231

(C) 462 (D) 924

9. The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle, is :

(A) $120°$ (B) $6°$

(C) $75°$ (D) $150°$

10. The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is :

(A) 23 (B) 276

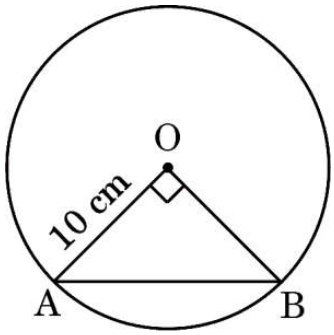
(C) 138 (D) 69

11. The number of terms in the A.P. 3, 6, 9, 12, ..., 111 is :

(A) 36 (B) 40

(C) 37 (D) 30

12. A chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is :



(A) $5\sqrt{2}$ (B) $10\sqrt{2}$

(C) $\frac{5}{\sqrt{2}}$ (D) 5

13. The LCM of three numbers 28, 44, 132 is :

(A) 258 (B) 231

(C) 462 (D) 924

14. यदि दो सह-अभाज्य संख्याओं का गुणनफल 553 है, तो उनका म.स. (HCF) है :

(A) 1 (B) 553

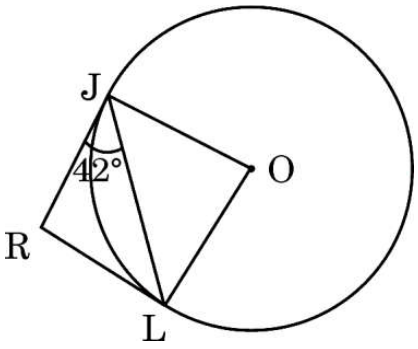
(C) 7 (D) 79

15. यदि α तथा β बहुपद $p(x) = kx^2 - 30x + 45k$ के शून्यक हैं तथा $\alpha + \beta = \alpha\beta$ है, तो k का मान है :

(A) $-\frac{2}{3}$ (B) $-\frac{3}{2}$

(C) $\frac{3}{2}$ (D) $\frac{2}{3}$

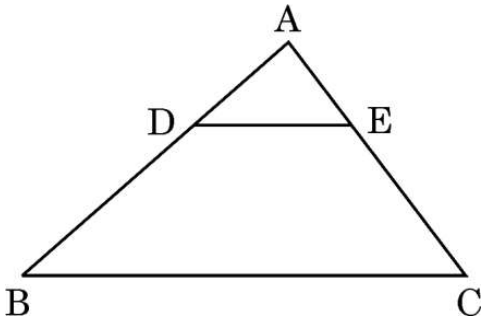
16. दी गई आकृति में, RJ तथा RL, वृत्त पर खींची गई दो स्पर्श-रेखाएँ हैं । यदि $\angle RJL = 42°$ है, तो $\angle JOL$ की माप है :



(A) 42° (B) 84°

(C) 96° (D) 138°

17. दी गई आकृति में, ΔABC में, DE || BC है । यदि AD = 2·4 cm, DB = 4 cm तथा AE = 2 cm है, तो AC की लंबाई है :



(A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm

(C) $\frac{16}{3}$ cm (D) 1·2 cm

14. If the product of two co-prime numbers is 553, then their HCF is :

(A) 1 (B) 553

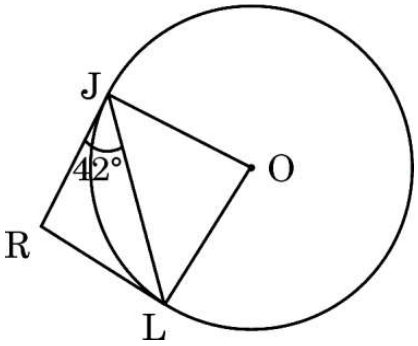
(C) 7 (D) 79

15. If α and β are the zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then the value of k is :

(A) $-\frac{2}{3}$ (B) $-\frac{3}{2}$

(C) $\frac{3}{2}$ (D) $\frac{2}{3}$

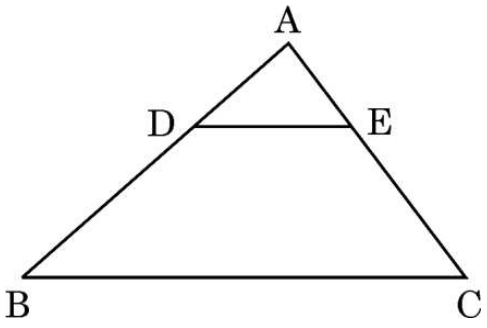
16. In the given figure, RJ and RL are two tangents to the circle. If $\angle RJL = 42°$, then the measure of $\angle JOL$ is :



(A) 42° (B) 84°

(C) 96° (D) 138°

17. In the given figure, in ΔABC, DE || BC. If AD = 2·4 cm, DB = 4 cm and AE = 2 cm, then the length of AC is :



(A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm

(C) $\frac{16}{3}$ cm (D) 1·2 cm

18. यदि 7·5 m लंबा सीधा खड़ा खंभा भूमि पर 5 m लंबी छाया बनाता है और उसी समय एक मीनार की छाया की लंबाई 24 m है, तो मीनार की ऊँचाई है :

(A) 20 m (B) 40 m

(C) 60 m (D) 36 m

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* ABCD एक समलंब है जिसमें DC || AB है । E तथा F क्रमशः AD तथा BC पर ऐसे बिंदु हैं कि EF || AB है । तो $\frac{AE}{ED} = \frac{BF}{FC}$ ।

तर्क (R) : किसी समलंब की समांतर भुजाओं के समांतर कोई रेखा असमांतर भुजाओं को समानुपात में बाँटती है ।

20. *अभिकथन (A) :* शून्य बहुपद की घात परिभाषित नहीं है ।

तर्क (R) : एक शून्येतर अचर बहुपद की घात 0 होती है ।

18. If a vertical pole of length 7·5 m casts a shadow 5 m long on the ground and at the same time, a tower casts a shadow 24 m long, then the height of the tower is :

(A) 20 m (B) 40 m

(C) 60 m (D) 36 m

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$.

Reason (R) : Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.

20. *Assertion (A) :* Degree of a zero polynomial is not defined.

Reason (R): Degree of a non-zero constant polynomial is 0.

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं । $5 \times 2 = 10$

21. (a) यदि 3 cm त्रिज्या वाले एक वृत्त पर खींची गई दो स्पर्श-रेखाएँ परस्पर $60°$ के कोण पर झुकी हैं, तो प्रत्येक स्पर्श-रेखा की लंबाई ज्ञात कीजिए ।

अथवा

(b) सिद्ध कीजिए कि वृत्त के किसी व्यास के सिरों पर खींची गई स्पर्श-रेखाएँ परस्पर समांतर होती हैं ।

22. मान ज्ञात कीजिए :

$$\frac{2 \tan 30° \cdot \sec 60° \cdot \tan 45°}{1 - \sin^2 60°}$$

23. यदि α, β बहुपद $p(x) = 5x^2 - 6x + 1$ के शून्यक हैं, तो $\alpha + \beta + \alpha\beta$ का मान ज्ञात कीजिए ।

24. (a) वह अनुपात ज्ञात कीजिए जिसमें बिंदु $P(-4, 6)$, बिंदुओं $A(-6, 10)$ तथा $B(3, -8)$ को मिलाने वाले रेखाखण्ड को विभाजित करता है ।

अथवा

(b) सिद्ध कीजिए कि बिंदु $(3, 0)$, $(6, 4)$ तथा $(-1, 3)$ एक समद्विबाहु त्रिभुज के शीर्ष हैं ।

25. एक डिब्बे में 60 कमीजें हैं, जिनमें 48 अच्छी कमीजें हैं, जबकि 8 में प्रमुख दोष हैं तथा 4 में छोटे दोष हैं । निगम, एक व्यापारी, केवल अच्छी कमीजें ही स्वीकार करता है, जबकि एक दूसरा व्यापारी अनमोल, केवल उन्हीं कमीजों को अस्वीकार करता है जिनमें प्रमुख दोष हों । डिब्बे में से यादृच्छया एक कमीज निकाली गई । प्रायिकता ज्ञात कीजिए कि निकाली गई कमीज अनमोल को स्वीकार है ।

SECTION B

This section comprises Very Short Answer (VSA) type questions of 2 marks each. *5×2=10*

21. (a) If two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm, then find the length of each tangent.

OR

(b) Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

22. Evaluate :

$$\frac{2 \tan 30° \cdot \sec 60° \cdot \tan 45°}{1 - \sin^2 60°}$$

23. If α, β are zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$.

24. (a) Find the ratio in which the point P(– 4, 6) divides the line segment joining the points A(– 6, 10) and B(3, – 8).

OR

(b) Prove that the points (3, 0), (6, 4) and (– 1, 3) are the vertices of an isosceles triangle.

25. A carton consists of 60 shirts of which 48 are good, 8 have major defects and 4 have minor defects. Nigam, a trader, will accept the shirts which are good but Anmol, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. Find the probability that it is acceptable to Anmol.

खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं । *6×3=18*

26. (a) सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

अथवा

(b) सिद्ध कीजिए कि $\left(\sqrt{2} + \sqrt{3}\right)^2$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{6}$ एक अपरिमेय संख्या है ।

27. (a) यदि एक समांतर श्रेढ़ी के पहले 14 पदों का योगफल 1050 है तथा इसका प्रथम पद 10 है, तो इस समांतर श्रेढ़ी का 20वाँ पद तथा nवाँ पद ज्ञात कीजिए ।

अथवा

(b) एक समांतर श्रेढ़ी का प्रथम पद 5, अंतिम पद 45 तथा सभी पदों का योगफल 400 है । इस समांतर श्रेढ़ी के पदों की संख्या तथा सार्व अंतर ज्ञात कीजिए ।

28. सिद्ध कीजिए कि एक वृत्त के परिगत समांतर चतुर्भुज एक समचतुर्भुज होता है ।

29. सिद्ध कीजिए कि :

$$\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A \operatorname{cosec} A$$

30. तीन निष्पक्ष सिक्के एक साथ उछाले गए । निम्नलिखित के प्राप्त करने की प्रायिकता ज्ञात कीजिए :

(i) कम-से-कम एक चित

(ii) मात्र एक पट

(iii) दो चित तथा एक पट

31. 10 cm त्रिज्या वाले वृत्त की एक चाप वृत्त के केंद्र पर समकोण बनाती है । तो संगत दीर्घ त्रिज्यखण्ड का क्षेत्रफल ज्ञात कीजिए । ($\pi = 3{\cdot}14$ प्रयोग कीजिए)

SECTION C

This section comprises Short Answer (SA) type questions of 3 marks each. *6×3=18*

26. (a) Prove that $\sqrt{3}$ is an irrational number.

OR

(b) Prove that $\left(\sqrt{2} + \sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.

27. (a) If the sum of the first 14 terms of an A.P. is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.

OR

(b) The first term of an A.P. is 5, the last term is 45 and the sum of all the terms is 400. Find the number of terms and the common difference of the A.P.

28. Prove that the parallelogram circumscribing a circle is a rhombus.

29. Prove that :

$$\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A \operatorname{cosec} A$$

30. Three unbiased coins are tossed simultaneously. Find the probability of getting :

(i) at least one head.

(ii) exactly one tail.

(iii) two heads and one tail.

31. An arc of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding major sector. (Use $\pi = 3{\cdot}14$)

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं । *4×5=20*

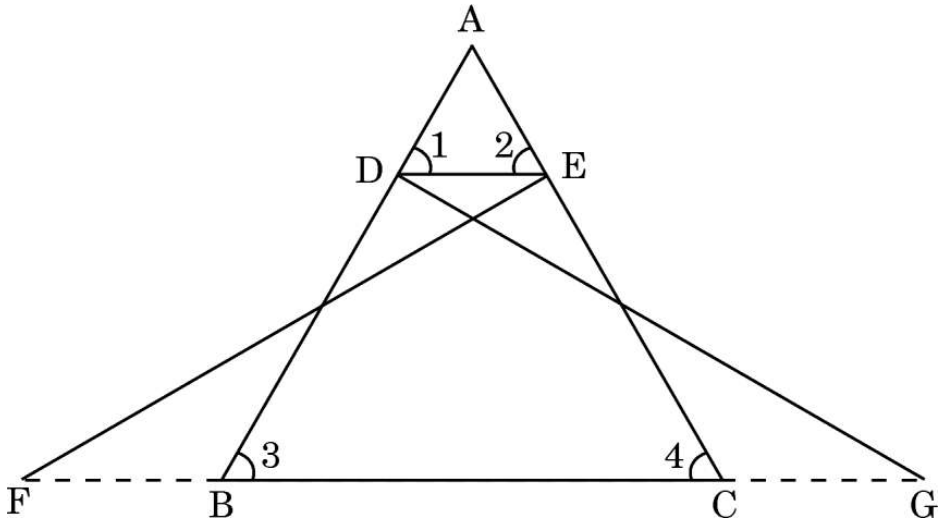
32. (a) 'k' का वह मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0, k \neq -1$ के वास्तविक और समान मूल हैं ।

अथवा

(b) एक व्यक्ति की आयु अपने बेटे की आयु के वर्ग की दुगुनी है । आठ वर्ष पश्चात्, इस व्यक्ति की आयु अपने बेटे की आयु के तीन गुने से 4 वर्ष अधिक होगी । उनकी वर्तमान आयु ज्ञात कीजिए ।

33. एक नदी के पुल के एक बिंदु से, नदी के सम्मुख किनारों के अवनमन कोण क्रमश: $30°$ और $60°$ हैं । यदि पुल, किनारों से 4 m की ऊँचाई पर हो, तो नदी की चौड़ाई ज्ञात कीजिए ।

34. (a) दी गई आकृति में, $\Delta FEC \cong \Delta GDB$ तथा $\angle 1 = \angle 2$ है । सिद्ध कीजिए कि $\Delta ADE \sim \Delta ABC$.



अथवा

(b) एक ΔABC की भुजाएँ AB और AC तथा माध्यिका AD क्रमश: एक अन्य त्रिभुज ΔPQR की भुजाओं PQ और PR तथा माध्यिका PM के समानुपाती हैं । दर्शाइए कि $\Delta ABC \sim \Delta PQR$.

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each. *4×5=20*

32. (a) Find the value of 'k' for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0$, $k \neq -1$ has real and equal roots.

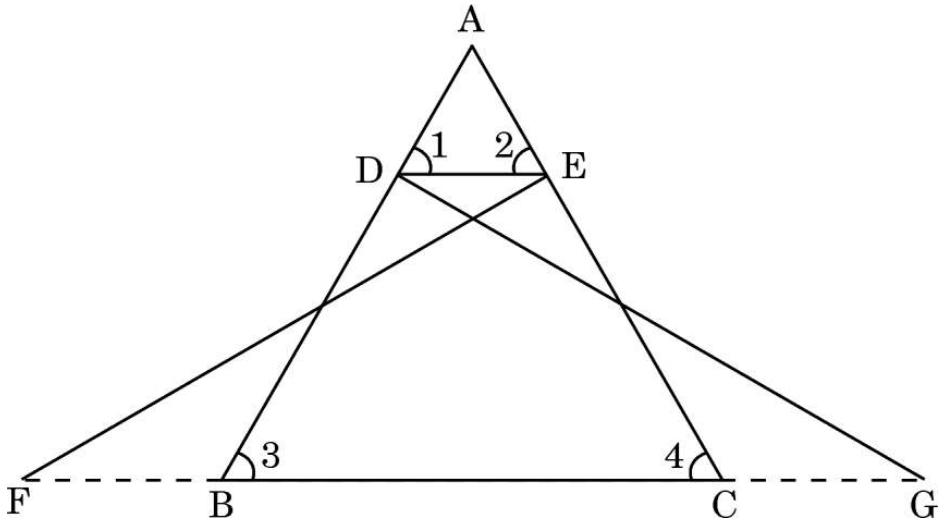
OR

(b) The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.

33. From a point on a bridge across the river, the angles of depressions of the banks on opposite sides of the river are 30° and 60° respectively. If the bridge is at a height of 4 m from the banks, find the width of the river.

34. (a) In the given figure, $\Delta FEC \cong \Delta GDB$ and $\angle 1 = \angle 2$.

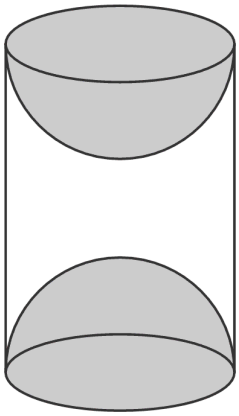
Prove that $\Delta ADE \sim \Delta ABC$.



OR

(b) Sides AB and AC and median AD of a ΔABC are respectively proportional to sides PQ and PR and median PM of another ΔPQR. Show that $\Delta ABC \sim \Delta PQR$.

35. लकड़ी के एक ठोस बेलन के प्रत्येक सिरे पर एक अर्धगोला खोद कर निकालते हुए, एक वस्तु बनाई गई है, जैसा कि आकृति में दिखाया गया है । यदि बेलन की ऊँचाई 5·8 cm है और इसके आधार की त्रिज्या 2·1 cm है, तो इस वस्तु का संपूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।



खण्ड ङ

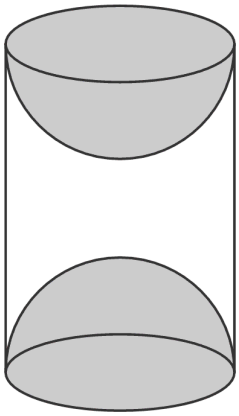
इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं । *3×4=12*

प्रकरण अध्ययन – 1

36. एस्सेल वर्ल्ड भारत के सबसे बड़े मनोरंजन पार्कों में से एक है जो सभी उम्र के आगंतुकों के लिए रोमांचक सवारी, जल आकर्षण और मनोरंजन विकल्पों की एक विविध शृंखला प्रदान करता है । यह पार्क अपने प्रतिष्ठित "वॉटर किंगडम" के लिए जाना जाता है, जो इसे पारिवारिक सैर और मनोरंजन के लिए एक लोकप्रिय गंतव्य बनाता है । पार्क का टिकट शुल्क ₹ 150 प्रति बच्चा तथा ₹ 250 प्रति वयस्क है ।

एक दिन, पार्क के खजांची ने यह पाया कि 300 टिकट बिकी हैं तथा ₹ 55,000 एकत्र हुए हैं ।

35. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5·8 cm and its base is of radius 2·1 cm, find the total surface area of the article.



SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

Case Study – 1

36. Essel World is one of India's largest amusement parks that offers a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹ 250 per adult.

On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹ 55,000 was collected.

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) यदि उस दिन आए बच्चों की संख्या x तथा वयस्कों की संख्या y है, तो दी गई स्थिति को बीजगणितीय रूप में लिखिए । *1*

(ii) (a) इस मनोरंजन पार्क में उस दिन कितने बच्चे आए ? *2*

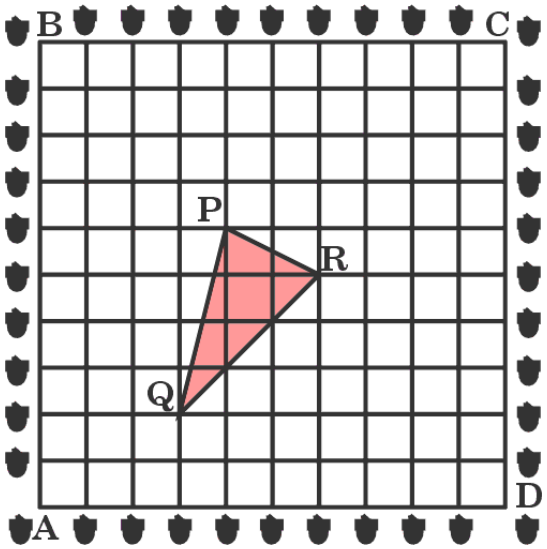
अथवा

(b) इस मनोरंजन पार्क में उस दिन कितने वयस्क आए ? *2*

(iii) मनोरंजन पार्क में यदि 250 बच्चे तथा 100 वयस्क आए, तो कितनी राशि एकत्र होगी ? *1*

प्रकरण अध्ययन – 2

37. एक बगीचा एक वर्ग के आकार का है । माली ने बगीचे की सीमा पर एक-दूसरे से 1 m की दूरी पर अशोक के पेड़ के पौधे उगाए । वह बगीचे को गुलाब के पौधों से सजाना चाहता है । उसने गुलाब के पौधे उगाने के लिए बगीचे के अन्दर एक त्रिभुजाकार क्षेत्र चुना । उपर्युक्त स्थिति में, माली ने कक्षा 10 के छात्रों की मदद ली जिन्होंने निम्न प्रकार का चार्ट बनाया ।



उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) A को मूल-बिंदु लेकर, Δ PQR के शीर्षों के निर्देशांक क्या हैं ? *1*

(ii) (a) दूरियाँ PQ तथा QR ज्ञात कीजिए । *2*

अथवा

(b) बिंदुओं P तथा R को मिलाने वाले रेखाखण्ड को 2 : 1 के अन्त: विभाजन करने वाले बिंदु के निर्देशांक ज्ञात कीजिए । *2*

(iii) ज्ञात कीजिए कि क्या Δ PQR एक समद्विबाहु त्रिभुज है । *1*

Based on the above, answer the following questions :

(i) If the number of children visited be x and the number of adults visited be y, then write the given situation algebraically. *1*

(ii) (a) How many children visited the amusement park that day ? *2*

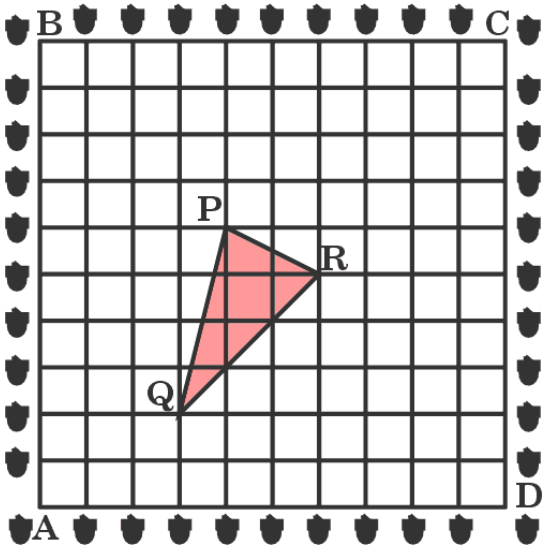
OR

(b) How many adults visited the amusement park that day ? *2*

(iii) How much amount will be collected if 250 children and 100 adults visit the amusement park ? *1*

Case Study – 2

37. A garden is in the shape of a square. The gardener grew saplings of Ashoka tree on the boundary of the garden at the distance of 1 m from each other. He wants to decorate the garden with rose plants. He chose a triangular region inside the garden to grow rose plants. In the above situation, the gardener took help from the students of class 10. They made a chart for it which looks like the given figure.



Based on the above, answer the following questions :

(i) If A is taken as origin, what are the coordinates of the vertices of Δ PQR ? *1*

(ii) (a) Find distances PQ and QR. *2*

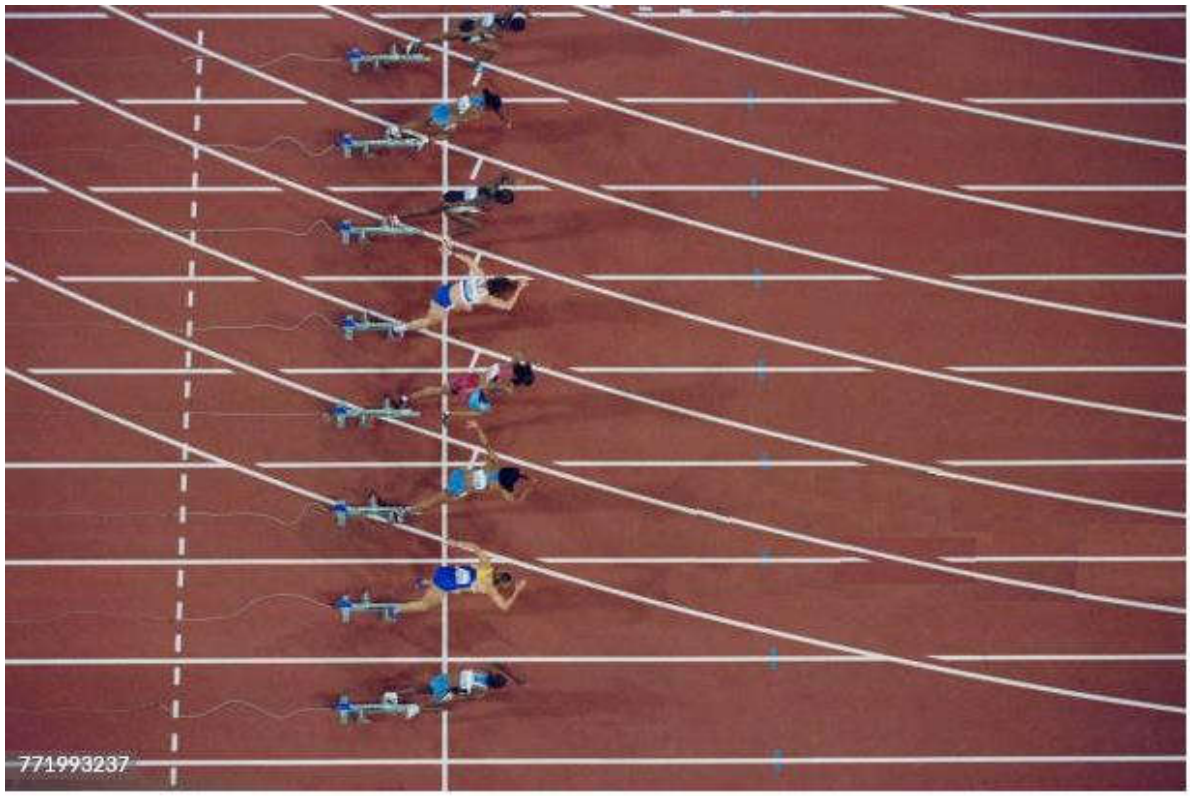
OR

(b) Find the coordinates of the point which divides the line segment joining points P and R in the ratio 2 : 1 internally. *2*

(iii) Find out if Δ PQR is an isosceles triangle. *1*

प्रकरण अध्ययन – 3

38. दौड़ने या साइकिल चलाने जैसी गतिविधियाँ तनाव और अवसाद जैसे मानसिक विकार के जोखिम को कम करती हैं । दौड़ने से सहनशक्ति बढ़ाने में मदद मिलती है । बच्चों की हड्डियाँ और मांसपेशियाँ मजबूत होती हैं और उनका वजन बढ़ने की संभावना कम होती है । एक स्कूल के शारीरिक शिक्षा शिक्षक ने अपने स्कूल परिसर में एक इंटर-स्कूल रनिंग प्रतियोगिता आयोजित करने का निर्णय लिया । छात्रों के समूह द्वारा 100 m की दौड़ में लिया गया समय नोट किया गया, जो निम्न प्रकार है :



समय (सेकण्ड में)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
छात्रों की संख्या	8	10	13	6	3

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) ऊपर दिए गए आँकड़ों का माध्यक वर्ग क्या है ? *1*

(ii) (a) दौड़ पूरी करने में छात्रों द्वारा लिया गया माध्य समय ज्ञात कीजिए । *2*

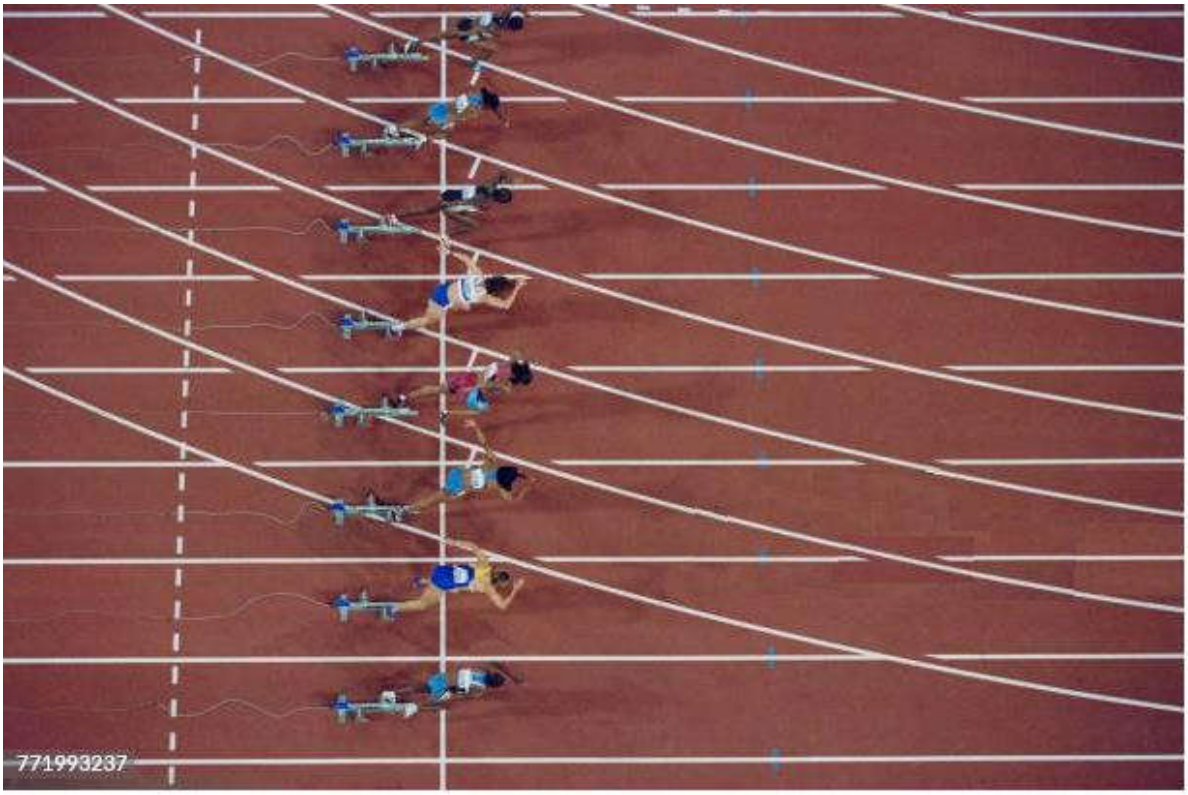
अथवा

(b) ऊपर दिए गए आँकड़ों का बहुलक ज्ञात कीजिए । *2*

(iii) कितने छात्रों ने 60 सेकण्ड से कम समय लिया ? *1*

Case Study – 3

38. Activities like running or cycling reduce stress and the risk of mental disorders like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100 m, was noted as follows :



Time (in seconds)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	8	10	13	6	3

Based on the above, answer the following questions :

(i) What is the median class of the above given data ? *1*

(ii) (a) Find the mean time taken by the students to finish the race. *2*

OR

(b) Find the mode of the above given data. *2*

(iii) How many students took time less than 60 seconds ? *1*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30/5/1

General Instructions: -

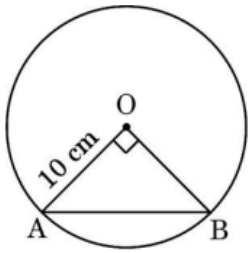
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

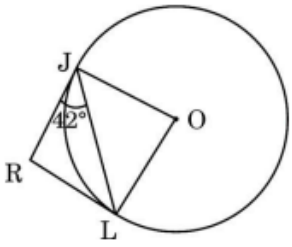
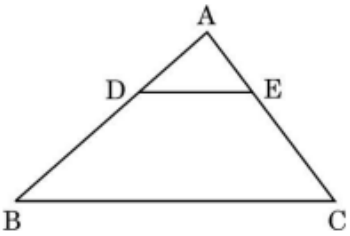
9	**<u>In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".</u>**
10	**<u>In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".</u>**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

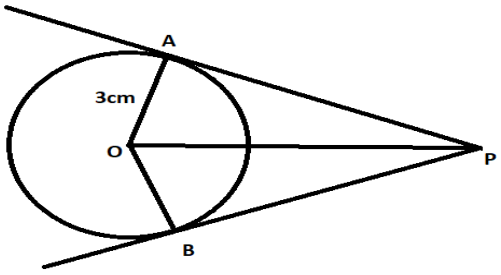
MARKING SCHEME
MATHEMATICS (SUBJECT CODE- 041)
PAPER CODE: 30/5/1

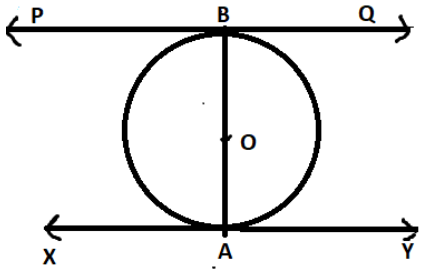
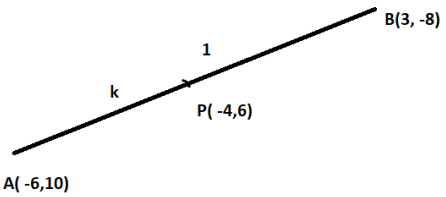
Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION-A **This section comprises Multiple Choice Questions (MCQs) of 1 mark each**	
1.	The next (4^{th}) term of the A.P. $\sqrt{18}$, $\sqrt{50}$, $\sqrt{98}$, ... is : (A) $\sqrt{128}$ (B) $\sqrt{140}$ (C) $\sqrt{162}$ (D) $\sqrt{200}$	
Sol.	(C) $\sqrt{162}$	1
2.	If $\frac{x}{3} = 2 \sin A$, $\frac{y}{3} = 2 \cos A$, then the value of $x^2 + y^2$ is : (A) 36 (B) 9 (C) 6 (D) 18	
Sol.	(A) 36	1
3.	If $4 \sec \theta - 5 = 0$, then the value of $\cot \theta$ is : (A) $\frac{3}{4}$ (B) $\frac{4}{5}$ (C) $\frac{5}{3}$ (D) $\frac{4}{3}$	
Sol.	(D) $\frac{4}{3}$	1
4.	Which out of the following type of straight lines will be represented by the system of equations $3x + 4y = 5$ and $6x + 8y = 7$? (A) Parallel (B) Intersecting (C) Coincident (D) Perpendicular to each other	
Sol.	(A) Parallel	1
5.	The ratio of the sum and product of the roots of the quadratic equation $5x^2 - 6x + 21 = 0$ is : (A) 5 : 21 (B) 2 : 7 (C) 21 : 5 (D) 7 : 2	
Sol.	(B) 2:7	1

6.	For the data 2, 9, x + 6, 2x + 3, 5, 10, 5; if the mean is 7, then the value of x is : (A) 9 (B) 6 (C) 5 (D) 3	
Sol.	(D) 3	1
7.	One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number which is a multiple of 7 is : (A) $\frac{1}{7}$ (B) $\frac{1}{8}$ (C) $\frac{1}{5}$ (D) $\frac{7}{40}$	
Sol.	(B) $\frac{1}{8}$	1
8.	The perimeter of the sector of a circle of radius 21 cm which subtends an angle of 60° at the centre of circle, is : (A) 22 cm (B) 43 cm (C) 64 cm (D) 462 cm	
Sol.	(C) 64 cm	1
9.	The length of an arc of a circle with radius 12 cm is 10π cm. The angle subtended by the arc at the centre of the circle, is : (A) 120° (B) 6° (C) 75° (D) 150°	
Sol.	(D) 150^0	1
10.	The greatest number which divides 281 and 1249, leaving remainder 5 and 7 respectively, is : (A) 23 (B) 276 (C) 138 (D) 69	
Sol.	(C) 138	1
11.	The number of terms in the A.P. 3, 6, 9, 12, ..., 111 is : (A) 36 (B) 40 (C) 37 (D) 30	
Sol.	(C) 37	1

12.	A chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is :  (A) $5\sqrt{2}$ (B) $10\sqrt{2}$ (C) $\frac{5}{\sqrt{2}}$ (D) 5	
Sol.	(B) $10\sqrt{2}$	1
13.	The LCM of three numbers 28, 44, 132 is : (A) 258 (B) 231 (C) 462 (D) 924	
Sol.	(D) 924	1
14.	If the product of two co-prime numbers is 553, then their HCF is : (A) 1 (B) 553 (C) 7 (D) 79	
Sol.	(A) 1	1
15.	If α and β are the zeroes of the polynomial $p(x) = kx^2 - 30x + 45k$ and $\alpha + \beta = \alpha\beta$, then the value of k is : (A) $-\frac{2}{3}$ (B) $-\frac{3}{2}$ (C) $\frac{3}{2}$ (D) $\frac{2}{3}$	
Sol.	(D) $\frac{2}{3}$	1

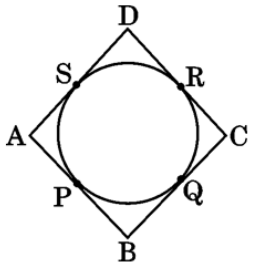
16.	In the given figure, RJ and RL are two tangents to the circle. If $\angle RJL = 42°$, then the measure of $\angle JOL$ is :  (A) 42° (B) 84° (C) 96° (D) 138°	
Sol.	(B) 84^0	1
17.	In the given figure, in Δ ABC, DE $\|\|$ BC. If AD = 2·4 cm, DB = 4 cm and AE = 2 cm, then the length of AC is :  (A) $\frac{10}{3}$ cm (B) $\frac{3}{10}$ cm (C) $\frac{16}{3}$ cm (D) 1·2 cm	
Sol.	(C) $\frac{16}{3}$ cm	1
18.	If a vertical pole of length 7·5 m casts a shadow 5 m long on the ground and at the same time, a tower casts a shadow 24 m long, then the height of the tower is : (A) 20 m (B) 40 m (C) 60 m (D) 36 m	
Sol.	(D) 36 m	1
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	

19.	*Assertion (A) :* ABCD is a trapezium with DC || AB. E and F are points on AD and BC respectively, such that EF || AB. Then $\frac{AE}{ED} = \frac{BF}{FC}$. *Reason (R) :* Any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1
20.	*Assertion (A) :* Degree of a zero polynomial is not defined. *Reason (R):* Degree of a non-zero constant polynomial is 0.	
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).	1
	SECTION- B **This section comprises Very Short Answer (VSA) type questions of 2 marks each**	
21.(a)	If two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm, then find the length of each tangent.	
Sol.	Correct Figure  $\angle$ APO = 30^0 tan $30^0 = \frac{1}{\sqrt{3}} = \frac{3}{AP}$ AP = $3\sqrt{3}$ cm	½ ½ ½ ½
	OR	

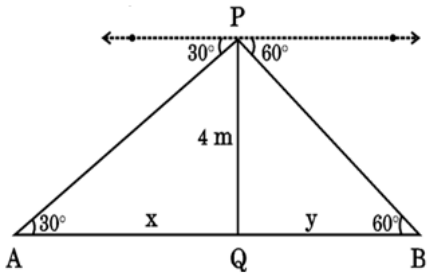
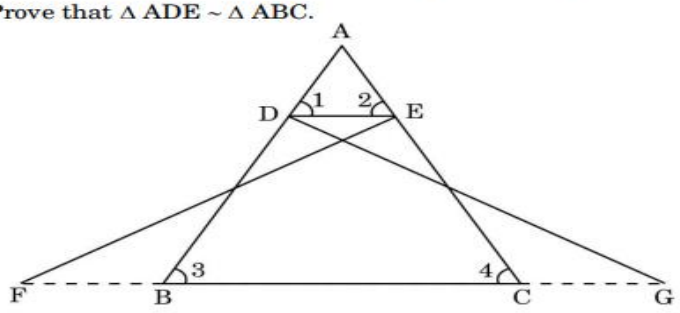
21.(b)	**Prove that the tangents drawn at the ends of a diameter of a circle are parallel.**	
Sol.	Correct Figure  $\angle$ OAY = $\angle$ OBP = 90^0 But they are forming alternate interior angles Therefore, PQ || XY	½ ½ 1
22.	**Evaluate :** $\frac{2\tan 30^\circ \cdot \sec 60^\circ \cdot \tan 45^\circ}{1-\sin^2 60^\circ}$	
Sol.	$\frac{2\times\frac{1}{\sqrt{3}}\times 2\times 1}{1-\frac{3}{4}}$ $= \frac{16}{\sqrt{3}}$ or $\frac{16\sqrt{3}}{3}$	1½ ½
23.	**If α, β are zeroes of the polynomial $p(x) = 5x^2 - 6x + 1$, then find the value of $\alpha + \beta + \alpha\beta$.**	
Sol.	$\alpha + \beta = \frac{6}{5}$ $\alpha\beta = \frac{1}{5}$ $\alpha + \beta + \alpha\beta = \frac{6}{5} + \frac{1}{5} = \frac{7}{5}$	½ ½ 1
24.(a)	**Find the ratio in which the point P(– 4, 6) divides the line segment joining the points A(– 6, 10) and B(3, – 8).**	
Sol.	Let the ratio be k:1 $-4 = \frac{3k-6}{k+1}$ $\Rightarrow$ k = $\frac{2}{7}$ ∴ required ratio is 2 : 7  	1 ½ ½
	OR	

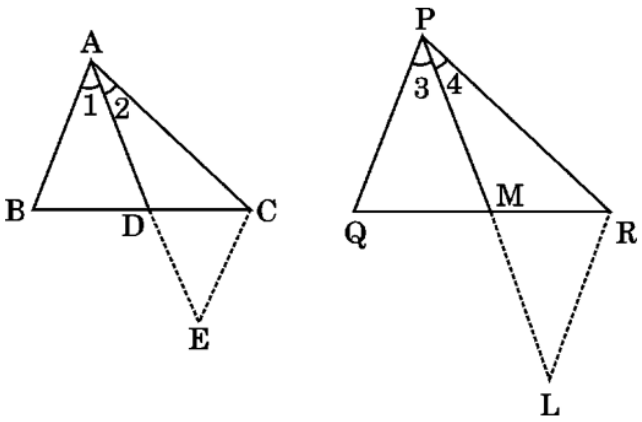
24.(b)	**Prove that the points (3, 0), (6, 4) and (– 1, 3) are the vertices of an isosceles triangle.**	
Sol.	Let A(3,0) , B(6,4) , C(-1, 3) AB = $\sqrt{(3-6)^2 + (0-4)^2} = 5$ BC = $\sqrt{(6+1)^2 + (4-3)^2} = \sqrt{50}$ CA = $\sqrt{(3+1)^2 + (0-3)^2} = 5$ As, AB = AC $\Rightarrow$ ABC is an isosceles triangle	 ½ ½ ½ ½
25.	**A carton consists of 60 shirts of which 48 are good, 8 have major defects and 4 have minor defects. Nigam, a trader, will accept the shirts which are good but Anmol, another trader, will only reject the shirts which have major defects. One shirt is drawn at random from the carton. Find the probability that it is acceptable to Anmol.**	
Sol.	Number of Shirts without major defects = 52 P(Anmol will accept the shirt) = $\frac{52}{60}$ or $\frac{13}{15}$	½ 1½
	SECTION- C **This section comprises Short Answer (SA) type questions of 3 marks each.**	
26.(a)	**Prove that $\sqrt{3}$ is an irrational number.**	
Sol.	Let $\sqrt{3}$ be a rational number. $\therefore \sqrt{3} = \frac{p}{q}$, where q≠0 and p & q are coprime. $3q^2 = p^2 \Rightarrow p^2$ is divisible by 3 $\Rightarrow$ p is divisible by 3----- (i) $\Rightarrow$ p = 3a, where 'a' is a postive integer $9a^2 = 3q^2 \Rightarrow q^2 = 3a^2 \Rightarrow q^2$ is divisible by 3 $\Rightarrow$ q is divisible by 3 ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are coprime. $\therefore \sqrt{3}$ is an irrational number.	 ½ 1 1 ½
	OR	

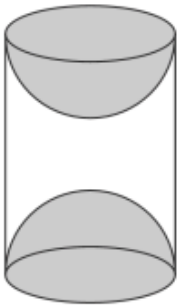
26.(b)	**Prove that $\left(\sqrt{2}+\sqrt{3}\right)^2$ is an irrational number, given that $\sqrt{6}$ is an irrational number.**	
Sol.	$(\sqrt{2}+\sqrt{3})^2 = 2+3+2\sqrt{6} = 5+2\sqrt{6}$ Let us assume, to the contrary, that $5+2\sqrt{6}$ is rational $\therefore 5+2\sqrt{6} = \frac{a}{b}$; a, b are integers, $b \neq 0$ $\therefore \sqrt{6} = \frac{a-5b}{2b}$ RHS is a rational number, whereas LHS is an irrational number. $\therefore$ Our assumption is wrong. $\Rightarrow 5+2\sqrt{6} = (\sqrt{2}+\sqrt{3})^2$ is an irrational number	1 ½ ½ ½ ½
27.(a)	**If the sum of the first 14 terms of an A.P. is 1050 and the first term is 10, then find the 20^{th} term and the n^{th} term.**	
Sol.	$\frac{14}{2}(20+13d) = 1050$ $\Rightarrow$ d = 10 $\therefore a_{20} = 10 + 19 \times 10 = 200$ $a_n = 10 + (n-1)\,10 = 10n$	1 1 ½ ½
	OR	
27. (b)	**The first term of an A.P. is 5, the last term is 45 and the sum of all the terms is 400. Find the number of terms and the common difference of the A.P.**	
Sol.	$a = 5,\ a_n = 45,\ S_n = 400$ $\frac{n}{2}(5+45) = 400$ $\Rightarrow$ n = 16 $5 + 15d = 45$ $\Rightarrow d = \frac{40}{15}$ or $\frac{8}{3}$	1 1 ½ ½

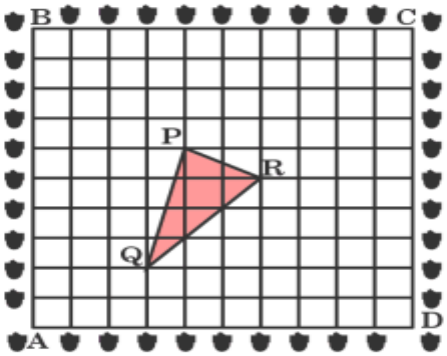
28.	**Prove that the parallelogram circumscribing a circle is a rhombus.**	
Sol.	Correct figure  $\therefore$ AP = AS BP = BQ CR = CQ DR = DS Adding, (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ) $\Rightarrow$ AB + CD = AD + BC Now AB = CD and AD = BC $\Rightarrow$ 2 AB = 2 BC $\Rightarrow$ AB = BC $\Rightarrow$ ABCD is a rhombus	½ 1 1 ½
29.	**Prove that :** $\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A \operatorname{cosec} A$	
Sol.	LHS = $\frac{\frac{sinA}{cosA}}{\frac{(\sin A - cosA)}{sinA}} + \frac{\frac{cosA}{sinA}}{\frac{(\cos A - sinA)}{cosA}}$ $= \frac{1}{(sinA-cosA)}\left[\frac{sin^2A}{cosA} - \frac{cos^2A}{sinA}\right]$ $= \frac{1}{(sinA-cosA)} \times \frac{(sinA-cosA)(sin^2A+ cos^2A+ sinA\ cosA)}{sinAcosA}$ $= \frac{1}{sinAcosA} + 1$ $= 1 + secA\ cosecA$ = RHS	½ 1 1 ½

30.	Three unbiased coins are tossed simultaneously. Find the probability of getting : (i) at least one head. (ii) exactly one tail. (iii) two heads and one tail.	
Sol.	Total number of possible outcomes = 8 (i) P(at least one head) = $\frac{7}{8}$ (ii) P (exactly one tail) = $\frac{3}{8}$ (iii) P (2 heads and one tail) = $\frac{3}{8}$	 1 1 1
31.	An arc of a circle of radius 10 cm subtends a right angle at the centre of the circle. Find the area of the corresponding major sector. (Use $\pi = 3{\cdot}14$)	
Sol.	Area of circle = $3.14 \times 10 \times 10 = 314$ cm^2 Area of minor sector = $\frac{3.14 \times 10 \times 10 \times 90}{360} = \frac{157}{2}$ cm^2 or 78.5 cm^2 Area of major sector = $314 - 78.5 = 235.5$ cm^2	1 1 1
	SECTION- D **This section comprises Long Answer (LA) type questions of 5 marks each.**	
32.(a)	Find the value of 'k' for which the quadratic equation $(k + 1)x^2 - 6(k + 1)x + 3(k + 9) = 0, k \neq -1$ has real and equal roots.	
Sol.	For real and equal roots, $D = b^2 - 4ac = 0$ $36 (k + 1)^2 - 4 (k + 1) \times 3 (k + 9) = 0$ $\Rightarrow k^2 - 2k - 3 = 0$ $\Rightarrow (k - 3) (k + 1) = 0$ $k \neq -1$ So, $k = 3$	 2 1½ 1 ½
	OR	
32.(b)	The age of a man is twice the square of the age of his son. Eight years hence, the age of the man will be 4 years more than three times the age of his son. Find their present ages.	
Sol.	Let present age of son = x years and present age of man = $2x^2$ years A.T.Q. $3(x + 8) + 4 = 2x^2 + 8$	 1 1

	$\Rightarrow 2x^2 - 3x - 20 = 0$	1
	$\Rightarrow (2x + 5)(x - 4) = 0$	1
	$x \neq -\frac{5}{2}$ So, $x = 4$	½
	Present age of son = 4 years	
	Present age of man = 32 years	½
33.	From a point on a bridge across the river, the angles of depressions of the banks on opposite sides of the river are 30° and 60° respectively. If the bridge is at a height of 4 m from the banks, find the width of the river.	
Sol.	Correct Figure	1
		
	Let AB be the width of river	
	In right Δ PAQ,	
	$\tan 30° = \frac{1}{\sqrt{3}} = \frac{4}{x}$	1
	$\Rightarrow 4\sqrt{3} = x$	½
	In right Δ PBQ,	
	$\tan 60° = \sqrt{3} = \frac{4}{y}$	1
	$\Rightarrow y = \frac{4}{\sqrt{3}}$	½
	Width of river = $x + y = 4\sqrt{3} + \frac{4}{\sqrt{3}} = \frac{16}{3}\sqrt{3}$ m	1
34.(a)	In the given figure, Δ FEC ≅ Δ GDB and ∠ 1 = ∠ 2. Prove that Δ ADE ~ Δ ABC. 	
Sol.	Δ FEC ≅ Δ GDB	
	Therefore, ∠3 = ∠4	1

	In Δ ABC, $\angle 3 = \angle 4$ $\therefore$ AB = AC ……(i) In Δ ADE, $\angle 1 = \angle 2$ AD = AE ……(ii) Dividing (ii) by (i) $\frac{AD}{AB} = \frac{AE}{AC}$ $\Rightarrow$ DE $\|\|$ BC $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$ $\therefore$ Δ ADE ~ Δ ABC	1 1 1 1
	OR	
34.(b)	**Sides AB and AC and median AD of a Δ ABC are respectively proportional to sides PQ and PR and median PM of another Δ PQR. Show that Δ ABC ~ Δ PQR.**	
Sol.	Correct figure  Produce AD to E such that AD = DE and join EC. Produce PM to L such that PM = ML and join LR. $\therefore$ Δ ABD $\cong$ Δ ECD $\therefore$ AB = EC Similarly, PQ = LR $\frac{AB}{PQ} = \frac{AC}{PR} = \frac{AD}{PM}$ $\frac{EC}{LR} = \frac{AC}{PR} = \frac{2AD}{2PM} = \frac{AE}{PL}$ $\therefore$ Δ AEC ~ Δ PLR	1 ½ 1 1

	$\Rightarrow \angle 2 = \angle 4$ Similarly, $\angle 1 = \angle 3$ Adding both, $\angle BAC = \angle QPR$ $\therefore \Delta ABC \sim \Delta PQR$	½ ½ ½
35.	A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 5·8 cm and its base is of radius 2·1 cm, find the total surface area of the article. 	
Sol.	CSA of cylinder $= 2 \times \frac{22}{7} \times 2.1 \times 5.8$ $= 76.56 \text{ cm}^2$ CSA of two hemisphere $= 4 \times \frac{22}{7} \times 2.1 \times 2.1$ $= 55.44 \text{ cm}^2$ Total Surface Area of article $= 76.56 + 55.44 = 132 \text{ cm}^2$	1 1 1 1 1
	SECTION-E **This section comprises 3 case study based questions of 4 marks each.**	
36.	**Case Study – 1** Essel World is one of India's largest amusement parks that offers a diverse range of thrilling rides, water attractions and entertainment options for visitors of all ages. The park is known for its iconic "Water Kingdom" section, making it a popular destination for family outings and fun-filled adventure. The ticket charges for the park are ₹ 150 per child and ₹ 250 per adult.  On a day, the cashier of the park found that 300 tickets were sold and an amount of ₹ 55,000 was collected.	

	Based on the above, answer the following questions : (i) If the number of children visited be x and the number of adults visited be y, then write the given situation algebraically. (ii) (a) How many children visited the amusement park that day ? **OR** (b) How many adults visited the amusement park that day ? (iii) How much amount will be collected if 250 children and 100 adults visit the amusement park ?	
Sol.	i) $x + y = 300$ ……(i) $150x + 250y = 55000$……..(ii) (ii) (a) Solving equation (i) and (ii) Number of children visited park (x) = 200 OR (b) Solving equation (i) and (ii) Number of adults visited park (y) = 100 (iii) Amount collected = $250 \times 150 + 100 \times 250$ = ₹ 62500	½ ½ 2 2 1
37.	**Case Study – 2** A garden is in the shape of a square. The gardener grew saplings of Ashoka tree on the boundary of the garden at the distance of 1 m from each other. He wants to decorate the garden with rose plants. He chose a triangular region inside the garden to grow rose plants. In the above situation, the gardener took help from the students of class 10. They made a chart for it which looks like the given figure.  Based on the above, answer the following questions : (i) If A is taken as origin, what are the coordinates of the vertices of Δ PQR ? (ii) (a) Find distances PQ and QR. **OR** (b) Find the coordinates of the point which divides the line segment joining points P and R in the ratio 2 : 1 internally. (iii) Find out if Δ PQR is an isosceles triangle.	
Sol.	(i) P (4, 6) , Q (3, 2), R (6, 5)	1

	(ii) (a) PQ = $\sqrt{(4-3)^2 + (6-2)^2} = \sqrt{17}$	1
	QR = $\sqrt{(3-6)^2 + (2-5)^2} = \sqrt{18}$	1
	OR	
	(b) The coordinate of required point are $\left(\frac{6\times2+1\times4}{3}, \frac{5\times2+1\times6}{3}\right)$	1
	i.e. $\left(\frac{16}{3}, \frac{16}{3}\right)$	1
	(iii) PQ = $\sqrt{(4-3)^2 + (6-2)^2} = \sqrt{17}$	
	QR = $\sqrt{(3-6)^2 + (2-5)^2} = \sqrt{18}$	
	PR = $\sqrt{(4-6)^2 + (6-5)^2} = \sqrt{5}$	½
	PQ ≠ QR ≠ PR	½
	Δ PQR is not isosceles	
38.	**Case Study – 3** Activities like running or cycling reduce stress and the risk of mental disorders like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100 m, was noted as follows : 	

Time (in seconds)	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100
Number of students	8	10	13	6	3

Based on the above, answer the following questions :

(i) What is the median class of the above given data ?

(ii) (a) Find the mean time taken by the students to finish the race.

OR

(b) Find the mode of the above given data.

(iii) How many students took time less than 60 seconds ?

Time (in sec)	Number of students (f)	x_i	cf	$f_i x_i$
0 – 20	8	10	8	80
20 – 40	10	30	18	300
40 – 60	13	50	31	650
60 – 80	6	70	37	420
80 – 100	3	90	40	270
Total	40			1720

Sol.

(i) Correct Cummulative Frequency ½

Median class = 40 – 60 ½

(ii) (a) Correct table for x_i and $f_i x_i$ 1½

Mean = $\frac{1720}{40} = 43$ ½

OR

(b) Modal class = 40-60 ½

Mode = $40 + \frac{(13-10)}{(26-10-6)} \times 20$ 1

= 46 ½

(iii) 31 students took time less than 60 seconds 1

* * *

Series #CDBA/S **SET~1**

प्रश्न–पत्र कोड
Q.P. Code **30/S/1**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **27** हैं ।
Please check that this question paper contains **27** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।
Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
MATHEMATICS (STANDARD)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं। **सभी** प्रश्न **अनिवार्य** हैं।*

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ**।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं। प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है। यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है।*

(ix) *जहाँ आवश्यक हो स्वच्छ आकृतियाँ बनाइए। जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है। *20×1=20*

1. यदि $x = 5$, द्विघात समीकरण $2x^2 + (k - 1)x + 10 = 0$ का एक हल है, तो k का मान है :

(A) 11 (B) – 11

(C) 13 (D) – 13

2. दो धनात्मक पूर्णांकों m और n को $m = p^5q^2$ तथा $n = p^3q^4$, जहाँ p और q अभाज्य संख्याएँ हैं, द्वारा व्यक्त किया गया है। m और n का LCM है :

(A) p^8q^6 (B) p^3q^2

(C) p^5q^4 (D) $p^5q^2 + p^3q^4$

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A**, **B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are multiple choice questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are short answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are long answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Draw neat diagrams wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **not** allowed.*

SECTION A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each. *20×1=20*

1. If x = 5 is a solution of the quadratic equation $2x^2 + (k - 1)x + 10 = 0$, then the value of k is :

(A) 11 (B) – 11

(C) 13 (D) – 13

2. Two positive integers m and n are expressed as $m = p^5q^2$ and $n = p^3q^4$, where p and q are prime numbers. The LCM of m and n is :

(A) p^8q^6 (B) p^3q^2

(C) p^5q^4 (D) $p^5q^2 + p^3q^4$

3. समीकरण युग्म $x = 2a$ और $y = 3b$ $(a, b \neq 0)$ का ग्राफ जिन सरल रेखाओं को निरूपित करता है, वे

(A) संपाती हैं (B) समांतर हैं

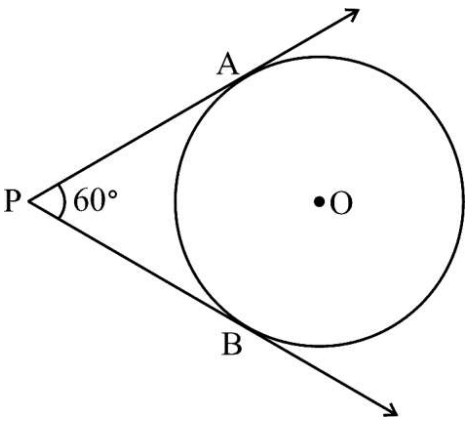
(C) (2a, 3b) पर प्रतिच्छेदी हैं (D) (3b, 2a) पर प्रतिच्छेदी हैं

4. यदि $k + 7, 2k - 2$ और $2k + 6$ एक A.P. के तीन क्रमागत पद हैं, तो k का मान है :

(A) 15 (B) 17

(C) 5 (D) 1

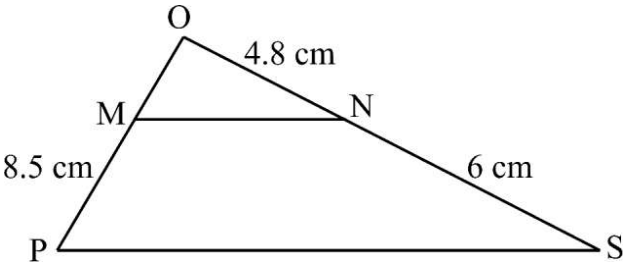
5. दी गई आकृति में, केंद्र O वाले एक वृत्त पर PA और PB दो स्पर्श-रेखाएँ खींची गई हैं और वृत्त की त्रिज्या 5 cm है। यदि $\angle APB = 60°$ है, तो PA की लंबाई है :



(A) $\frac{5}{\sqrt{3}}$ cm (B) $5\sqrt{3}$ cm

(C) $\frac{10}{\sqrt{3}}$ cm (D) 10 cm

6. दी गई आकृति में, यदि Δ OPS की भुजाओं OP और OS पर क्रमश: बिन्दु M और N इस प्रकार स्थित हैं कि MN || PS है, तो OP की लंबाई है :



(A) 6.8 cm (B) 17 cm

(C) 15.3 cm (D) 9.6 cm

3. The pair of equations $x = 2a$ and $y = 3b$ ($a, b \neq 0$) graphically represents straight lines which are :

(A) coincident (B) parallel

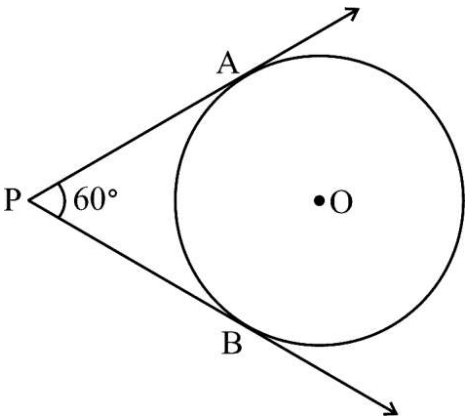
(C) intersecting at (2a, 3b) (D) intersecting at (3b, 2a)

4. If $k + 7$, $2k - 2$ and $2k + 6$ are three consecutive terms of an A.P., then the value of k is :

(A) 15 (B) 17

(C) 5 (D) 1

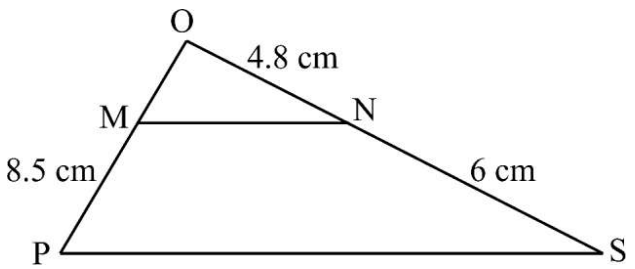
5. In the given figure, PA and PB are two tangents drawn to the circle with centre O and radius 5 cm. If $\angle APB = 60°$, then the length of PA is :



(A) $\frac{5}{\sqrt{3}}$ cm (B) $5\sqrt{3}$ cm

(C) $\frac{10}{\sqrt{3}}$ cm (D) 10 cm

6. In the given figure, if M and N are points on the sides OP and OS respectively of ΔOPS, such that $MN \parallel PS$, then the length of OP is :



(A) 6.8 cm (B) 17 cm

(C) 15.3 cm (D) 9.6 cm

7. 52 पत्तों की एक ताश की गड्डी से सभी बेगम, गुलाम और इक्के निकाल दिए जाते हैं। शेष पत्तों को अच्छी प्रकार से फेंटा जाता है और तब एक पत्ता यादृच्छया निकाला जाता है। निकाले गए पत्ते के एक बादशाह होने की प्रायिकता है :

(A) $\frac{1}{10}$ (B) $\frac{1}{13}$

(C) $\frac{3}{10}$ (D) $\frac{3}{13}$

8. केंद्र O(2, – 4) वाले एक वृत्त का, PQ एक व्यास है। यदि बिंदु P के निर्देशांक (– 4, 5) हैं, तो बिंदु Q के निर्देशांक हैं :

(A) (– 3, 4.5) (B) (– 1, 0.5)

(C) (4, – 5) (D) (8, – 13)

9. $\left(\sin^2 \theta + \frac{1}{1 + \tan^2 \theta} \right)$ का मान है :

(A) 0 (B) 2

(C) 1 (D) – 1

10. एक टोपी बेलनाकार आकार की है जिस पर एक शंकु अध्यारोपित है। यदि बेलनाकार भाग का आयतन शंक्वाकार भाग के आयतन के बराबर है, तो बेलनाकार भाग की ऊँचाई का शंक्वाकार भाग की ऊँचाई से अनुपात है :

(A) 1 : 2 (B) 1 : 3

(C) 2 : 1 (D) 3 : 1

11. A.P. : – 8, – 5, – 2, ..., 49 का अंतिम पद से प्रथम पद की ओर 7वाँ पद है :

(A) 67 (B) 13

(C) 31 (D) 10

7. All queens, jacks and aces are removed from a pack of 52 playing cards. The remaining cards are well-shuffled and one card is picked up at random from it. The probability of that card to be a king is :

(A) $\frac{1}{10}$ (B) $\frac{1}{13}$

(C) $\frac{3}{10}$ (D) $\frac{3}{13}$

8. PQ is a diameter of a circle with centre O(2, – 4). If the coordinates of the point P are (– 4, 5), then the coordinates of the point Q will be :

(A) (– 3, 4.5) (B) (– 1, 0.5)

(C) (4, – 5) (D) (8, – 13)

9. The value of $\left(\sin^2 \theta + \frac{1}{1+\tan^2 \theta} \right)$ is :

(A) 0 (B) 2

(C) 1 (D) – 1

10. A cap is cylindrical in shape, surmounted by a conical top. If the volume of the cylindrical part is equal to that of the conical part, then the ratio of the height of the cylindrical part to the height of the conical part is :

(A) 1 : 2 (B) 1 : 3

(C) 2 : 1 (D) 3 : 1

11. The 7^{th} term from the end of the A.P. : – 8, – 5, – 2, ..., 49 is :

(A) 67 (B) 13

(C) 31 (D) 10

12. एक समचतुर्भुज ABCD के विकर्ण बिंदु O पर प्रतिच्छेदी हैं। बिंदु 'O' को केंद्र लेकर, त्रिज्या 6 cm की एक चाप OA तथा OD को क्रमश: बिंदुओं E और F पर काटती है। त्रिज्यखंड OEF का क्षेत्रफल है :

(A) 9π cm^2 (B) 3π cm^2

(C) 12π cm^2 (D) 18π cm^2

13. 600 आइसक्रीमों के समूह में से एक चॉकलेट फ्लेवर वाली आइसक्रीम के निकालने की प्रायिकता 0.055 है। इस समूह में चॉकलेट फ्लेवर वाली आइसक्रीमों की संख्या है :

(A) 33 (B) 55

(C) 11 (D) 44

14. यदि $\tan^2\theta + \cot^2\alpha = 2$ है, जहाँ $\theta = 45°$ और $0° \le \alpha \le 90°$ है, तो α का मान है :

(A) 30° (B) 45°

(C) 60° (D) 90°

15. x-अक्ष का वह बिंदु, जो बिंदुओं (5, – 3) और (4, 2) से एकसमान दूरी पर है, है :

(A) (4.5, 0) (B) (7, 0)

(C) (0.5, 0) (D) (– 7, 0)

16. यदि एक वृत्त का एक चाप, जो इसके केंद्र पर 60° का कोण अंतरित करता है, की लंबाई 22 cm है, तो वृत्त की त्रिज्या है :

(A) $\sqrt{21}$ cm (B) 21 cm

(C) $\sqrt{42}$ cm (D) 42 cm

17. यदि एक खंभे की भूमि पर छाया की लंबाई, खंभे की ऊँचाई का $\sqrt{3}$ गुना है, तो सूर्य का उन्नतांश है :

(A) 30° (B) 45°

(C) 60° (D) 90°

12. The diagonals of a rhombus ABCD intersect at O. Taking 'O' as the centre, an arc of radius 6 cm is drawn intersecting OA and OD at E and F respectively. The area of the sector OEF is :

(A) 9π cm^2 (B) 3π cm^2

(C) 12π cm^2 (D) 18π cm^2

13. The probability of getting a chocolate flavoured ice cream at random, in a lot of 600 ice creams is 0.055. The number of chocolate flavoured ice creams in the lot is :

(A) 33 (B) 55

(C) 11 (D) 44

14. If $\tan^2\theta + \cot^2\alpha = 2$, where $\theta = 45°$ and $0° \le \alpha \le 90°$, then the value of α is :

(A) 30° (B) 45°

(C) 60° (D) 90°

15. The point on x-axis which is equidistant from the points (5, – 3) and (4, 2) is :

(A) (4.5, 0) (B) (7, 0)

(C) (0.5, 0) (D) (– 7, 0)

16. If the length of an arc of a circle subtending an angle 60° at its centre is 22 cm, then the radius of the circle is :

(A) $\sqrt{21}$ cm (B) 21 cm

(C) $\sqrt{42}$ cm (D) 42 cm

17. If the length of the shadow on the ground of a pole is $\sqrt{3}$ times the height of the pole, then the angle of elevation of the Sun is :

(A) 30° (B) 45°

(C) 60° (D) 90°

18. दो पासों को एक साथ उछाला गया तथा उन पर आई संख्याओं का गुणनफल नोट किया गया। दोनों पासों पर आई संख्याओं का गुणनफल 8 और 13 के बीच होने की प्रायिकता है :

(A) $\frac{7}{36}$ (B) $\frac{5}{36}$

(C) $\frac{2}{9}$ (D) $\frac{1}{4}$

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं। दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है। इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है।

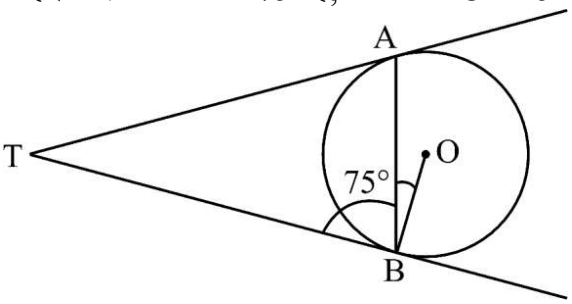
(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है।

19. *अभिकथन (A)* : यदि एक बहुपद का ग्राफ x-अक्ष को केवल दो बिंदुओं पर प्रतिच्छेदित करता हो, तो बहुपद के शून्यकों की संख्या 2 है।

तर्क (R) : एक बहुपद के शून्यकों की संख्या उन बिंदुओं की संख्या के बराबर होती है जिन पर बहुपद का ग्राफ x-अक्ष को प्रतिच्छेदित करता है।

20. *अभिकथन (A)* : बाह्य बिंदु T से केंद्र 'O' वाले वृत्त पर खींची गई दो स्पर्श-रेखाएँ TA और TB हैं। यदि $\angle$ TBA = 75° है, तो $\angle$ ABO = 25° होगा।



तर्क (R) : वृत्त के किसी बिंदु पर खींची गई स्पर्श-रेखा स्पर्श बिंदु से जाने वाली त्रिज्या पर लंब होती है।

18. Two dice are thrown at the same time and the product of the numbers appearing on them is noted. The probability that the product of the numbers lies between 8 and 13 is :

(A) $\frac{7}{36}$ (B) $\frac{5}{36}$

(C) $\frac{2}{9}$ (D) $\frac{1}{4}$

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

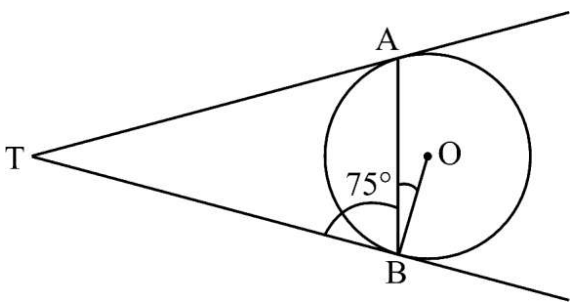
(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A)* : If the graph of a polynomial intersects the x-axis at exactly two points, then the number of zeroes of that polynomial is 2.

Reason (R) : The number of zeroes of a polynomial is equal to the number of points where the graph of the polynomial intersects x-axis.

20. *Assertion (A)* : TA and TB are two tangents drawn from an external point T to a circle with centre 'O'. If $\angle$ TBA = 75° then $\angle$ ABO = 25°.

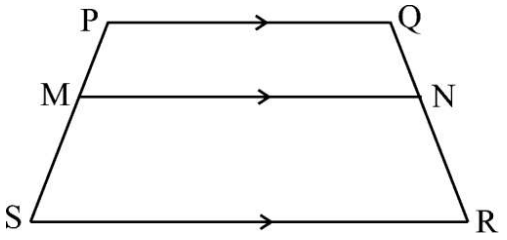


Reason (R) : The tangent drawn at any point of a circle is perpendicular to the radius through the point of contact.

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 2 अंक हैं। *5×2=10*

21. PQRS एक समलंब है जिसमें PQ || SR है। यदि असमांतर भुजाओं PS और QR पर क्रमश: दो बिंदु M और N इस प्रकार स्थित हैं कि भुजा MN, भुजा PQ के समांतर है, तो दर्शाइए कि $\frac{PM}{MS} = \frac{QN}{NR}$.

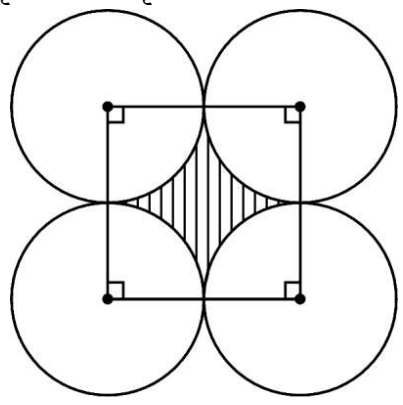


22. सिद्ध कीजिए कि $7 - 3\sqrt{5}$ एक अपरिमेय संख्या है, दिया गया है कि $\sqrt{5}$ एक अपरिमेय संख्या है।

23. (a) 14 cm त्रिज्या वाले एक वृत्त की कोई जीवा केंद्र पर 90° का कोण अंतरित करती है। संगत लघु वृत्तखण्ड का क्षेत्रफल ज्ञात कीजिए।

अथवा

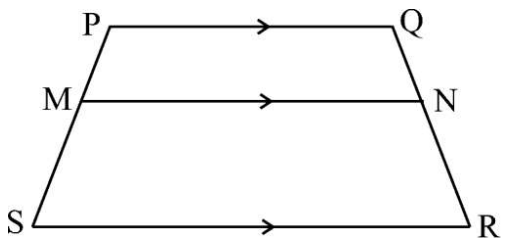
(b) आकृति में छायांकित क्षेत्र का क्षेत्रफल ज्ञात कीजिए, यदि प्रत्येक वृत्त की त्रिज्या 7 cm है और प्रत्येक वृत्त दो अन्य वृत्तों को बाह्य रूप से स्पर्श करता हो।



SECTION B

This section comprises Very Short Answer (VSA) type questions of 2 marks each. $5 \times 2 = 10$

21. PQRS is a trapezium with PQ ‖ SR. If M and N are two points on the non-parallel sides PS and QR respectively, such that MN is parallel to PQ, then show that $\frac{PM}{MS} = \frac{QN}{NR}$.

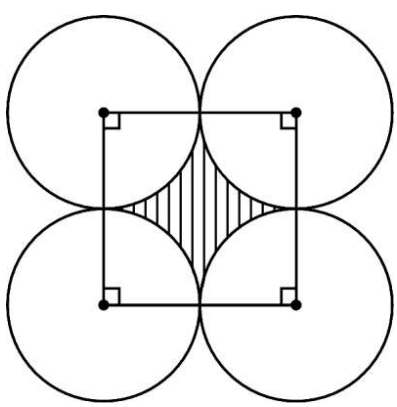


22. Prove that $7 - 3\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number.

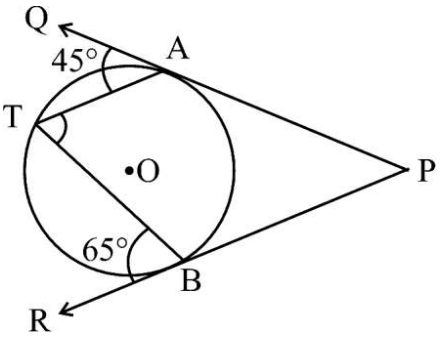
23. (a) A chord is subtending an angle of 90° at the centre of a circle of radius 14 cm. Find the area of the corresponding minor segment of the circle.

OR

(b) Find the area of the shaded region if length of radius of each circle is 7 cm. Each circle touches the other two externally.



24. दी गई आकृति में, बिंदुओं A और B पर क्रमश: PAQ और PBR केंद्र 'O' वाले किसी वृत्त पर दो स्पर्श-रेखाएँ हैं। यदि वृत्त पर बिंदु T इस प्रकार है कि $\angle QAT = 45°$ तथा $\angle TBR = 65°$ है, तो $\angle ATB$ ज्ञात कीजिए।



25. (a) यदि $\cos (A + B) = \frac{1}{2}$ और $\tan (A - B) = \frac{1}{\sqrt{3}}$ है, जहाँ $0 \leq A + B \leq 90°$ है, तो $\sec (2A - 3B)$ का मान ज्ञात कीजिए ।

अथवा

(b) x का मान ज्ञात कीजिए जिसके लिए

$$3 \tan^2 60° - x \sin^2 45° + \frac{3}{4} \sec^2 30° = 2 \operatorname{cosec}^2 30°$$

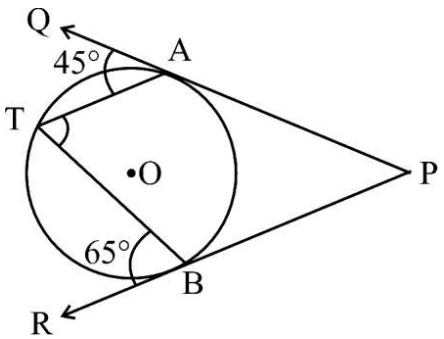
खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 3 अंक हैं। *6×3=18*

26. एक रेल दुर्घटना के उपरांत सरकार ने 100 व्यक्तियों को बचाया। उनकी आयु का ब्यौरा निम्न सारणी में अंकित किया गया था। उनकी माध्य आयु ज्ञात कीजिए।

आयु (वर्षों में)	बचाए गए व्यक्तियों की संख्या
10 – 20	9
20 – 30	14
30 – 40	15
40 – 50	21
50 – 60	23
60 – 70	12
70 – 80	6

24. In the given figure, PAQ and PBR are tangents to the circle with centre 'O' at the points A and B respectively. If T is a point on the circle such that $\angle$ QAT = 45° and $\angle$ TBR = 65°, then find $\angle$ ATB.



25. (a) If $\cos(A + B) = \frac{1}{2}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, where $0 \leq A + B \leq 90°$, then find the value of sec (2A – 3B).

OR

(b) Find the value of x such that,

$3\tan^2 60° - x\sin^2 45° + \frac{3}{4}\sec^2 30° = 2\,\text{cosec}^2 30°$

SECTION C

This section comprises Short Answer (SA) type questions of 3 marks each. *6×3=18*

26. The government rescued 100 people after a train accident. Their ages were recorded in the following table. Find their mean age.

Age (in years)	Number of people rescued
10 – 20	9
20 – 30	14
30 – 40	15
40 – 50	21
50 – 60	23
60 – 70	12
70 – 80	6

27. सिद्ध कीजिए कि :

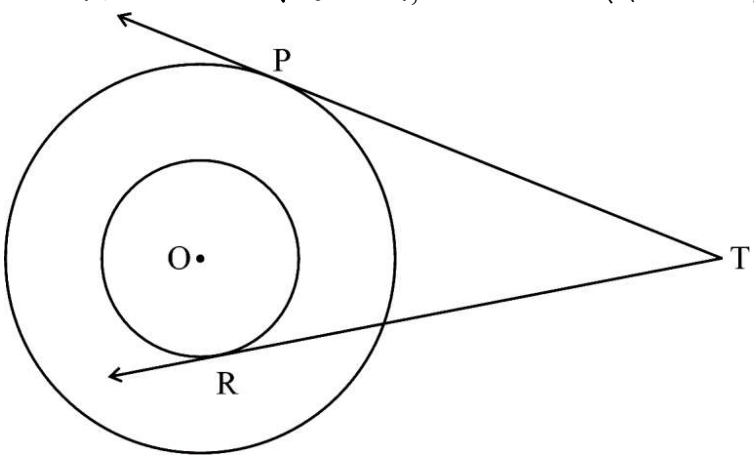
$$\left(\frac{1+\tan^2 A}{1+\cot^2 A}\right) = \frac{(1-\tan A)^2}{(1-\cot A)^2}$$

28. (a) यदि एक वृत्त के परिगत एक षट्भुज PQRSTU खींचा गया है, तो सिद्ध कीजिए कि

$$PQ + RS + TU = QR + ST + UP$$

अथवा

(b) दी गई आकृति में, त्रिज्या 3 cm और त्रिज्या 5 cm के दो संकेंद्रीय वृत्त बने हैं। एक बाह्य बिन्दु T से इन वृत्तों पर दो स्पर्श-रेखाएँ TR और TP इस प्रकार खींची गई हैं कि TR आंतरिक वृत्त को बिंदु R पर स्पर्श करती है, तथा TP बाहरी वृत्त को बिंदु P पर स्पर्श करती है। यदि $TR = 4\sqrt{10}$ cm है, तो TP की लंबाई ज्ञात कीजिए।



29. वह द्विघात बहुपद ज्ञात कीजिए जिसके शून्यकों का योगफल 8 तथा अंतर 2 है।

30. (a) एक 2-अंकीय संख्या के अंकों का योगफल 12 है। इस संख्या का 7 गुना, संख्या के अंकों को पलटने से बनी संख्या के 4 गुने के समान है। संख्या ज्ञात कीजिए।

अथवा

(b) निम्न रैखिक समीकरणों के युग्म में x और y के मान ज्ञात कीजिए :

$$62x + 43y = 167$$

$$43x + 62y = 148$$

27. Prove that :

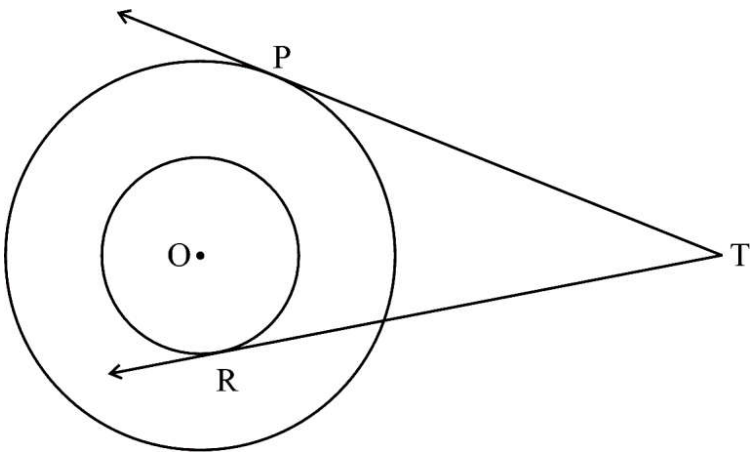
$$\left(\frac{1+\tan^2 A}{1+\cot^2 A}\right) = \frac{(1-\tan A)^2}{(1-\cot A)^2}$$

28. (a) If a hexagon PQRSTU circumscribes a circle, prove that,

$$PQ + RS + TU = QR + ST + UP$$

OR

(b) In the given figure, two concentric circles have radii 3 cm and 5 cm. Two tangents TR and TP are drawn to the circles from an external point T such that TR touches the inner circle at R and TP touches the outer circle at P. If $TR = 4\sqrt{10}$ cm, then find the length of TP.



29. Find a quadratic polynomial whose sum of the zeroes is 8 and difference of the zeroes is 2.

30. (a) The sum of the digits of a 2-digit number is 12. Seven times the number is equal to four times the number obtained by reversing the order of the digits. Find the number.

OR

(b) Find the values of x and y from the following pair of linear equations :

$$62x + 43y = 167$$

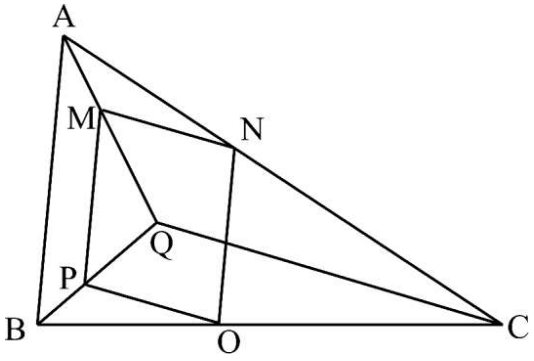
$$43x + 62y = 148$$

31. एक विज्ञान कार्यशाला में भाग लेने के लिए एक स्कूल ने 42 गणित के शिक्षक, 56 भौतिकी के शिक्षक और 70 रसायन विज्ञान के शिक्षकों को आमंत्रित किया। यदि प्रत्येक मेज़ पर बैठने वाले शिक्षकों की संख्या समान हो और प्रत्येक मेज़ पर एक ही विषय के शिक्षकों को बैठना हो, तो कम-से-कम कितनी मेज़ों की आवश्यकता होगी, ज्ञात कीजिए।

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक के 5 अंक हैं। $4 \times 5 = 20$

32. दी गई आकृति में, MNOP एक समांतर चतुर्भुज है और AB || MP है। सिद्ध कीजिए कि QC || PO.



33. एक ब्लॉक के आयु अनुसार साक्षर लोगों की संख्या निम्न सारणी में अंकित है। साक्षर लोगों की कुल संख्या 100 है और उनकी माध्यक आयु 41.5 वर्ष है। दो समूहों के लोगों की संख्या लुप्त है जिनको सारणी में x और y से निरूपित किया गया है। x और y के मान ज्ञात कीजिए।

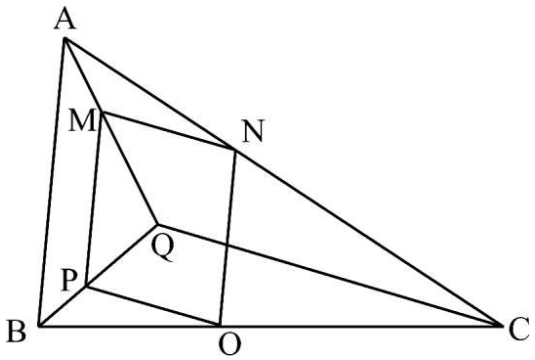
आयु (वर्षों में)	साक्षर लोगों की संख्या
10 – 20	15
20 – 30	x
30 – 40	12
40 – 50	20
50 – 60	y
60 – 70	8
70 – 80	10

31. A school has invited 42 Mathematics teachers, 56 Physics teachers and 70 Chemistry teachers to attend a Science workshop. Find the minimum number of tables required, if the same number of teachers are to sit at a table and each table is occupied by teachers of the same subject.

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each. *4×5=20*

32. In the given figure, MNOP is a parallelogram and AB ‖ MP. Prove that QC ‖ PO.



33. An age-wise list of number of literate people in a block is prepared in the following table. There are total 100 people and their median age is 41.5 years. Information about two groups are missing, which are denoted by x and y. Find the value of x and y.

Age (in years)	Number of literate people
10 – 20	15
20 – 30	x
30 – 40	12
40 – 50	20
50 – 60	y
60 – 70	8
70 – 80	10

34. (a) यदि निधि अपनी वास्तविक उम्र से 7 वर्ष छोटी होती, तो उसकी उम्र (वर्षों में) का वर्ग उसकी वास्तविक उम्र के 5 गुना से 1 अधिक होता। उसकी वास्तविक उम्र क्या है ?

अथवा

(b) एक दुकानदार ₹ 1,800 में कुछ पुस्तकें खरीदता है। यदि वह इसी राशि से 15 पुस्तकें अधिक खरीदता, तो उसे प्रत्येक पुस्तक ₹ 20 कम की पड़ती। ज्ञात कीजिए कि उसने कुल कितनी पुस्तकें प्रारम्भ में खरीदी थीं।

35. (a) भुजा 21 cm वाले लकड़ी के एक घनाकार ब्लॉक से बड़े-से-बड़ा एक अर्धगोला खोद कर इस प्रकार निकाला जाता है कि अर्धगोले का आधार, घनाकार ब्लॉक का एक फलक है। ज्ञात कीजिए :

(i) ब्लॉक में बची लकड़ी का आयतन,

(ii) बचे ठोस का कुल पृष्ठीय क्षेत्रफल।

अथवा

(b) एक ठोस खिलौना एक लम्ब-वृत्तीय शंकु के आकार का है, जो एक अर्धगोले पर अध्यारोपित है। शंकु की त्रिज्या का उसकी तिर्यक ऊँचाई से अनुपात 3 : 5 है। यदि खिलौने का आयतन 240π cm^3 है, तो खिलौने की कुल ऊँचाई ज्ञात कीजिए।

खण्ड ङ

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक के 4 अंक हैं। *3×4=12*

प्रकरण अध्ययन – 1

36. शॉर्ट सर्किट के कारण, न्यू होम कॉम्पलेक्स में आग लग गई है। दो इमारतें X तथा Y मुख्य रूप से प्रभावित हुई हैं। दमकल की गाड़ी आ गई है और उसे दोनों इमारतों के बीच तैनात किया गया है। दमकल की गाड़ी के सामने एक बिंदु O पर एक सीढ़ी लगाई जाती है।

34. (a) If Nidhi were 7 years younger than what she actually is, then the square of her age (in years) would be 1 more than 5 times her actual age. What is her present age ?

OR

(b) A shopkeeper buys a number of books for ₹ 1,800. If he had bought 15 more books for the same amount, then each book would have cost him ₹ 20 less. Find how many books he bought initially.

35. (a) The largest possible hemisphere is drilled out from a wooden cubical block of side 21 cm such that the base of the hemisphere is on one of the faces of the cube. Find :

(i) the volume of wood left in the block,

(ii) the total surface area of the remaining solid.

OR

(b) A solid toy is in the form of a hemisphere surmounted by a right circular cone. Ratio of the radius of the cone to its slant height is 3 : 5. If the volume of the toy is 240π cm^3, then find the total height of the toy.

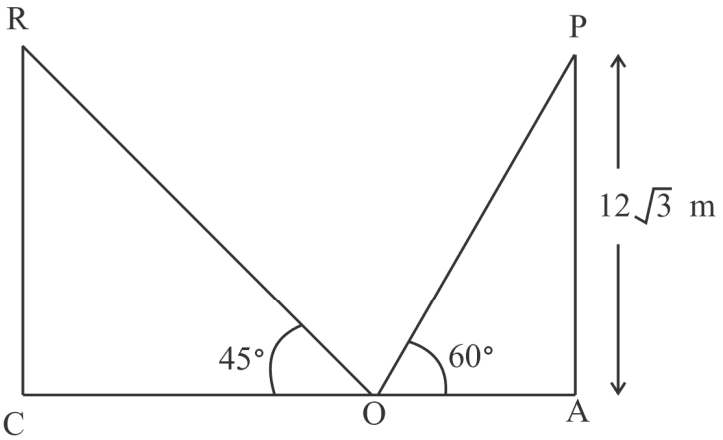
SECTION E

This section comprises 3 case study based questions of 4 marks each. *3×4=12*

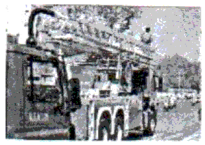
Case Study – 1

36. Due to short circuit, a fire has broken out in New Home Complex. Two buildings, namely X and Y have mainly been affected. The fire engine has arrived and it has been stationed at a point which is in between the two buildings. A ladder at point O is fixed in front of the fire engine.

क्षैतिज से 60° के कोण पर झुकी हुई सीढ़ी इमारत Y की छत के साथ लगी हुई है। सीढ़ी के पायदान को स्थिर रखा जाता है और कुछ समय बाद इसे बायीं ओर विपरीत इमारत X की छत पर भूमि से 45° के कोण पर झुका दिया जाता है। सीढ़ी का पाद बिंदु 'O' तथा दोनों इमारतों के पाद एक सीधी रेखा में हैं।



(इमारत X)



(इमारत Y)

उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) सीढ़ी की लंबाई ज्ञात कीजिए। *1*

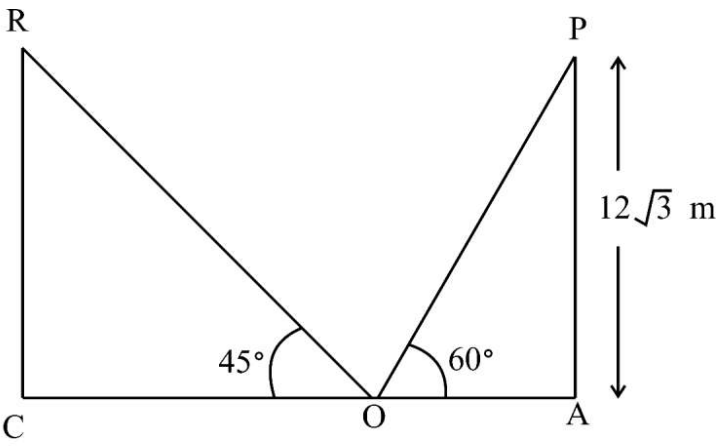
(ii) बिंदु 'O' से इमारत Y की दूरी, अर्थात् OA ज्ञात कीजिए। *1*

(iii) (a) दोनों इमारतों के बीच की क्षैतिज दूरी ज्ञात कीजिए। *2*

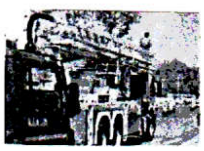
अथवा

(b) इमारत X की ऊँचाई ज्ञात कीजिए। *2*

The ladder inclined at an angle 60° to the horizontal is leaning against the wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed and after some time it is made to lean against the terrace (top) of the opposite building X at an angle of 45° with the ground. Both the buildings along with the foot of the ladder, fixed at 'O' are in a straight line.



(Building X)



(Building Y)

Based on the above given information, answer the following questions :

(i) Find the length of the ladder. *1*

(ii) Find the distance of the building Y from point 'O', i.e. OA. *1*

(iii) (a) Find the horizontal distance between the two buildings. *2*

OR

(b) Find the height of the building X. *2*

प्रकरण अध्ययन – 2

37. एक स्कूल ने 51वें विश्व पर्यावरण दिवस पर निकटतम पार्क में कुछ संकटापन्न पेड़ लगाने का निर्णय लिया है । उन्होंने उन पेड़ों को कुछ संकेंद्रीय वृत्ताकार पंक्तियों में लगाने का निर्णय लिया है, ताकि प्रत्येक अगली वृत्ताकार पंक्ति में पिछली वृत्ताकार पंक्ति की तुलना में 20 पेड़ अधिक हों । पहली वृत्ताकार पंक्ति में 50 पेड़ लगे हैं।

उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) 10वीं पंक्ति में कितने पेड़ लगेंगे ? *1*

(ii) 8वीं पंक्ति में, 5वीं पंक्ति से कितने अधिक पेड़ लगेंगे ? *1*

(iii) (a) यदि पार्क में 3200 पेड़ लगाने हों, तो कितनी पंक्तियों की आवश्यकता होगी ? *2*

अथवा

(b) यदि पार्क में 3200 पेड़ लगाने हों, तो 11वीं पंक्ति के पश्चात् कितने पेड़ लगाने के लिए बचे रहेंगे ? *2*

Case Study – 2

37. A school has decided to plant some endangered trees on 51st World Environment Day in the nearest park. They have decided to plant those trees in few concentric circular rows such that each succeeding row has 20 more trees than the previous one. The first circular row has 50 trees.

Based on the above given information, answer the following questions :

(i) How many trees will be planted in the 10th row ? *1*

(ii) How many more trees will be planted in the 8th row than in the 5th row ? *1*

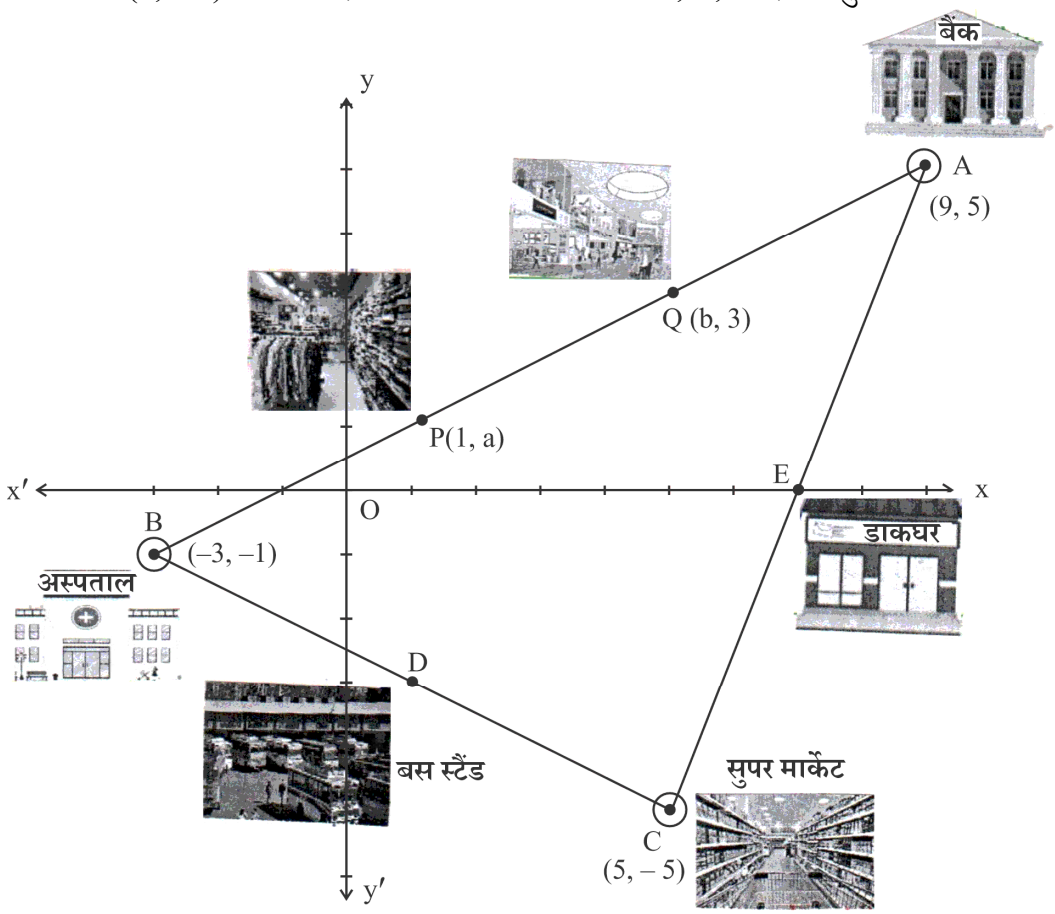
(iii) (a) If 3200 trees are to be planted in the park, then how many rows are required ? *2*

OR

(b) If 3200 trees are to be planted in the park, then how many trees are still left to be planted after the 11th row ? *2*

प्रकरण अध्ययन – 3

38. पार्थ, एक सॉफ्टवेयर इंजीनियर, अपने काम के सिलसिले में यरूशलम में रहता है। वह शहर के सबसे सुविधाजनक क्षेत्र में रहता है जहाँ से बैंक, अस्पताल, डाकघर और सुपर मार्केट तक आसानी से पहुँचा जा सकता है। ग्राफ़ में, बैंक को A(9, 5) के रूप में, अस्पताल को B(– 3, – 1) के रूप में तथा सुपर मार्केट को C(5, – 5) के रूप में इस प्रकार दर्शाया गया है कि A, B, C एक त्रिभुज बनाते हैं।



उपर्युक्त दी गई जानकारी के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) बैंक और अस्पताल के बीच की दूरी ज्ञात कीजिए। *1*

(ii) बैंक और सुपर मार्केट के बीच, एक डाकघर E के रूप में दर्शाया गया है जो कि उन दोनों के बीच का मध्य-बिंदु है। E के निर्देशांक ज्ञात कीजिए। *1*

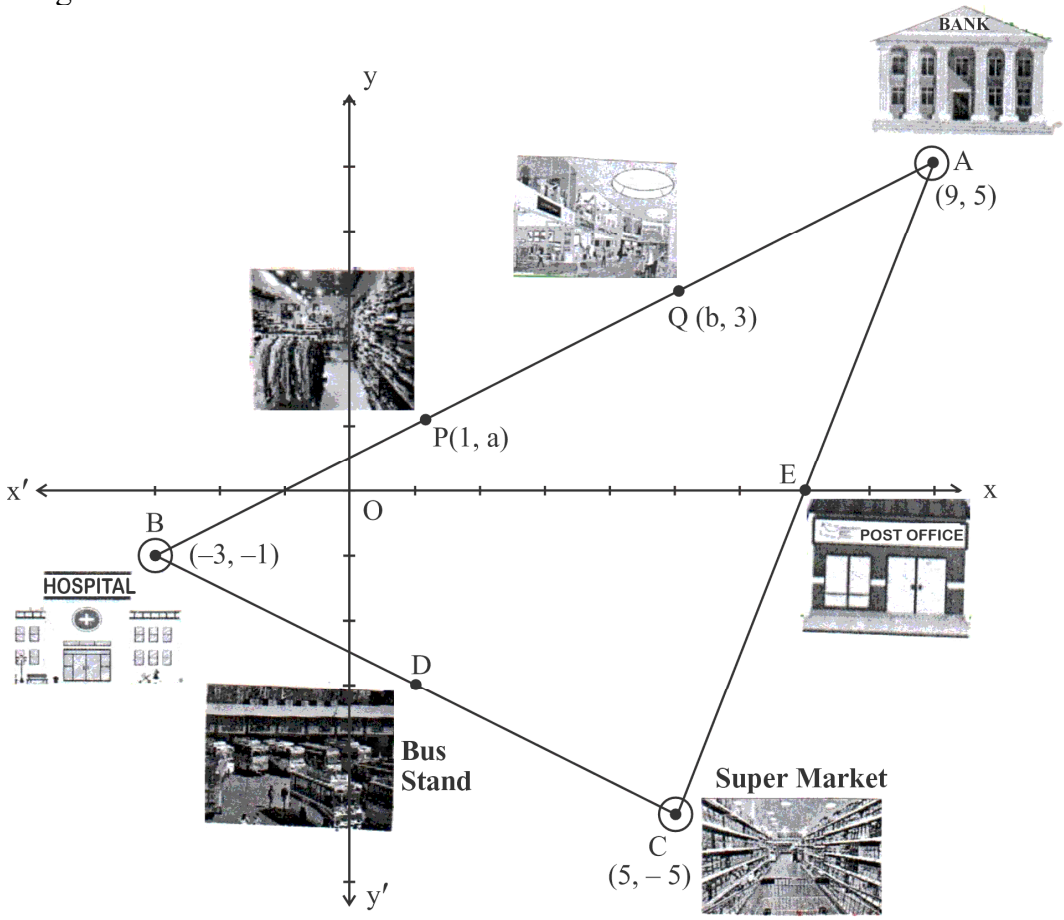
(iii) (a) अस्पताल और सुपर मार्केट के बीच, एक बस स्टैंड है जिसे D के रूप में दर्शाया गया है, जो उन दोनों के बीच का मध्य-बिंदु है। यदि पार्थ बैंक से बस स्टैंड जाना चाहता हो, तो उसको कितनी दूरी तय करने की ज़रूरत होगी ? *2*

अथवा

(b) बैंक और अस्पताल के बीच दो विभिन्न वस्त्रों की दुकानें P और Q हैं, जहाँ BP = PQ = QA है। यदि P और Q के निर्देशांक क्रमशः (1, a) तथा (b, 3) हैं, तो 'a' और 'b' के मान ज्ञात कीजिए । *2*

Case Study – 3

38. Partha, a software engineer, lives in Jerusalem for his work. He lives in the most convenient area of the city from where bank, hospital, post office and supermarket can be easily accessed. In the graph, the bank is plotted as A(9, 5), hospital as B(– 3, – 1) and supermarket as C(5, – 5) such that A, B, C form a triangle.



Based on the above given information, answer the following questions :

(i) Find the distance between the bank and the hospital. *1*

(ii) In between the bank and the supermarket, there is a post office plotted at E which is their mid-point. Find the coordinates of E. *1*

(iii) (a) In between the hospital and the supermarket, there is a bus stop plotted as D, which is their mid-point. If Partha wants to reach the bus stand from the bank, then how much distance does he need to cover ? *2*

OR

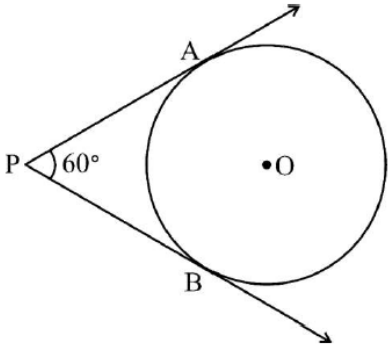
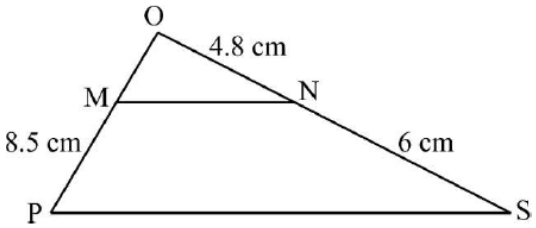
(b) P and Q are two different garment shops lying between the bank and the hospital, such that BP = PQ = QA. If the coordinates of P and Q are (1, a) and (b, 3) respectively, then find the values of 'a' and 'b'. *2*

	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Supplementary Examination, 2024** **MATHEMATICS 041 PAPER CODE 30/S/1**
General Instructions: -	
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class -X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

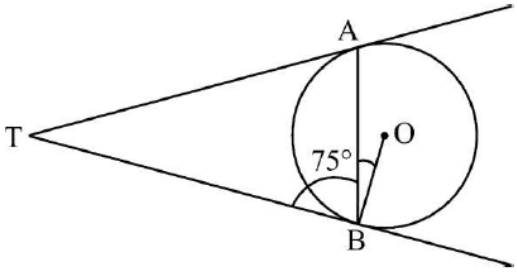
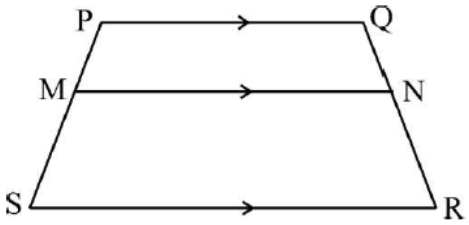
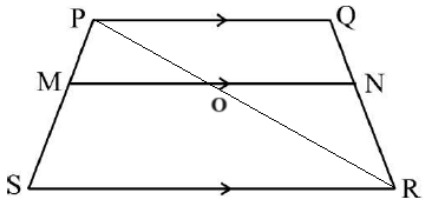
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/S/1)

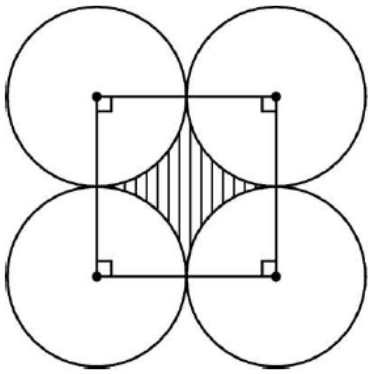
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section comprises Multiple Choice Questions (MCQs) 1 mark each.**	
1	If x = 5 is a solution of the quadratic equation $2x^2 + (k - 1)x + 10 = 0$, then the value of k is : (A) 11 (B) – 11 (C) 13 (D) – 13	
Sol.	(B) -11	**1**
2	Two positive integers m and n are expressed as $m = p^5q^2$ and $n = p^3q^4$, where p and q are prime numbers. The LCM of m and n is : (A) p^8q^6 (B) p^3q^2 (C) p^5q^4 (D) $p^5q^2 + p^3q^4$	
Sol.	(C) p^5q^4	**1**
3	The pair of equations x = 2a and y = 3b (a, b ≠ 0) graphically represents straight lines which are : (A) coincident (B) parallel (C) intersecting at (2a, 3b) (D) intersecting at (3b, 2a)	
Sol.	(C) intersecting at (2a, 3b)	**1**
4	If k + 7, 2k – 2 and 2k + 6 are three consecutive terms of an A.P., then the value of k is : (A) 15 (B) 17 (C) 5 (D) 1	
Sol.	(B) 17	**1**

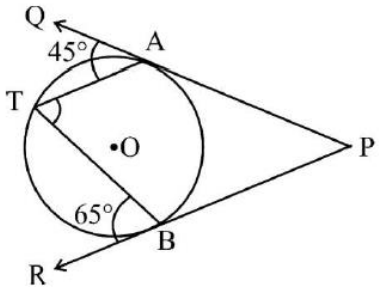
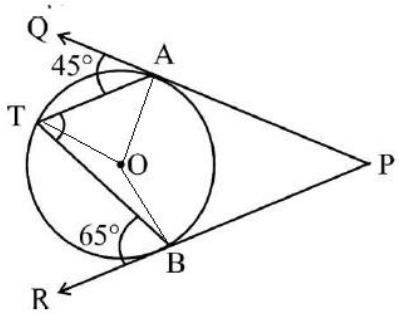
5	In the given figure, PA and PB are two tangents drawn to the circle with centre O and radius 5 cm. If $\angle APB = 60°$, then the length of PA is :  (A) $\frac{5}{\sqrt{3}}$ cm (B) $5\sqrt{3}$ cm (C) $\frac{10}{\sqrt{3}}$ cm (D) 10 cm	
Sol.	(B) $5\sqrt{3}$ cm	**1**
6	In the given figure, if M and N are points on the sides OP and OS respectively of ΔOPS, such that MN $\parallel$ PS, then the length of OP is :  (A) 6.8 cm (B) 17 cm (C) 15.3 cm (D) 9.6 cm	
Sol.	(C) 15.3 cm	**1**
7	All queens, jacks and aces are removed from a pack of 52 playing cards. The remaining cards are well-shuffled and one card is picked up at random from it. The probability of that card to be a king is : (A) $\frac{1}{10}$ (B) $\frac{1}{13}$ (C) $\frac{3}{10}$ (D) $\frac{3}{13}$	
Sol.	(A) $\frac{1}{10}$	**1**
8	PQ is a diameter of a circle with centre O(2, – 4). If the coordinates of the point P are (– 4, 5), then the coordinates of the point Q will be : (A) (– 3, 4.5) (B) (– 1, 0.5) (C) (4, – 5) (D) (8, – 13)	
Sol.	(D) (8, −13)	**1**

9	The value of $\left(\sin^2 \theta + \frac{1}{1+\tan^2 \theta} \right)$ is : (A) 0 (B) 2 (C) 1 (D) – 1	
Sol.	(C) 1	**1**
10	A cap is cylindrical in shape, surmounted by a conical top. If the volume of the cylindrical part is equal to that of the conical part, then the ratio of the height of the cylindrical part to the height of the conical part is : (A) 1 : 2 (B) 1 : 3 (C) 2 : 1 (D) 3 : 1	
Sol.	(B) 1: 3	**1**
11	The 7^{th} term from the end of the A.P. : – 8, – 5, – 2, ..., 49 is : (A) 67 (B) 13 (C) 31 (D) 10	
Sol.	(C) 31	**1**
12	The diagonals of a rhombus ABCD intersect at O. Taking 'O' as the centre, an arc of radius 6 cm is drawn intersecting OA and OD at E and F respectively. The area of the sector OEF is : (A) 9π cm^2 (B) 3π cm^2 (C) 12π cm^2 (D) 18π cm^2	
Sol.	(A) 9π cm^2	**1**
13	The probability of getting a chocolate flavoured ice cream at random, in a lot of 600 ice creams is 0.055. The number of chocolate flavoured ice creams in the lot is : (A) 33 (B) 55 (C) 11 (D) 44	
Sol.	(A) 33	**1**
14	If $\tan^2 \theta + \cot^2 \alpha = 2$, where $\theta = 45°$ and $0° \leq \alpha \leq 90°$, then the value of α is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(B) 45°	**1**

15	The point on x-axis which is equidistant from the points (5, – 3) and (4, 2) is : (A) (4.5, 0) (B) (7, 0) (C) (0.5, 0) (D) (– 7, 0)	
Sol.	(B) (7, 0)	**1**
16	If the length of an arc of a circle subtending an angle 60° at its centre is 22 cm, then the radius of the circle is : (A) $\sqrt{21}$ cm (B) 21 cm (C) $\sqrt{42}$ cm (D) 42 cm	
Sol.	(B) 21 cm	**1**
17	If the length of the shadow on the ground of a pole is $\sqrt{3}$ times the height of the pole, then the angle of elevation of the Sun is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(A) 30°	**1**
18	Two dice are thrown at the same time and the product of the numbers appearing on them is noted. The probability that the product of the numbers lies between 8 and 13 is : (A) $\frac{7}{36}$ (B) $\frac{5}{36}$ (C) $\frac{2}{9}$ (D) $\frac{1}{4}$	
Sol.	(A) $\frac{7}{36}$	**1**
	Directions : In Question **19** and **20**, **Assertion (A)** and **Reason (R)** are given. Select the correct option from the following : (A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A). (C) Assertion (A) is true but Reason (R) is not true. (D) Assertion (A) is not true but Reason (R) is true.	

19	*Assertion (A)* : If the graph of a polynomial intersects the x-axis at exactly two points, then the number of zeroes of that polynomial is 2. *Reason (R)* : The number of zeroes of a polynomial is equal to the number of points where the graph of the polynomial intersects x-axis.	
Sol.	(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A)	**1**
20	*Assertion (A)* : TA and TB are two tangents drawn from an external point T to a circle with centre 'O'. If $\angle$ TBA = 75° then $\angle$ ABO = 25°.  *Reason (R)* : The tangent drawn at any point of a circle is perpendicular to the radius through the point of contact.	
Sol.	(D) Assertion (A) is not true but Reason (R) is true.	**1**
	SECTION B **This section comprises of Very Short Answer (VSA) type questions of 2 marks each.**	
21	PQRS is a trapezium with PQ ‖ SR. If M and N are two points on the non-parallel sides PS and QR respectively, such that MN is parallel to PQ, then show that $\frac{PM}{MS} = \frac{QN}{NR}$. 	
Sol.	Join PR  PQ ‖ SR and MN ‖ PQ ⇒ MN ‖ SR In Δ PSR, $\frac{PM}{MS} = \frac{PO}{OR}$ … (i) In Δ PQR, $\frac{PO}{OR} = \frac{QN}{NR}$ … (ii) From (i) and (ii), $\frac{PM}{MS} = \frac{QN}{NR}$	½ ½ ½ ½

22	Prove that $7 - 3\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number.	
Sol.	Assuming $7 - 3\sqrt{5}$ to be a rational number. Let $7 - 3\sqrt{5} = \frac{a}{b}$ where a and b are integers & $b \neq 0$ $\Rightarrow \sqrt{5} = \frac{7b-a}{3b}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong. Hence, $7 - 3\sqrt{5}$ is an irrational number.	½ **1** ½
23(a)	A chord is subtending an angle of 90° at the centre of a circle of radius 14 cm. Find the area of the corresponding minor segment of the circle.	
Sol.	Area of minor segment $= \pi \times 14^2 \times \frac{1}{4} - \frac{1}{2} \times 14^2$ $= (154 - 98) = 56$ Hence, area of minor segment $= 56\ \text{cm}^2$	**1** **1**
	OR	
23(b)	Find the area of the shaded region if length of radius of each circle is 7 cm. Each circle touches the other two externally. 	
Sol.	Side of square $= 14$ cm Area of shaded region = area of square – area of 4 quadrants $= 14^2 - 4 \times \frac{22}{7} \times 7^2 \times \frac{90}{360}$ $= (196 - 154) = 42$ Hence, area of shaded region $= 42\ \text{cm}^2$	½ **1** ½

24	In the given figure, PAQ and PBR are tangents to the circle with centre 'O' at the points A and B respectively. If T is a point on the circle such that $\angle$ QAT = 45° and $\angle$ TBR = 65°, then find $\angle$ ATB.  	
Sol.	Join OA, OB and OT  Now $\angle ATO = \angle TAO = 90° - 45 = 45°$ and $\angle BTO = \angle TBO = 90° - 65° = 25°$ $\Rightarrow \angle ATB = \angle ATO + \angle BTO$ $= 45° + 25° = 70°$	½ ½ ½ ½
25(a)	If cos (A + B) = $\frac{1}{2}$ and tan (A – B) = $\frac{1}{\sqrt{3}}$, where $0 \leq$ A + B $\leq 90°$, then find the value of sec (2A – 3B).	
Sol.	$\cos(A + B) = \frac{1}{2} \Rightarrow$ A + B = 60° … (i) $\tan(A - B) = \frac{1}{\sqrt{3}} \Rightarrow$ A – B = 30° … (ii) Solving (i) and (ii), we get $A = 45°$ and $B = 15°$ $\Rightarrow \sec(2A - 3B) = \sec(90° - 45°)$ $= \sec 45° = \sqrt{2}$	½ ½ ½ ½
	OR	
25(b)	Find the value of x such that, $3 \tan^2 60° - x \sin^2 45° + \frac{3}{4} \sec^2 30° = 2 \operatorname{cosec}^2 30°$	
Sol.	$3 \tan^2 60° - x \sin^2 45° + \frac{3}{4}\sec^2 30° = 2 \operatorname{cosec}^2 30°$ $\Rightarrow 3(\sqrt{3})^2 - x\left(\frac{1}{\sqrt{2}}\right)^2 + \frac{3}{4}\left(\frac{2}{\sqrt{3}}\right)^2 = 2(2)^2$ $\Rightarrow 9 - \frac{x}{2} + 1 = 8$ $\Rightarrow x = 4$	**1** **1**
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	

26

The government rescued 100 people after a train accident. Their ages were recorded in the following table. Find their mean age.

Age (in years)	Number of people rescued
10 – 20	9
20 – 30	14
30 – 40	15
40 – 50	21
50 – 60	23
60 – 70	12
70 – 80	6

Sol.

Age (in years)	Number of people rescued (f_i)	x_i	u_i	f_iu_i
10-20	9	15	-3	-27
20-30	14	25	-2	-28
30-40	15	35	-1	-15
40-50	21	45	0	0
50-60	23	55	1	23
60-70	12	65	2	24
70-80	6	75	3	18
Total	100			-5

1½ marks for correct table

Mean Age $= 45 + \frac{(-5)}{100} \times 10$

$= 44.5$ **1**

Hence, mean age is 44.5 years ½

27

Prove that :

$$\left(\frac{1+\tan^2 A}{1+\cot^2 A}\right) = \frac{(1-\tan A)^2}{(1-\cot A)^2}$$

LHS $= \frac{1+tan^2A}{1+\frac{1}{tan^2A}}$ **1**

$= tan^2A$ ½

RHS $= \frac{(1-\tan A)^2}{\left(1-\frac{1}{\tan A}\right)^2}$ **1**

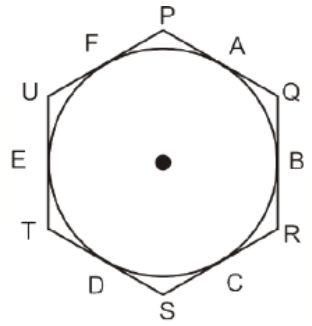
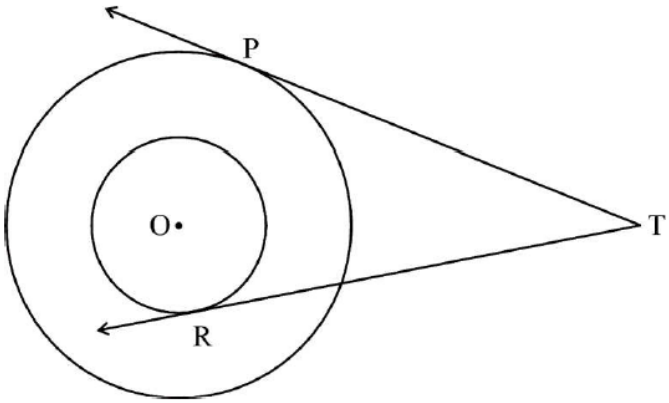
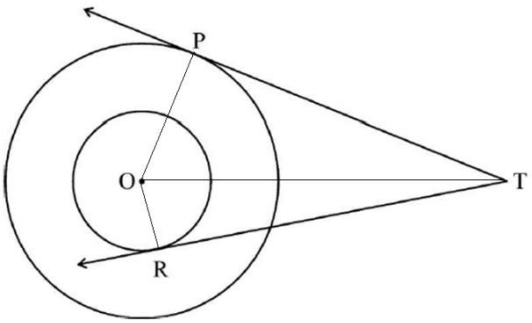
$= tan^2A$ ½

∴ LHS = RHS

28(a)

If a hexagon PQRSTU circumscribes a circle, prove that,

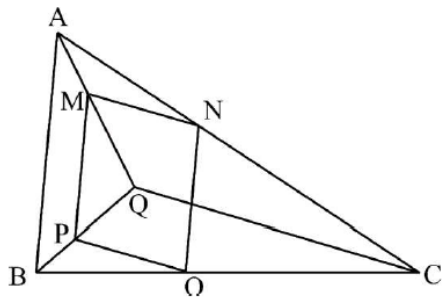
PQ + RS + TU = QR + ST + UP

Sol.	 Correct figure In the given figure, PA = PF … (1) AQ = BQ … (2) RC = RB … (3) CS = DS … (4) ET = TD … (5) UE = UF … (6) Adding (1), (2),(3), (4), (5) and (6), PA + AQ + RC + CS + ET + UE = PF + BQ + BR + DS + TD + UF $\Longrightarrow$ PQ+RS+TU = UP+ST+QR	**1** **1½** **½**
	OR	
28(b)	In the given figure, two concentric circles have radii 3 cm and 5 cm. Two tangents TR and TP are drawn to the circles from an external point T such that TR touches the inner circle at R and TP touches the outer circle at P. If $TR = 4\sqrt{10}$ cm, then find the length of TP. 	
Sol.	 Join OR, OP and OT In Δ ORT, $OT^2 = OR^2 + TR^2 = 3^2 + (4\sqrt{10})^2 = 169$ $\therefore$ OT = 13 cm In Δ OPT,	**1** **1**

	$TP^2 = OT^2 - TP^2 = 13^2 - 5^2 = 144$ $\therefore TP = 12$ cm	**1**
29	Find a quadratic polynomial whose sum of the zeroes is 8 and difference of the zeroes is 2.	
Sol.	Let the zeroes be α and β $\therefore \alpha + \beta = 8$ and $\alpha - \beta = 2$ Solving above two equations, we get $\alpha = 5$ and $\beta = 3$ So, the quadratic polynomial is $x^2 - 8x + 15$	**1** **1** **1**
30(a)	The sum of the digits of a 2-digit number is 12. Seven times the number is equal to four times the number obtained by reversing the order of the digits. Find the number.	
Sol.	Let the unit's place digit be x and ten's place digit be y $\therefore$ Number = $10y + x$ According to question, $x + y = 12$ …(i) and $7(10y + x) = 4(10x + y)$ $x - 2y = 0$ …(ii) Solving (i) and (ii), we get $x = 8$ and $y = 4$ Hence, the required number is 48	½ ½ **1** ½ ½
	OR	
30(b)	Find the values of x and y from the following pair of linear equations : $62x + 43y = 167$ $43x + 62y = 148$	
Sol.	$62x + 43y = 167$ …(i) $43x + 62y = 148$ …(ii) Adding (i) and (ii) and simplifying, we get $x + y = 3$ …(iii) Subtracting (ii) from (i) and simplifying, we get $x - y = 1$ …(iv) Solving (iii) and (iv) to get $x = 2$ and $y = 1$	**1** **1** **1**
31	A school has invited 42 Mathematics teachers, 56 Physics teachers and 70 Chemistry teachers to attend a Science workshop. Find the minimum number of tables required, if the same number of teachers are to sit at a table and each table is occupied by teachers of the same subject.	
Sol.	HCF (42, 56, 70) = 14 Minimum number of tables required $= \frac{42}{14} + \frac{56}{14} + \frac{70}{14}$ $= 12$	**1½** **1** ½
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	

32

In the given figure, MNOP is a parallelogram and AB ∥ MP. Prove that QC ∥ PO.



Sol.

$MP \parallel AB$

$\Rightarrow \Delta QMP \sim \Delta QAB$ ½

$\Rightarrow \frac{MP}{AB} = \frac{QP}{QB}$ … (i) **1**

Now, $NO \parallel MP \parallel AB$

$\Rightarrow \Delta CNO \sim \Delta CAB$ ½

$\Rightarrow \frac{NO}{AB} = \frac{CO}{CB}$ …(ii) **1**

As $MP = NO$ ½

From (i) and (ii), $\frac{CO}{CB} = \frac{QP}{QB}$ **1**

$\frac{CO}{CB} - 1 = \frac{QP}{QB} - 1$

or $\frac{BO}{OC} = \frac{BP}{PQ}$

$\therefore QC \parallel PO$ ½

33

An age-wise list of number of literate people in a block is prepared in the following table. There are total 100 people and their median age is 41.5 years. Information about two groups are missing, which are denoted by x and y. Find the value of x and y.

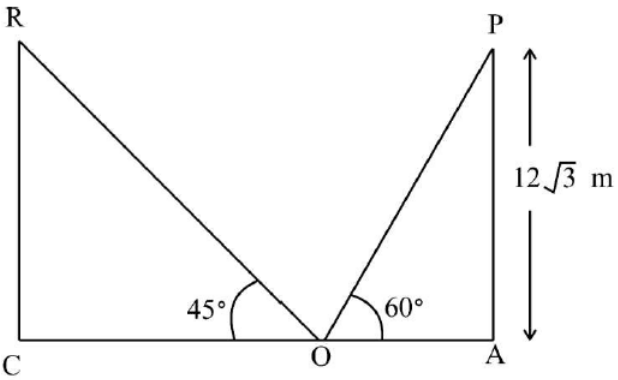
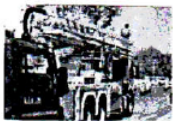
Age (in years)	Number of literate people
10 – 20	15
20 – 30	x
30 – 40	12
40 – 50	20
50 – 60	y
60 – 70	8
70 – 80	10

Sol.

Age (in years)	Number of literate people (f_i)	Cumulative frequency
$10 - 20$	15	15
$20 - 30$	x	$15 + x$
$30 - 40$	12	$27 + x$
$40 - 50$	20	$47 + x$
$50 - 60$	y	$47 + x + y$
$60 - 70$	8	$55 + x + y$
$70 - 80$	10	$65 + x + y$

1 mark for correct table

	$65 + x + y = 100$ $\Rightarrow x + y = 35$ …(i) Median $= 41.5 \therefore 40 - 50$ is the median class. $\Rightarrow\ 41.5 = 40 + \frac{50-27-x}{20} \times 10$ Solving, we get $x = 20$ From (i), $y = 15$	**1** ½ **1½** ½ ½
34(a)	If Nidhi were 7 years younger than what she actually is, then the square of her age (in years) would be 1 more than 5 times her actual age. What is her present age ?	
Sol.	Let the present age of Nidhi be x years. According to question, $(x-7)^2 = 5x + 1$ $\Rightarrow\ x^2 - 19x + 48 = 0$ $\Rightarrow (x-16)(x-3) = 0$ $\Rightarrow x = 16, 3$ $x \neq 3$ $\therefore x = 16$ Hence, the present age of Nidhi $= 16$ years	**2** **1** **1** **1**
	OR	
34(b)	A shopkeeper buys a number of books for ₹ 1,800. If he had bought 15 more books for the same amount, then each book would have cost him ₹ 20 less. Find how many books he bought initially.	
Sol.	Let the number of books bought initially be x According to question, $\frac{1800}{x} - \frac{1800}{x+15} = 20$ $\Rightarrow\ x^2 + 15x - 1350 = 0$ $\Rightarrow (x+45)(x-30) = 0$ $x \neq -45$ $\therefore x = 30$ So, the number of books bought initially = 30	**2** **1** **1** **1**
35(a)	The largest possible hemisphere is drilled out from a wooden cubical block of side 21 cm such that the base of the hemisphere is on one of the faces of the cube. Find : (i) the volume of wood left in the block, (ii) the total surface area of the remaining solid.	
Sol.	Diameter of hemisphere = side of the cube = 21 cm $\therefore$ radius of hemisphere = $\frac{21}{2}$ cm (i) Volume of the wood left = volume of cube – volume of hemisphere $= 21^3 - \frac{2}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$	½ **1**

	$= 6835.5 \text{ cm}^3$ (ii) Total surface area of remaining solid = TSA of cube − base area of hemisphere + CSA of hemisphere $= 6 \times 21^2 - \frac{22}{7} \times \left(\frac{21}{2}\right)^2 + 2 \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2$ $= 2992.5 \text{ cm}^2$	**1** **1½** **1**
	OR	
35(b)	A solid toy is in the form of a hemisphere surmounted by a right circular cone. Ratio of the radius of the cone to its slant height is 3 : 5. If the volume of the toy is $240\pi \text{ cm}^3$, then find the total height of the toy.	
Sol.	Let the radius and the slant height of the cone be $3x$ cm and $5x$ cm respectively ∴ height of the cone $(h) = \sqrt{(5x)^2 - (3x)^2} = 4x$ cm According to question, volume of toy $= 240\pi$ $\Rightarrow \frac{2}{3}\pi(3x)^3 + \frac{1}{3}\pi(3x)^2(4x) = 240\pi$ Solving, we get $x = 2$ ∴ Total height of toy $= [4(2) + 3(2)]$ cm $= 14$ cm	**½** **1** **1½** **1** **1**
	SECTION E **This section comprises of 3 case study-based questions of 4 marks each.**	
36	Due to short circuit, a fire has broken out in New Home Complex. Two buildings, namely X and Y have mainly been affected. The fire engine has arrived and it has been stationed at a point which is in between the two buildings. A ladder at point O is fixed in front of the fire engine. The ladder inclined at an angle 60° to the horizontal is leaning against the wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed and after some time it is made to lean against the terrace (top) of the opposite building X at an angle of 45° with the ground. Both the buildings along with the foot of the ladder, fixed at 'O' are in a straight line.  (Building X)  (Building Y)	

	Based on the above given information, answer the following questions : (i) Find the length of the ladder. *1* (ii) Find the distance of the building Y from point 'O', i.e. OA. *1* (iii) (a) Find the horizontal distance between the two buildings. *2* **OR** (b) Find the height of the building X. *2*	
Sol.	(i) In ΔOAP, $\frac{OP}{12\sqrt{3}} = coesc\ 60° = \frac{2}{\sqrt{3}}$ $\Longrightarrow OP = 24$ m $\therefore$ Length of ladder is 24 m (ii) In ΔOAP, $\frac{OA}{12\sqrt{3}} = \cot 60° = \frac{1}{\sqrt{3}}$ $\Longrightarrow OA = 12$ m $\therefore$ the distance of the building Y from point O ie.,OA is 12 m (iii) (a) $OP = OR = 24$ m $\therefore$ In ΔOCR, $\frac{OC}{24} = \cos 45° = \frac{1}{\sqrt{2}}$ $\Longrightarrow OC = 12\sqrt{2}$ m $\therefore$ distance between two buildings $= OA + OC$ $= (12 + 12\sqrt{2})$ m or $12(1 + \sqrt{2})$ m **OR** (iii) (b) $OP = OR = 24$ m $\therefore$ In ΔOCR, $\frac{RC}{24} = \sin 45° = \frac{1}{\sqrt{2}}$ $\Longrightarrow RC = 12\sqrt{2}$ m $\therefore$ height of building X is $12\sqrt{2}$ m	½ ½ ½ ½ ½ **1** ½ ½ **1** ½

37

A school has decided to plant some endangered trees on 51st World Environment Day in the nearest park. They have decided to plant those trees in few concentric circular rows such that each succeeding row has 20 more trees than the previous one. The first circular row has 50 trees.

Based on the above given information, answer the following questions :

(i) How many trees will be planted in the 10^{th} row ? *1*

(ii) How many more trees will be planted in the 8^{th} row than in the 5^{th} row ? *1*

(iii) (a) If 3200 trees are to be planted in the park, then how many rows are required ? *2*

OR

(b) If 3200 trees are to be planted in the park, then how many trees are still left to be planted after the 11^{th} row ? *2*

Sol.

Here $a = 50$ and $d = 20$

(i) Number of trees planted in 10^{th} row = $a_{10} = 50 + 9 \times 20$ ½

$= 230$ ½

(ii) $a_8 - a_5 = 3 \times 20 = 60$ **1**

(iii) (a) Let $S_n = 3200$

$\Rightarrow \frac{n}{2}[2 \times 50 + (n-1) \times 20] = 3200$ ½

$\Rightarrow n^2 + 4n - 320 = 0$ ½

$\Rightarrow (n+20)(n-16) = 0$ ½

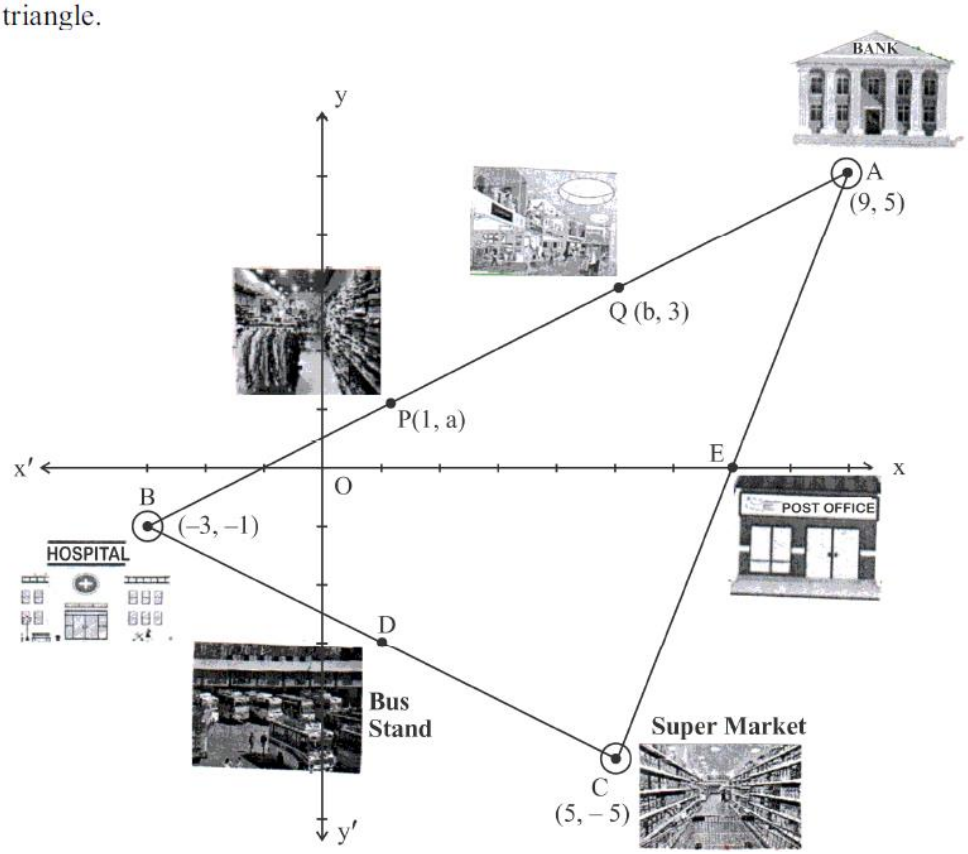
$n \neq -20$

$\therefore n = 16$ ½

Hence, required number of rows are 16

OR

(iii) (b) Required number of trees = $S_n - S_{11}$ ½

	$= 3200 - \frac{11}{2}[2 \times 50 + 10 \times 20]$ $= 1550$ Hence, number of trees left are 1550	**1** ½
38	Partha, a software engineer, lives in Jerusalem for his work. He lives in the most convenient area of the city from where bank, hospital, post office and supermarket can be easily accessed. In the graph, the bank is plotted as A(9, 5), hospital as B(– 3, – 1) and supermarket as C(5, – 5) such that A, B, C form a triangle.  Based on the above given information, answer the following questions : (i) Find the distance between the bank and the hospital. *1* (ii) In between the bank and the supermarket, there is a post office plotted at E which is their mid-point. Find the coordinates of E. *1* (iii) (a) In between the hospital and the supermarket, there is a bus stop plotted as D, which is their mid-point. If Partha wants to reach the bus stand from the bank, then how much distance does he need to cover ? *2* **OR** (b) P and Q are two different garment shops lying between the bank and the hospital, such that BP = PQ = QA. If the coordinates of P and Q are (1, a) and (b, 3) respectively, then find the values of 'a' and 'b'. *2*	
Sol.	(i) Distance between bank and hospital $= \sqrt{(-3-9)^2 + (-1-5)^2}$ $= \sqrt{180}$ units or $6\sqrt{5}$ units (ii) Coordinates of E are $\left(\frac{9+5}{2}, \frac{5+(-5)}{2}\right) = (7,0)$ (iii) (a) Coordinates of D are $\left(\frac{-3+5}{2}, \frac{-1+(-5)}{2}\right) = (1,-3)$ Distance Partha need to cover $= \sqrt{(9-1)^2 + (5-(-3))^2}$ $= \sqrt{128}$ units or $8\sqrt{2}$ units	½ ½ ½ +½ **1** ½ ½

	OR	
	(iii) (b) P is mid-point of BQ $\therefore a = \frac{-1+3}{2} = 1$ Q is mid-point of PA $\therefore b = \frac{1+9}{2} = 5$	**1** **1**

Series #CDBA/S **SET~5**

प्रश्न–पत्र कोड *Q.P. Code* **30(B)/S**

रोल नं.

Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।

Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।

Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।

Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**

Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।

15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)

(केवल दृष्टिबाधित परीक्षार्थियों के लिए)

MATHEMATICS (STANDARD)

(FOR VISUALLY IMPAIRED CANDIDATES ONLY)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*

Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में **38** प्रश्न हैं । **सभी** प्रश्न **अनिवार्य** हैं ।*

(ii) *यह प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **क, ख, ग, घ** एवं **ङ** ।*

(iii) ***खण्ड क** में प्रश्न संख्या **1** से **18** तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या **19** एवं **20** अभिकथन एवं तर्क आधारित **1** अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख** में प्रश्न संख्या **21** से **25** तक अति लघु-उत्तरीय (VSA) प्रकार के **2** अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग** में प्रश्न संख्या **26** से **31** तक लघु-उत्तरीय (SA) प्रकार के **3** अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ** में प्रश्न संख्या **32** से **35** तक दीर्घ-उत्तरीय (LA) प्रकार के **5** अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ** में प्रश्न संख्या **36** से **38** तक प्रकरण अध्ययन आधारित **4** अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प **2** अंकों के प्रश्न में दिया गया है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।*

(ix) *जहाँ आवश्यक हो $\pi = \frac{22}{7}$ लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग **वर्जित** है ।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है ।

1. यदि एक A.P. के पाँचवें पद का 5 गुना, इसके नौंवें पद के 9 गुना के बराबर है, तो इसका 14वाँ पद है :

(A) 5 (B) 9

(C) 0 (D) 14

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A**, **B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **not** allowed.*

SECTION A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each.

1. If 5 times the 5^{th} term of an A.P. is equal to 9 times the 9^{th} term, then its 14^{th} term is :

(A) 5 (B) 9

(C) 0 (D) 14

2. यदि द्विघात समीकरण $ax^2 + 6x + 4a = 0$ के मूलों का योगफल और गुणनफल एकसमान है, तो 'a' का मान है :

(A) $\frac{3}{2}$

(B) $-\frac{3}{2}$

(C) $\frac{2}{3}$

(D) $-\frac{2}{3}$

3. यदि $3x + 2ky = 2$ तथा $2x + 5y = 1$ द्वारा निरूपित रेखाएँ परस्पर समानांतर हैं, तो k का मान है :

(A) $-\frac{5}{4}$

(B) $\frac{2}{5}$

(C) $\frac{15}{4}$

(D) $\frac{3}{2}$

4. यदि α तथा β बहुपद $2x^2 + 5x + 1$ के शून्यक हैं, तो $\alpha + \beta + 3\alpha\beta$ का मान है :

(A) -4

(B) $-\frac{3}{2}$

(C) 1

(D) -1

2. If the sum and the product of the roots of the quadratic equation $ax^2 + 6x + 4a = 0$ are equal, then 'a' is equal to :

(A) $\frac{3}{2}$

(B) $-\frac{3}{2}$

(C) $\frac{2}{3}$

(D) $-\frac{2}{3}$

3. If the lines given by $3x + 2ky = 2$ and $2x + 5y = 1$ are parallel, then the value of k is :

(A) $-\frac{5}{4}$

(B) $\frac{2}{5}$

(C) $\frac{15}{4}$

(D) $\frac{3}{2}$

4. If α and β are the zeroes of the polynomial $2x^2 + 5x + 1$, then the value of $\alpha + \beta + 3\alpha\beta$ is :

(A) -4

(B) $-\frac{3}{2}$

(C) 1

(D) -1

5. यदि $a = 2^4 \times 3^3$, $b = 2^3 \times 3^2 \times 5$, $c = 3^n \times 5^2$ हैं तथा

LCM (a, b, c) = $(5^2 \times 3^4 \times 2^4)$ है, तो n है :

(A) 1

(B) 2

(C) 3

(D) 4

6. निम्न बारंबारता बंटन में :

ऊँचाई (cm में) :	120 – 125	125 – 130	130 – 135	135 – 140	140 – 145
विद्यार्थियों की संख्या :	17	12	13	8	10

बहुलक वर्ग की ऊपरी सीमा तथा माध्यक वर्ग की निचली सीमा का योगफल है :

(A) 250

(B) 255

(C) 260

(D) 245

7. यदि एक बारंबारता बंटन का माध्यक तथा बहुलक क्रमशः 26 तथा 29 हैं, तो इसका माध्य है :

(A) 27·5 (B) 24·5

(C) 28·4 (D) 25·8

8. किसी यादृच्छया चुने गए लीप वर्ष में 52 सोमवार तथा 53 रविवार होने की प्रायिकता है :

(A) $\frac{1}{366}$ (B) $\frac{1}{52}$

(C) $\frac{2}{7}$ (D) $\frac{1}{7}$

5. If $a = 2^4 \times 3^3$, $b = 2^3 \times 3^2 \times 5$, $c = 3^n \times 5^2$ and LCM $(a, b, c) = (5^2 \times 3^4 \times 2^4)$, then n is :

(A) 1

(B) 2

(C) 3

(D) 4

6. In the following frequency distribution :

Height (in cm) :	120 – 125	125 – 130	130 – 135	135 – 140	140 – 145
Number of students :	17	12	13	8	10

the sum of the upper limit of the modal class and the lower limit of the median class is :

(A) 250

(B) 255

(C) 260

(D) 245

7. If the median and mode of a frequency distribution are 26 and 29 respectively, then the mean is :

(A) 27·5 (B) 24·5

(C) 28·4 (D) 25·8

8. The probability for a leap year (selected at random) to have 52 Mondays and 53 Sundays is :

(A) $\frac{1}{366}$ (B) $\frac{1}{52}$

(C) $\frac{2}{7}$ (D) $\frac{1}{7}$

9. तीन बच्चों के एक परिवार में कम-से-कम दो लड़के होने की प्रायिकता है :

(A) $\frac{1}{8}$

(B) $\frac{7}{8}$

(C) $\frac{4}{8}$

(D) $\frac{6}{8}$

10. एक अर्धगोलाकार बर्तन 0·30 cm मोटाई के स्टील से बना है । इस बर्तन की आंतरिक त्रिज्या 3 cm है । इसमें प्रयुक्त स्टील का आयतन (cu cm में) है :

(A) $595{\cdot}8\ \pi$

(B) $5{\cdot}958\ \pi$

(C) $6\ \pi$

(D) $59{\cdot}58\ \pi$

11. एक वृत्त से 120° केंद्रीय कोण वाला त्रिज्यखण्ड काटा गया, जिसका क्षेत्रफल $\frac{264}{7}$ sq cm है । वृत्त की त्रिज्या (cm में) है :

(A) 6

(B) 5

(C) 7

(D) 12

12. यदि $\text{cosec}\ \theta = \sqrt{10}$ है, तो $\sec\ \theta$ का मान है :

(A) $\frac{3}{\sqrt{10}}$ (B) $\frac{\sqrt{10}}{3}$

(C) $\frac{1}{\sqrt{10}}$ (D) $\frac{2}{\sqrt{10}}$

9. The probability that in a family of three children, there will be at least two boys, is :

(A) $\frac{1}{8}$

(B) $\frac{7}{8}$

(C) $\frac{4}{8}$

(D) $\frac{6}{8}$

10. A hemispherical bowl is made of steel of thickness 0·30 cm. The inner radius of the bowl is 3 cm. The volume of steel used (in cu cm) is :

(A) $595{\cdot}8\ \pi$

(B) $5{\cdot}958\ \pi$

(C) $6\ \pi$

(D) $59{\cdot}58\ \pi$

11. A sector of a circle with central angle 120° and area $\frac{264}{7}$ sq cm is cut from a circle. The radius of the circle (in cm) is :

(A) 6

(B) 5

(C) 7

(D) 12

12. If $\text{cosec}\ \theta = \sqrt{10}$, then the value of $\sec\ \theta$ is :

(A) $\frac{3}{\sqrt{10}}$ (B) $\frac{\sqrt{10}}{3}$

(C) $\frac{1}{\sqrt{10}}$ (D) $\frac{2}{\sqrt{10}}$

13. $\frac{\sin^3 A + \cos^3 A}{\sin A + \cos A} + \sin A \cos A$ के सरलीकरण से प्राप्त होता है :

(A) 1 (B) 2

(C) $1 + 2 \sin A \cos A$ (D) 0

14. सड़क पर खड़ी एक कार का 75 m ऊँची एक मीनार के शिखर से अवनमन कोण 30° है । इस कार की मीनार के तल से दूरी है :

(A) $75\sqrt{3}$ m (B) $50\sqrt{3}$ m

(C) $25\sqrt{3}$ m (D) 75 m

15. केंद्र O वाले दो संकेन्द्रीय वृत्तों में बाह्य वृत्त की त्रिज्या 50 cm है । बाह्य वृत्त की एक जीवा AB, अन्त:वृत्त को D पर स्पर्श करती है । यदि AB की लंबाई 96 cm है, तो अन्त:वृत्त की त्रिज्या है :

(A) 14 cm (B) 7 cm

(C) 24 cm (D) 15 cm

16. दो त्रिभुजों ABC तथा PQR में, यदि $\frac{AB}{QR} = \frac{BC}{QP} = \frac{AC}{PR}$ है, तो :

(A) $\Delta PQR \sim \Delta CAB$ (B) $\Delta PQR \sim \Delta ABC$

(C) $\Delta PQR \sim \Delta CBA$ (D) $\Delta PQR \sim \Delta BCA$

17. एक ΔABC में, भुजा BC के समांतर DE खींची गई जो AB को D तथा AC को E पर काटती है । यदि AD = 2 cm, BD = 3 cm तथा DE = 4 cm है, तो BC की लंबाई (cm में) है :

(A) 6 (B) 10

(C) $\frac{8}{3}$ (D) $\frac{20}{3}$

13. $\frac{\sin^3 A + \cos^3 A}{\sin A + \cos A} + \sin A \cos A$ on simplification gives :

(A) 1 (B) 2

(C) $1 + 2 \sin A \cos A$ (D) 0

14. The angle of depression of a car parked on the road from the top of a 75 m high tower is 30°. The distance of the car from the base of the tower is :

(A) $75\sqrt{3}$ m (B) $50\sqrt{3}$ m

(C) $25\sqrt{3}$ m (D) 75 m

15. In two concentric circles with centre O, the radius of the outer circle is 50 cm. Chord AB of the outer circle is tangent to the inner circle at D. If length of AB is 96 cm, then the radius of the inner circle is :

(A) 14 cm (B) 7 cm

(C) 24 cm (D) 15 cm

16. In two Δs ABC and PQR, if $\frac{AB}{QR} = \frac{BC}{QP} = \frac{AC}{PR}$, then

(A) Δ PQR ~ Δ CAB (B) Δ PQR ~ Δ ABC

(C) Δ PQR ~ Δ CBA (D) Δ PQR ~ Δ BCA

17. In a Δ ABC, a line DE is drawn parallel to BC to intersect AB at D and AC at E. If AD = 2 cm, BD = 3 cm and DE = 4 cm, then the length of BC (in cm) is :

(A) 6 (B) 10

(C) $\frac{8}{3}$ (D) $\frac{20}{3}$

18. बिंदु $(-2, -2)$, $(6, -2)$ तथा $(2, 1)$ शीर्ष बिंदु हैं :

(A) एक समकोणीय त्रिभुज के

(B) एक समद्विबाहु त्रिभुज के

(C) एक समकोणीय समद्विबाहु त्रिभुज के

(D) एक विषमबाहु त्रिभुज के

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* दो घन जिनमें प्रत्येक की भुजा 12 cm है, को किनारे के साथ किनारा रखकर मिलाया गया । इस प्रकार बने घनाभ का पृष्ठीय क्षेत्रफल = 2 × (एक घन का पृष्ठीय क्षेत्रफल) ।

तर्क (R) : एक घनाभ का पृष्ठीय क्षेत्रफल = $2(l\mathrm{b} + \mathrm{bh} + \mathrm{h}l)$ है, जहाँ l, b तथा h क्रमश: इसकी लंबाई, चौड़ाई तथा ऊँचाई है ।

20. *अभिकथन (A) :* A.P. $\frac{1}{\mathrm{m}}, \frac{1+2\mathrm{m}}{\mathrm{m}}, \frac{1+4\mathrm{m}}{\mathrm{m}}, \ldots$ का आठवाँ पद $\frac{1+14\mathrm{m}}{\mathrm{m}}$ है ।

तर्क (R) : एक A.P. का nवाँ पद $(a_n) = a + (n-1)\,d$.

18. The points $(-2, -2)$, $(6, -2)$ and $(2, 1)$ are the vertices of :

(A) a right angled triangle

(B) an isosceles triangle

(C) an isosceles right triangle

(D) a scalene triangle

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* Two cubes each with 12 cm edge are joined end to end. The surface area of the resulting cuboid = 2 × (surface area of one cube).

Reason (R) : The surface area of a cuboid = $2(l\text{b} + \text{bh} + \text{h}l)$, where l, b, h respectively are its length, breadth and height.

20. *Assertion (A) :* The eighth term of the A.P.

$$\frac{1}{\text{m}}, \frac{1+2\text{m}}{\text{m}}, \frac{1+4\text{m}}{\text{m}}, \ldots \text{ is } \frac{1+14\text{m}}{\text{m}}.$$

Reason (R) : The n^{th} term of A.P. $(a_n) = a + (n - 1)\,d$.

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 2 अंकों का है ।

21. Δ PQR की भुजाओं PQ तथा PR पर क्रमशः बिंदु E तथा F हैं । यदि PE = 3·9 cm, EQ = 3 cm, PF = 3·6 cm तथा PR = 6 cm है, तो ज्ञात कीजिए कि क्या EF $||$ QR है ।

22. (a) सिद्ध कीजिए कि एक वृत्त की दो समांतर स्पर्श रेखाओं के स्पर्श बिंदुओं को मिलाने वाला रेखाखण्ड, इसके केन्द्र से होकर गुजरता है ।

अथवा

(b) केंद्र O वाले वृत्त पर एक बाह्य बिंदु P से दो स्पर्श रेखाएँ PQ तथा PR खींची गई हैं । सिद्ध कीजिए कि QORP एक चक्रीय चतुर्भुज है ।

23. यदि 12 cosec A = 13 है, तो $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$ का मान ज्ञात कीजिए ।

24. एक दीवार घड़ी की मिनट की सुई की लंबाई 21 cm है । इस सुई के द्वारा 45 मिनटों में रचित क्षेत्रफल ज्ञात कीजिए ।

25. (a) ज्ञात कीजिए कि निम्न में से कौन-सी परिमेय अथवा अपरिमेय संख्या है :

(i) $\left(\sqrt{5}-\sqrt{3}\right)^2$ (ii) $\left(5+\sqrt{3}\right)\left(5-\sqrt{3}\right)$

अथवा

(b) चार अंकों की वह छोटी-से-छोटी संख्या ज्ञात कीजिए, जो 15, 24 तथा 36 से पूर्णतया भाज्य है ।

SECTION B

This section comprises Very Short Answer (VSA) type questions of 2 marks each.

21. E and F are points on the sides PQ and PR respectively of a Δ PQR. If PE = 3·9 cm, EQ = 3 cm, PF = 3·6 cm and PR = 6 cm, find whether EF $||$ QR.

22. (a) Prove that the line segment joining the points of contact of two parallel tangents to a circle passes through its centre.

OR

(b) Two tangents PQ and PR are drawn from an external point P to a circle with centre O. Prove that QORP is a cyclic quadrilateral.

23. If 12 cosec A = 13, then find the value of $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$.

24. The length of the minute hand of a wall clock is 21 cm. Find the area swept by the minute hand in 45 minutes.

25. (a) Find whether each of the following is an irrational number or a rational number.

(i) $\left(\sqrt{5}-\sqrt{3}\right)^2$ (ii) $\left(5+\sqrt{3}\right)\left(5-\sqrt{3}\right)$

OR

(b) Find the smallest 4-digit number exactly divisible by 15, 24 and 36.

खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 3 अंकों का है ।

26. (a) सिद्ध कीजिए कि एक वृत्त के परिगत खींचा गया समांतर चतुर्भुज एक समचतुर्भुज होता है ।

अथवा

(b) सिद्ध कीजिए कि वृत्त के किसी व्यास के सिरों पर खींची गई स्पर्श रेखाएँ परस्पर समांतर होती हैं ।

27. एक राजमार्ग पर दो स्थान A तथा B 160 km की दूरी पर हैं । एक कार A से तथा दूसरी B से एक ही समय पर चलना शुरू करती हैं । यदि यह कारें भिन्न चालों से एक ही दिशा में चलती हैं तो यह 4 घंटे में मिलती हैं । जबकि यदि यह एक दूसरे की ओर चलती हैं तो 1 घंटा 36 मिनट में मिलती हैं । दोनों कारों की चालें क्या हैं ?

28. (a) यदि α तथा β एक द्विघातीय बहुपद $f(x) = 6x^2 + 11x - 10$ के शून्यक हैं, तो $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}$ का मान ज्ञात कीजिए ।

अथवा

(b) बहुपद $2t^2 - 9t - 45$ के शून्यक ज्ञात कीजिए तथा शून्यकों एवं बहुपद के गुणांकों के बीच के संबंधों की पुष्टि कीजिए ।

29. सिद्ध कीजिए कि $\sqrt{5}$ एक अपरिमेय संख्या है ।

30. सिद्ध कीजिए कि $\sqrt{\sec^2 A + \operatorname{cosec}^2 A} = \tan A + \cot A.$

31. नीचे दी गई सारणी एक इलाके के 25 घरों द्वारा किए गए खाद्य पदार्थों पर दैनिक खर्च, दर्शाती है :

दैनिक खर्च (₹ में) :	200 – 250	250 – 300	300 – 350	350 – 400	400 – 450
घरों की संख्या :	4	5	12	2	2

खाद्य पदार्थों पर माध्य दैनिक खर्च ज्ञात कीजिए ।

SECTION C

This section comprises Short Answer (SA) type questions of 3 marks each.

26. (a) Prove that the parallelogram circumscribing a circle is a rhombus.

OR

(b) Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

27. Places A and B are 160 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 4 hours. If they travel towards each other, they meet in 1 hour 36 minutes. What are the speeds of the two cars ?

28. (a) If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + 11x - 10$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

OR

(b) Find the zeroes of the polynomial $2t^2 - 9t - 45$ and verify the relationship between the zeroes and the coefficients of the polynomial.

29. Prove that $\sqrt{5}$ is an irrational number.

30. Prove that $\sqrt{\sec^2 A + \text{cosec}^2 A} = \tan A + \cot A$.

31. The table below shows the daily expenditure on food of 25 households in a locality :

Daily expenditure (in ₹) :	200 – 250	250 – 300	300 – 350	350 – 400	400 – 450
Number of households :	4	5	12	2	2

Find the mean daily expenditure on food.

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 5 अंकों का है ।

32. (a) कुछ विद्यार्थियों ने मिल कर एक पिकनिक पर जाने का निर्णय लिया । भोजन पर आने वाला कुल खर्च ₹ 500 था, परन्तु 5 विद्यार्थी नहीं जा पाए, जिसके कारण प्रति विद्यार्थी खर्च ₹ 5 बढ़ गया । कितने विद्यार्थियों ने पिकनिक में भाग लिया ?

अथवा

(b) यदि समीकरण $(2p+1)x^2-(7p+2)x+7p-3=0$ के मूल वास्तविक तथा समान हैं, तो p का मान ज्ञात कीजिए ।

33. बिंदुओं A (– 2, 2) तथा B (2, 8) को मिलाने वाले रेखाखण्ड को चार समान भागों में बाँटने वाले बिंदुओं के निर्देशांक ज्ञात कीजिए ।

34. यदि किसी त्रिभुज की एक भुजा के समांतर एक रेखा इस प्रकार खींची जाए कि यह अन्य दो भुजाओं को विभिन्न बिंदुओं पर काटे, तो सिद्ध कीजिए कि अन्य दो भुजाएँ एक ही अनुपात में विभाजित होंगी ।

35. (a) एक ठोस एक लंबवृत्तीय बेलन के आकार का है जिसके दोनों सिरे अर्धगोलाकार हैं । इस ठोस की कुल ऊँचाई 58 cm है तथा बेलन का व्यास 28 cm है । इस ठोस का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।

अथवा

(b) 36 cm ऊँचाई तथा 14 cm व्यास वाले एक ठोस बेलन से एक 7 cm त्रिज्या तथा 24 cm ऊँचाई का एक शंक्वाकार ठोस खोद कर निकाल लिया जाता है । शेष बचे ठोस का आयतन ज्ञात कीजिए ।

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each.

32. (a) Some students planned a picnic. The total budget for food was ₹ 500, but 5 of them failed to go and thus the cost of food for each student increased by ₹ 5. How many students attended the picnic ?

OR

(b) Find the value of p if the equation $(2p+1)x^2-(7p+2)x+7p-3=0$ has real and equal roots.

33. Find the coordinates of the points which divide the line segment joining A (– 2, 2) and B (2, 8) into four equal parts.

34. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

35. (a) A solid is in the form of a right circular cylinder with hemispherical ends. The total height of the solid is 58 cm and the diameter of the cylinder is 28 cm. Find the total surface area of the solid.

OR

(b) From a solid cylinder of height 36 cm and diameter 14 cm, a conical cavity of radius 7 cm and height 24 cm is drilled out. Find the volume of the remaining solid.

खण्ड ङ

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक प्रश्न 4 अंकों का है ।

प्रकरण अध्ययन – 1

36. हरी एक 200 m की दौड़ में भाग लेना चाहता है । वह अभी इस दूरी को 51 सेकण्ड में दौड़ कर पूरी कर पाता है परन्तु प्रतिदिन अभ्यास से उम्मीद करता है कि प्रतिदिन इस समय को पहले दिन के समय से 2 सेकण्ड कम में पूरा कर लेगा । वह इस दौड़ को 31 सेकण्ड में पूरा करना चाहता है ।

उपर्युक्त जानकारी के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) उपर्युक्त को निरूपित करती समांतर श्रेढ़ी लिखिए । *1*

(ii) ज्ञात कीजिए कि नियत समय में दूरी पूरी कर लेने में उसे कम-से-कम कितने दिन का अभ्यास आवश्यक है । *1*

(iii) (a) इस समांतर श्रेढ़ी के nवें पद का व्यजंक ज्ञात कीजिए । *2*

अथवा

(b) यदि वह इस दूरी को 21 सेकण्ड में पूरा करना चाहता है, तो उसे कम-से-कम कितने दिन लगेंगे ? *2*

प्रकरण अध्ययन – 2

37. एक कक्षा VI का विद्यार्थी पार्क में गया तथा एक स्लाइड के ऊपर खेलने के लिए चढ़ गया । इस स्लाइड का उन्नयन कोण 30° है, परन्तु आधार जहाँ से यह कोण मापा गया, भूमि से 50 cm ऊँचा है तथा इस बिंदु की सीधी खड़ी सीढ़ी से दूरी $4\sqrt{3}$ m है । उपर्युक्त जानकारी के आधार पर निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) स्लाइड के शीर्ष से इसके आधार का अवनमन कोण लिखिए । *1*

(ii) (a) सीढ़ी की ऊँचाई ज्ञात कीजिए । *2*

अथवा

(b) स्लाइड की लंबाई ज्ञात कीजिए । *2*

(iii) यदि सीढ़ी को और लंबा कर दिया जाए तो उन्नयन कोण बढ़ेगा या घटेगा ? *1*

SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study – 1

36. Hari wants to participate in a 200 m race. He can currently run that distance in 51 seconds, and with each day of practice, he hopes to take 2 seconds less than the previous day. He wants to do it in 31 seconds.

Based on the above information, answer the following questions :

(i) Write the A.P. which represents the above situation. *1*

(ii) Find the minimum number of days he needs to practice to achieve the goal. *1*

(iii) (a) Find the expression for the n^{th} term of the A.P. *2*

OR

(b) If he wants to do it in 21 seconds, how many minimum days will he take ? *2*

Case Study – 2

37. A class VI student went to a park and went up the slide to play. The angle of elevation of the slide is 30^{o}, but the base from which the angle of elevation is measured is 50 cm above the ground level and the distance of this point from the bottom of the staircase (which is vertical) is $4\sqrt{3}$ m.

Based on the above information, answer the following questions:

(i) Write the angle of depression from the top of the slide to its base. *1*

(ii) (a) Find the height of the staircase. *2*

OR

(b) Find the length of the slide. *2*

(iii) Will the angle of elevation increase or decrease if the staircase was made taller ? *1*

प्रकरण अध्ययन – 3

38. भारतीय शिक्षा मंत्रालय द्वारा विभिन्न उच्चतर माध्यमिक विद्यालयों में विद्यार्थी–शिक्षक अनुपात जानने के लिए एक सर्वे कराया गया । मंत्रालय द्वारा निम्न बंटन दिया गया :

विद्यार्थियों की संख्या/अध्यापक :	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45
विद्यालयों की संख्या :	3	8	9	10	3	2

उपर्युक्त जानकारी के आधार पर निम्न प्रश्नों के उत्तर दीजिए :

(i) बहुलक वर्ग लिखिए । *1*

(ii) माध्यक वर्ग लिखिए । *1*

(iii) (a) आँकड़ों का बहुलक ज्ञात कीजिए । *2*

अथवा

(b) आँकड़ों का माध्यक ज्ञात कीजिए । *2*

Case Study – 3

38. A survey was conducted by the Education Ministry of India to record the teacher–student ratio in various higher secondary schools of India. The following distribution was given by the Ministry :

Number of students/teacher :	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45
Number of Schools :	3	8	9	10	3	2

Based on the above information, answer the following questions :

(i) Write the modal class. *1*

(ii) Write the median class. *1*

(iii) (a) Find the mode of the data. *2*

OR

(b) Find the median of the data. *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2024
MATHEMATICS PAPER CODE 30(B)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class - X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30(B))

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A This section comprises Multiple Choice Questions (MCQs) 1 mark each.	
1.	The LCM of 24, 36 and 60 in terms of their prime factors is : (A) $2^2 \times 3 \times 5$ (B) $2^3 \times 3^2$ (C) $2^3 \times 3^2 \times 5$ (D) $2^3 \times 3^3 \times 5$	
Sol.	(C) $2^3 \times 3^2 \times 5$	1
2.	The graph of a polynomial intersects the y-axis at one point and the x-axis at two points. The number of zeroes of this polynomial are : (A) 1 (B) 2 (C) 3 (D) 0	
Sol.	(B) 2	1
3.	The solution of the pair of linear equations $\frac{2x}{3} - \frac{y}{2} = -\frac{1}{6}$ and $\frac{x}{2} + \frac{2y}{3} = 3$ is : (A) $x = 2, y = -3$ (B) $x = -2, y = 3$ (C) $x = 2, y = 3$ (D) $x = -2, y = -3$	
Sol.	(C) $x = 2, y = 3$	1
4.	The roots of the quadratic equation $x^2 + x - p(p + 1) = 0$ are : (A) $p, p + 1$ (B) $-p, p + 1$ (C) $-p, -(p + 1)$ (D) $p, -(p + 1)$	
Sol.	(D) $p, -(p + 1)$	1

5.	The sum of the first three terms of an AP is 30 and the sum of the last three terms is 36. If the first term is 9, then the number of terms is : (A) 10 (B) 5 (C) 6 (D) 13	
Sol.	(B) 5	1
6.	The probability of getting a sum of 8, when two dice are thrown simultaneously, is : (A) $\frac{1}{12}$ (B) $\frac{1}{9}$ (C) $\frac{1}{6}$ (D) $\frac{5}{36}$	
Sol.	(D) $\frac{5}{36}$	1
7.	The perpendicular bisector of the line segment joining the points A(–1, 3) and B(2, 4) cuts the y-axis at : (A) (0, 5) (B) (0, – 5) (C) (0, 4) (D) (0, – 4)	
Sol.	(A) (0, 5)	1
8.	If in triangles ABC and PQR, $\frac{AB}{QR} = \frac{BC}{PR}$, then they will be similar, when : (A) $\angle B = \angle Q$ (B) $\angle A = \angle R$ (C) $\angle B = \angle R$ (D) $\angle C = \angle Q$	
Sol.	(C) $\angle B = \angle R$	1
9.	A line l intersects the sides PQ and PR of a Δ PQR at L and M respectively such that LM $\|\|$ QR. If PL = 5·7 cm, PQ = 15·2 cm and MR = 5·5 cm, then the length of PM (in cm) is : (A) 3 (B) 1·8 (C) 2·5 (D) 3·3	
Sol.	(D) 3.3	1

10.	If two tangents inclined at an angle of 60° are drawn to a circle of radius 5 cm, then the length of each tangent is : (A) $\frac{5\sqrt{3}}{2}$ cm (B) 10 cm (C) $\frac{5}{\sqrt{3}}$ cm (D) $5\sqrt{3}$ cm	
Sol.	(D) $5\sqrt{3}$ cm	1
11.	If $\tan A = 3 \cot A$, then the measure of the angle A is : (A) 15° (B) 30° (C) 45° (D) 60°	
Sol.	(D) 60°	1
12.	$(\sec \theta + \tan \theta)(1 - \sin \theta)$ is equal to : (A) $\sec \theta$ (B) $\sin \theta$ (C) $\text{cosec } \theta$ (D) $\cos \theta$	
Sol.	(D) $\cos \theta$	1
13.	A ladder 14 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is : (A) $14\sqrt{3}$ m (B) 7 m (C) 14 m (D) $7\sqrt{3}$ m	
Sol.	(B) 7 m	1
14.	If the area of a sector is one-twelfth that of a complete circle, then the angle of the sector is : (A) 36° (B) 30° (C) 60° (D) 45°	
Sol.	(B) 30°	1

15.	The minute hand of a clock is 21 cm long. The area swept by it in 10 minutes is : (A) $121\ cm^2$ (B) $131\ cm^2$ (C) $231\ cm^2$ (D) $172{\cdot}5\ cm^2$	
Sol.	(C) $231\ cm^2$	1
16.	A box contains cards numbered 6 to 50. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square, is : (A) $\frac{5}{44}$ (B) $\frac{1}{9}$ (C) $\frac{1}{11}$ (D) $\frac{7}{45}$	
Sol.	(B) $\frac{1}{9}$	1
17.	Two friends were born in the year 2000. The probability that they have the same birthday is : (A) $\frac{1}{365}$ (B) $\frac{364}{365}$ (C) $\frac{1}{366}$ (D) $\frac{365}{366}$	
Sol.	(C) $\frac{1}{366}$	1
18.		

Marks :	Below 10	Below 20	Below 30	Below 40	Below 50
Number of Students :	3	12	27	57	75

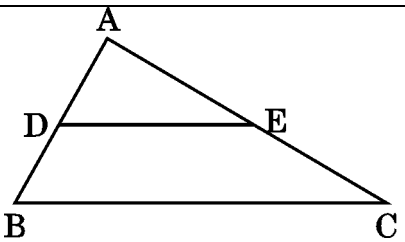
For the above distribution, the modal class is :

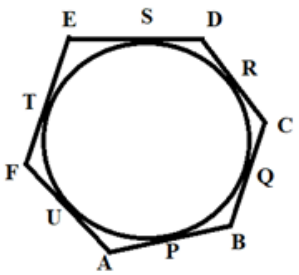
(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

Sol.	(C) 30 – 40	1

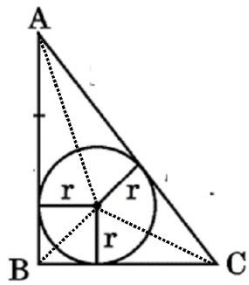
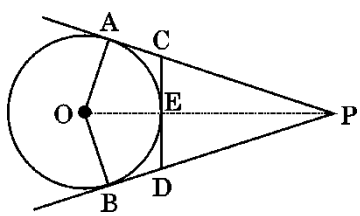
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19.	*Assertion (A) :* The area of canvas cloth required to just cover a heap of rice in the form of a cone of diameter 14 m and height 24 m is 175π sq.m. *Reason (R) :* The curved surface area of a cone of radius r and slant height l is $\pi r l$.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
20.	*Assertion (A) :* The sum of the first fifteen terms of the AP 21, 18, 15, 12, … is zero. *Reason (R) :* The sum of the first n terms of an AP with first term 'a' and common difference 'd' is given by $S_n = \frac{n}{2}[a + (n-1)d]$.	
Sol.	(C) Assertion (A) is true, but Reason (R) is false.	1
	SECTION B This section comprises of Very Short Answer (VSA) type questions of 2 marks each.	
21.	Find the smallest number that is divisible by each of 8, 9 and 10.	
Sol.	$8 = 2^3$ $9 = 3^2$ $10 = 2 \times 5$ LCM (8, 9, 10) = $2^3 \times 3^2 \times 5 = 360$ ∴ smallest number divisible by each 8, 9 and 10 is 360.	1 1

22. (a)	In a Δ ABC, D and E are points on the sides AB and AC respectively such that BD = CE. If $\angle$ B = $\angle$ C, then show that DE $\|\|$ BC.	
Sol.	In ΔABC, $\angle$B = $\angle$C $\Rightarrow$ AC = AB ---- ① Given, BD = CE ---- ② Subtract ② from ①, we have AD = AE ----③ ③ ÷ ②, we have $\frac{AD}{BD} = \frac{AE}{CE}$ Therefore, DE $\|$ BC.  	½ ½ ½ ½
	OR	
22. (b)	If Δ ABC ~ Δ DEF and AB = 4 cm, DE = 6 cm, EF = 9 cm and FD = 12 cm, find the perimeter of Δ ABC.	
Sol.	Given, ΔABC ~ ΔDEF $\therefore \frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{DF}$ $\Rightarrow \frac{4}{6} = \frac{BC}{9} = \frac{CA}{12}$ $\therefore$ BC = 6 cm and CA = 8 cm Perimeter of ΔABC = 4 + 6 + 8 = 18 cm	½ ½ + ½ ½

23.	If a hexagon ABCDEF circumscribes a circle, show that AB + CD + EF = BC + DE + FA.	
Sol.	PB = BQ ----① RC = QC ----② RD = DS ----③ ET = SE ----④ TF = FU ----⑤ AP = AU ----⑥  Adding ①, ②, ③, ④, ⑤ and ⑥, we get (AP+ PB)+(RC + RD)+(ET + TF) = (BQ + QC)+(DS + SE)+(FU + AU) ⟹ AB + CD + EF = BC + DE + FA	1½ ½
24(a).	If $\tan\theta + \sec\theta = m$, then prove that $\sec\theta = \frac{m^2+1}{2m}$.	
Sol.	$\tan\theta + \sec\theta = m$ ---- (i) Therefore, $\sec\theta - \tan\theta = \frac{1}{m}$ ---- (ii) Adding (i) and (ii) to get $2\sec\theta = m + \frac{1}{m}$ $\Rightarrow \sec\theta = \frac{m^2+1}{2m}$	1 ½ ½
	OR	

24(b).	If $\sin A = \frac{3}{5}$ and $\cos B = \frac{12}{13}$, then find the value of $(\tan A + \tan B)$.	
Sol.	$\sin A = \frac{3}{5} \Rightarrow \tan A = \frac{3}{4}$ $\cos B = \frac{12}{13} \Rightarrow \tan B = \frac{5}{12}$ $tanA + tanB = \frac{3}{4} + \frac{5}{12} = \frac{14}{12}$ or $\frac{7}{6}$	1 ½ ½
25.	A horse, a cow and a goat are tied, each by ropes of length 14 m, at the corners A, B and C respectively, of a grassy triangular field ABC with sides of lengths 35 m, 40 m and 50 m. Find the total area of grass field that can be grazed by them.	
Sol.	Required Area = $\frac{22}{7} \times 14 \times 14 \times \frac{180}{360}$ = 308 m^2	1 1
	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.	Prove that $\sqrt{3}$ is an irrational number.	
Sol.	Let $\sqrt{3}$ be a rational number. $\therefore \sqrt{3} = \frac{p}{q}$, where q≠0 and p & q are coprime. $3q^2 = p^2 \Rightarrow p^2$ is divisible by 3 $\Rightarrow$ p is divisible by 3 ----- (i) $\Rightarrow$ p = 3a, where 'a' is some integer $9a^2 = 3q^2 \Rightarrow q^2 = 3a^2 \Rightarrow q^2$ is divisible by 3 $\Rightarrow$ q is divisible by 3 ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are coprime. $\therefore \sqrt{3}$ is an irrational number.	½ 1 1 ½

27. (a)	If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + 11x - 10$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	Here $\alpha+\beta = \frac{-11}{6}$ and $\alpha\beta = \frac{-10}{6}$	1
	$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha\beta}$	1
	$= \frac{\left(\frac{-11}{6}\right)^2 - 2\times\left(\frac{-10}{6}\right)}{\frac{-10}{6}} = \frac{-241}{60}$	1
	OR	
27. (b)	Find the zeroes of the polynomial $f(t) = t^2 + 4\sqrt{3}\,t - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial.	
Sol.	$f(t) = t^2 + 4\sqrt{3}\,t - 15 = t^2 + 5\sqrt{3}\,t - \sqrt{3}\,t - 15$	
	$= (t - \sqrt{3})(t + 5\sqrt{3})$	1
	$\therefore$ Zeroes of given polynomial are $-5\sqrt{3}, \sqrt{3}$	1
	Sum of the zeroes $= (-5\sqrt{3} + \sqrt{3}) = \frac{-4\sqrt{3}}{1} = \frac{-(coefficient\ of\ t)}{coefficient\ of\ t^2}$	½
	Product of the zeroes $= (-5\sqrt{3}) \times \sqrt{3}) = \frac{-15}{1} = \frac{constant\ term}{coefficient\ of\ t^2}$	½
28.	The monthly incomes of A and B are in the ratio 8 : 7 and their expenditures are in the ratio 19 : 16. If each saves ₹ 2500 per month, find the monthly income of each.	
Sol.	Let the monthly incomes of A and B be ₹ 8x and ₹ 7x respectively and the expenditures of A and B be ₹ 19y and ₹ 16y respectively.	½
	A.T.Q.	
	$8x - 19y = 2500$ ---- ①	½
	$7x - 16y = 2500$ ---- ②	½

	Solving ① and ②, we have x = 1500 ∴ Monthly income of A = 8 × 1500 = 12000 and monthly income of B = 7 × 1500 = 10500 ∴ monthly incomes of A and B are ₹12000 and ₹ 10500 respectively.	½ ½ ½
29(a).	A circle is inscribed in a right-angled triangle ABC, right-angled at B. If BC = 7 cm and AB = 24 cm, find the radius of the circle.	
Sol.	$AC = \sqrt{24^2 + 7^2} = 25$ cm Let the radius of the circle be 'r' cm $\frac{1}{2} \times 24 \times 7 = \frac{1}{2} \times r \times 7 + \frac{1}{2} \times r \times 24 + \frac{1}{2} \times r \times 25$ $\Rightarrow r = 3$ ∴ radius of circle is 3 cm.  	1 1 1
	OR	
29(b).	From an external point P, two tangents PA and PB are drawn to a circle with centre O. At a point E on the circle, a tangent is drawn which intersects PA and PB at C and D respectively. If PA = 10 cm, find the perimeter of Δ PCD.	
Sol.	Perimeter of ΔPCD = PC + CD + DP = PC + CE + ED + DP = PC + CA + DB + DP = PA + PB = PA + PA = 2 PA = 2 × 10 = 20 cm  	1 ½ ½ ½ ½

30. **Prove that :** $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta$

Sol.

$$\text{LHS} = \frac{\tan\theta}{1 - \frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1 - \tan\theta} \quad \text{½}$$

$$= \frac{\tan^2\theta}{\tan\theta - 1} - \frac{1}{\tan\theta(\tan\theta - 1)} \quad \text{½}$$

$$= \frac{\tan^3\theta - 1}{\tan\theta(\tan\theta - 1)} \quad \text{½}$$

$$= \frac{(\tan\theta - 1)\,(\tan^2\theta + \tan\theta + 1)}{\tan\theta(\tan\theta - 1)} \quad 1$$

$$= \tan\theta + 1 + \cot\theta = \text{RHS} \quad \text{½}$$

31. **Calculate the mean of the following data :**

Class :	4 – 6	7 – 9	10 – 12	13 – 15
Frequency :	5	4	9	10

Sol.

Class	4 – 6	7 – 9	10 – 12	13 – 15	**Total**
f_i	5	4	9	10	28
x_i	5	8	11	14	
$f_i x_i$	25	32	99	140	296

Correct table 1½

Mean = $\frac{296}{28}$ 1

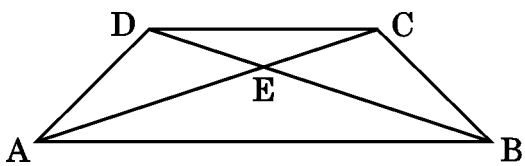
$= \frac{74}{7}$ or 10.57 approx. ½

SECTION D

This section comprises of Long Answer (LA) type questions of 5 marks each.

32(a). **The sum of two numbers is 18 and the sum of their reciprocals is $\frac{1}{4}$. Find the numbers.**

Sol. Let two numbers be x and (18 – x) 1

	A.T.Q. $\frac{1}{x} + \frac{1}{18-x} = \frac{1}{4}$ $\Rightarrow x^2 - 18x + 72 = 0$ $\Rightarrow (x - 12)(x - 6) = 0$ $\Rightarrow x = 12, x = 6$ $\therefore$ two numbers are 12 and 6.	1 1 ½ 1 ½
	OR	
32(b).	Solve for x : $\frac{4}{x} - \frac{5}{2x+3} = 3$	
Sol.	$4(2x + 3) - 5x = 3x(2x + 3)$ $\Rightarrow 6x^2 + 6x - 12 = 0$ or $x^2 + x - 2 = 0$ $\Rightarrow (x - 1)(x + 2) = 0$ $\Rightarrow x = 1, x = -2$	2 1 1 1
33.	ABCD is a trapezium with AB || DC. AC and BD intersect at E. If Δ AED ~ Δ BEC, then prove that AD = BC.	
Sol.	 Given Δ AED ~ Δ BEC $\therefore \frac{AE}{BE} = \frac{DE}{CE} = \frac{AD}{BC}$ ----① Also AB || DC $\Rightarrow$ Δ AEB ~ Δ CED $\therefore \frac{AE}{CE} = \frac{BE}{DE}$ *or* $\frac{AE}{BE} = \frac{CE}{DE}$ ---- ②	1 1

	From ① and ②, we get $\frac{DE}{CE} = \frac{CE}{DE}$ $\Rightarrow DE^2 = CE^2 \Rightarrow DE = CE$ $\therefore$ From ① $\frac{AD}{BC} = 1 \Rightarrow AD = BC$	1 1 1
34(a).	The interior of a building is in the form of a cylinder of base radius 12 m and height 3·5 m surmounted by a cone of equal base and slant height 14 m. Find the internal curved surface area of the building.	
Sol.	Internal CSA of the building = $2 \times \frac{22}{7} \times 12 \times 3.5 + \frac{22}{7} \times 12 \times 14$ = 792 m^2	2 + 2 1
	OR	
34(b).	Determine the ratio of the volume of a cube to that of the sphere which will exactly fit inside the cube.	
Sol.	Let the side of the cube be 'x' units $\therefore$ Radius of the sphere = $\frac{x}{2}$ units $\frac{Volume\ of\ cube}{Volume\ of\ sphere} = \frac{x^3}{\frac{4}{3} \times \pi \times \left(\frac{x}{2}\right)^3}$ $= \frac{6}{\pi}$ $\therefore$ required ratio is 6 : π	1 2 1½ ½
35.	The vertices of a quadrilateral ABCD are A(6, – 2), B(9, 2), C(5, –1) and D(2, –5). Prove that ABCD is a rhombus, and not a square.	
Sol.	$AB = \sqrt{(9-6)^2 + (2+2)^2} = 5$ $BC = \sqrt{(9-5)^2 + (2+1)^2} = 5$	½ ½

	$CD = \sqrt{(5-2)^2 + (-1+5)^2} = 5$ $AD = \sqrt{(6-2)^2 + (-2+5)^2} = 5$ $AC = \sqrt{(6-5)^2 + (-2+1)^2} = \sqrt{2}$ $BD = \sqrt{(9-2)^2 + (2+5)^2} = 7\sqrt{2}$ As AB = BC = CD = DA and AC ≠ BD ∴ ABCD is a rhombus and not a square.	½ ½ ½ ½ 1+1
	SECTION E This section comprises of 3 case study based questions of 4 marks each.	
36.	**Case Study – 1** Student-teacher ratio expresses the relationship between the number of students enrolled in a school and the number of teachers employed by the school. This ratio is important for a number of reasons. It can be used as a tool to measure teachers' workload as well as the allocation of resources. A survey was conducted in 100 secondary schools of a state and the following frequency distribution table was prepared :	

Number of students per Teacher	*Number of Schools*
20 – 25	5
25 – 30	15
30 – 35	25
35 – 40	30
40 – 45	15
45 – 50	10

Based on the above, answer the following questions :

(i) What is the lower limit of the median class ?

(ii) What is the upper limit of the modal class ?

(iii) (a) Find the median of the data.

OR

(b) Find the modal of the data.

Sol.

No. of Students per teacher	No. of School	c.f.
20 – 25	5	5
25 – 30	15	20
30 – 35	25	45
35 – 40	30	75
40 – 45	15	90
45 – 50	10	100

(i) Median class is 35 – 40

Lower limit of median class = 35 — 1

(ii) Modal class is 35 – 40

Upper limit of modal class = 40 — 1

(iii) (a)

Median class is 35 – 40

$$\text{Median} = 35 + \frac{\left(\frac{100}{2} - 45\right)}{30} \times 5$$ — 1½

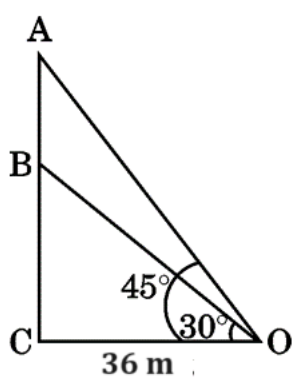
$$= \frac{215}{6} \text{ or } 35.83 \text{ approx.}$$ — ½

OR

(iii) (b) Modal class is 35 – 40

$$\text{Mode} = 35 + \frac{30 - 25}{2 \times 30 - 25 - 15} \times 5$$ — 1

$$= 36.25$$ — 1

37.	**Case Study – 2** Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure. On a similar concept, a radio station tower was built in two stations A and B (B vertically below A). The tower is supported by wires AO and BO from a point O on the ground. Distance between the base C of the tower and the point O is 36 m. From O, the angles of elevation of the tops of station B and station A are 30° and 45° respectively. Based on the above, answer the following questions : (i) Find the height of station B. (ii) Find the height of station A. (iii) (a) Find the length of the wire OA. **OR** (b) Find the length of the wire OB.	
Sol.	(i) $tan\ 30° = \frac{1}{\sqrt{3}} = \frac{BC}{36}$ $\Rightarrow$ BC = 12 $\sqrt{3}$ m (ii) $tan\ 45° = 1 = \frac{AC}{36}$ $\Rightarrow$ AC = 36 m (iii) (a) $\sec 45° = \sqrt{2} = \frac{OA}{36}$ $\Rightarrow$ OA = 36$\sqrt{2}$ m  OR (iii) (b) $\sec 30° = \frac{2}{\sqrt{3}} = \frac{OB}{36}$ $\Rightarrow$ OB = 24$\sqrt{3}$ m	½ ½ ½ ½ 1 1 1 1

38.	**Case Study – 3** A road roller is a compactor-type engineering vehicle, used to compact soil, gravel, concrete, etc, in the construction of roads and foundations. They are also used at landfills or in agriculture. A company started making road rollers 10 years ago and increased its production uniformly by a fixed number every year. The company produces 800 rollers in the 6^{th} year and 1130 rollers in the 9^{th} year. Based on the above information, answer the following questions : (i) What is the company's production in the first year ? (ii) What was the increase in the company's production every year ? (iii) (a) What was the company's production in the 8^{th} year ? **OR** (b) What was the company's total production in the first 6 years ?	
Sol.	(i) $(a + 8d) - (a + 5d) = 330 \Longrightarrow d = 110$ $a + 5 \times 110 = 800 \Longrightarrow a = 250$ (ii) $d = 110$ (iii) (a) $a_8 = 250 + 7 \times 110$ $= 1020$ OR (iii) (b) $S_6 = \frac{6}{2}[2 \times 250 + 5 \times 110]$ $= 3150$	½ ½ 1 1 1 1 1

Series #CDBA **SET~5**

प्रश्न–पत्र कोड **30(B)**
Q.P. Code

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

नोट / NOTE :

(i) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **23** हैं ।
Please check that this question paper contains **23** printed pages.

(ii) कृपया जाँच कर लें कि इस प्रश्न-पत्र में **38** प्रश्न हैं ।
Please check that this question paper contains **38** questions.

(iii) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.

(iv) **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
Please write down the serial number of the question in the answer-book before attempting it.

(v) इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

गणित (मानक)
(केवल दृष्टिबाधित परीक्षार्थियों के लिए)
MATHEMATICS (STANDARD)
(FOR VISUALLY IMPAIRED CANDIDATES ONLY)

निर्धारित समय : 3 घण्टे *अधिकतम अंक : 80*
Time allowed : 3 hours *Maximum Marks : 80*

सामान्य निर्देश :

निम्नलिखित निर्देशों को बहुत सावधानी से पढ़िए और उनका सख़्ती से पालन कीजिए :

(i) *इस प्रश्न-पत्र में* ***38*** *प्रश्न हैं ।* ***सभी*** *प्रश्न* ***अनिवार्य*** *हैं ।*

(ii) *यह प्रश्न-पत्र* ***पाँच*** *खण्डों में विभाजित है –* ***क, ख, ग, घ*** *एवं* ***ङ*** *।*

(iii) ***खण्ड क*** *में प्रश्न संख्या* ***1*** *से* ***18*** *तक बहुविकल्पीय (MCQ) तथा प्रश्न संख्या* ***19*** *एवं* ***20*** *अभिकथन एवं तर्क आधारित* ***1*** *अंक के प्रश्न हैं ।*

(iv) ***खण्ड ख*** *में प्रश्न संख्या* ***21*** *से* ***25*** *तक अति लघु-उत्तरीय (VSA) प्रकार के* ***2*** *अंकों के प्रश्न हैं ।*

(v) ***खण्ड ग*** *में प्रश्न संख्या* ***26*** *से* ***31*** *तक लघु-उत्तरीय (SA) प्रकार के* ***3*** *अंकों के प्रश्न हैं ।*

(vi) ***खण्ड घ*** *में प्रश्न संख्या* ***32*** *से* ***35*** *तक दीर्घ-उत्तरीय (LA) प्रकार के* ***5*** *अंकों के प्रश्न हैं ।*

(vii) ***खण्ड ङ*** *में प्रश्न संख्या* ***36*** *से* ***38*** *तक प्रकरण अध्ययन आधारित* ***4*** *अंकों के प्रश्न हैं । प्रत्येक प्रकरण अध्ययन में आंतरिक विकल्प* ***2*** *अंकों के प्रश्न में दिया गया है ।*

(viii) प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड ख के 2 प्रश्नों में, खण्ड ग के 2 प्रश्नों में, खण्ड घ के 2 प्रश्नों में तथा खण्ड ङ के 3 प्रश्नों में आंतरिक विकल्प का प्रावधान दिया गया है ।

(ix) *जहाँ आवश्यक हो* $\pi = \frac{22}{7}$ *लीजिए, यदि अन्यथा न दिया गया हो ।*

(x) *कैल्कुलेटर का उपयोग* ***वर्जित*** *है ।*

खण्ड क

इस खण्ड में बहुविकल्पीय प्रश्न (MCQ) हैं, जिनमें प्रत्येक प्रश्न 1 अंक का है ।

1. संख्याओं 24, 36 तथा 60 का ल.स. (LCM) अभाज्य गुणनखंडों में है :

(A) $2^2 \times 3 \times 5$ (B) $2^3 \times 3^2$

(C) $2^3 \times 3^2 \times 5$ (D) $2^3 \times 3^3 \times 5$

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **38** questions. **All** questions are **compulsory**.*

(ii) *This question paper is divided into **five** Sections – **A**, **B, C, D** and **E**.*

(iii) *In **Section A,** Questions no. **1** to **18** are Multiple Choice Questions (MCQs) and questions number **19** and **20** are Assertion-Reason based questions of **1** mark each.*

(iv) *In **Section B,** Questions no. **21** to **25** are Very Short Answer (VSA) type questions, carrying **2** marks each.*

(v) *In **Section C,** Questions no. **26** to **31** are Short Answer (SA) type questions, carrying **3** marks each.*

(vi) *In **Section D,** Questions no. **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.*

(vii) *In **Section E,** Questions no. **36** to **38** are case study based questions carrying **4** marks each. Internal choice is provided in **2** marks questions in each case study.*

(viii) *There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and 3 questions in Section E.*

(ix) *Take $\pi = \frac{22}{7}$ wherever required, if not stated.*

(x) *Use of calculator is **not** allowed.*

SECTION A

This section comprises Multiple Choice Questions (MCQs) of 1 mark each.

1. The LCM of 24, 36 and 60 in terms of their prime factors is :

(A) $2^2 \times 3 \times 5$ (B) $2^3 \times 3^2$

(C) $2^3 \times 3^2 \times 5$ (D) $2^3 \times 3^3 \times 5$

2. एक बहुपद का आलेख y-अक्ष को एक बिंदु पर तथा x-अक्ष को दो बिंदुओं पर प्रतिच्छेद करता है । इस बहुपद के शून्यकों की संख्या है :

(A) 1 (B) 2

(C) 3 (D) 0

3. निम्न रैखिक समीकरण युग्मों

$\frac{2x}{3} - \frac{y}{2} = -\frac{1}{6}$ और $\frac{x}{2} + \frac{2y}{3} = 3$

का हल है :

(A) $x = 2, y = -3$ (B) $x = -2, y = 3$

(C) $x = 2, y = 3$ (D) $x = -2, y = -3$

4. द्विघात समीकरण $x^2 + x - p(p + 1) = 0$ के मूल हैं :

(A) $p, p + 1$ (B) $-p, p + 1$

(C) $-p, -(p + 1)$ (D) $p, -(p + 1)$

5. एक समांतर श्रेढ़ी (AP) के प्रथम तीन पदों का योगफल 30 है तथा इसके अन्तिम तीन पदों का योगफल 36 है । यदि इसका प्रथम पद 9 है, तो इसके पदों की संख्या है :

(A) 10 (B) 5

(C) 6 (D) 13

6. दो पासों को एक साथ उछालने पर आई संख्याओं का योगफल 8 आने की प्रायिकता है :

(A) $\frac{1}{12}$ (B) $\frac{1}{9}$

(C) $\frac{1}{6}$ (D) $\frac{5}{36}$

2. The graph of a polynomial intersects the y-axis at one point and the x-axis at two points. The number of zeroes of this polynomial are :

(A) 1 (B) 2

(C) 3 (D) 0

3. The solution of the pair of linear equations

$\frac{2x}{3} - \frac{y}{2} = -\frac{1}{6}$ and $\frac{x}{2} + \frac{2y}{3} = 3$ is :

(A) $x = 2, y = -3$ (B) $x = -2, y = 3$

(C) $x = 2, y = 3$ (D) $x = -2, y = -3$

4. The roots of the quadratic equation $x^2 + x - p(p + 1) = 0$ are :

(A) $p, \ p + 1$ (B) $-p, \ p + 1$

(C) $-p, \ -(p + 1)$ (D) $p, \ -(p + 1)$

5. The sum of the first three terms of an AP is 30 and the sum of the last three terms is 36. If the first term is 9, then the number of terms is :

(A) 10 (B) 5

(C) 6 (D) 13

6. The probability of getting a sum of 8, when two dice are thrown simultaneously, is :

(A) $\frac{1}{12}$ (B) $\frac{1}{9}$

(C) $\frac{1}{6}$ (D) $\frac{5}{36}$

7. बिंदुओं A(– 1, 3) तथा B(2, 4) को मिलाने वाले रेखाखण्ड का लंब समद्विभाजक y-अक्ष को जिस बिंदु पर काटता है, वह है :

(A) (0, 5) (B) (0, – 5)

(C) (0, 4) (D) (0, – 4)

8. यदि त्रिभुजों ABC तथा PQR में, $\frac{AB}{QR} = \frac{BC}{PR}$ है, तो यह त्रिभुज समरूप होंगे जब :

(A) $\angle B = \angle Q$ (B) $\angle A = \angle R$

(C) $\angle B = \angle R$ (D) $\angle C = \angle Q$

9. एक रेखा l, एक Δ PQR की भुजाओं PQ तथा PR को क्रमशः बिंदुओं L तथा M पर इस प्रकार काटती है कि LM $||$ QR है । यदि PL = 5·7 cm, PQ = 15·2 cm तथा MR = 5·5 cm हैं, तो PM की (cm में) लंबाई है :

(A) 3 (B) 1·8

(C) 2·5 (D) 3·3

10. यदि 5 cm त्रिज्या वाले वृत्त पर 60° के कोण पर झुकी हुई दो स्पर्श-रेखाएँ खींची गई हैं, तो प्रत्येक स्पर्श-रेखा की लंबाई है :

(A) $\frac{5\sqrt{3}}{2}$ cm (B) 10 cm

(C) $\frac{5}{\sqrt{3}}$ cm (D) $5\sqrt{3}$ cm

11. यदि $\tan A = 3 \cot A$ है, तो कोण A का माप है :

(A) 15° (B) 30°

(C) 45° (D) 60°

12. $(\sec \theta + \tan \theta)(1 - \sin \theta)$ बराबर है :

(A) $\sec \theta$ (B) $\sin \theta$

(C) $\text{cosec}\, \theta$ (D) $\cos \theta$

7. The perpendicular bisector of the line segment joining the points A(–1, 3) and B(2, 4) cuts the y-axis at :

(A) (0, 5) (B) (0, – 5)

(C) (0, 4) (D) (0, – 4)

8. If in triangles ABC and PQR, $\frac{AB}{QR} = \frac{BC}{PR}$, then they will be similar, when :

(A) $\angle B = \angle Q$ (B) $\angle A = \angle R$

(C) $\angle B = \angle R$ (D) $\angle C = \angle Q$

9. A line l intersects the sides PQ and PR of a Δ PQR at L and M respectively such that LM $||$ QR. If PL = 5·7 cm, PQ = 15·2 cm and MR = 5·5 cm, then the length of PM (in cm) is :

(A) 3 (B) 1·8

(C) 2·5 (D) 3·3

10. If two tangents inclined at an angle of 60° are drawn to a circle of radius 5 cm, then the length of each tangent is :

(A) $\frac{5\sqrt{3}}{2}$ cm (B) 10 cm

(C) $\frac{5}{\sqrt{3}}$ cm (D) $5\sqrt{3}$ cm

11. If tan A = 3 cot A, then the measure of the angle A is :

(A) 15° (B) 30°

(C) 45° (D) 60°

12. (sec θ + tan θ) (1 – sin θ) is equal to :

(A) sec θ (B) sin θ

(C) cosec θ (D) cos θ

13. 14 m लंबी एक सीढ़ी एक दीवार के शिखर तक ही पहुँचती है । यदि यह सीढ़ी दीवार के साथ 60° का कोण बनाती है, तो दीवार की ऊँचाई है :

(A) $14\sqrt{3}$ m (B) 7 m

(C) 14 m (D) $7\sqrt{3}$ m

14. यदि एक त्रिज्यखण्ड का क्षेत्रफल पूरे वृत्त के क्षेत्रफल का $\frac{1}{12}$ है, तो त्रिज्यखण्ड का कोण है :

(A) 36° (B) 30°

(C) 60° (D) 45°

15. एक घड़ी की मिनटों वाली सुई 21 cm लंबी है । इसके द्वारा 10 मिनट में रचा गया क्षेत्रफल है :

(A) $121\ cm^2$ (B) $131\ cm^2$

(C) $231\ cm^2$ (D) $172{\cdot}5\ cm^2$

16. एक डिब्बे में कार्ड हैं जिन पर 6 से 50 तक की संख्याएँ अंकित हैं । बक्से में से यादृच्छया एक कार्ड निकाला गया । निकाले गए कार्ड पर अंकित संख्या के एक पूर्ण वर्ग संख्या होने की प्रायिकता है :

(A) $\frac{5}{44}$ (B) $\frac{1}{9}$

(C) $\frac{1}{11}$ (D) $\frac{7}{45}$

17. दो दोस्तों का जन्म वर्ष 2000 में हुआ । उनका जन्मदिन एक ही होने की प्रायिकता है :

(A) $\frac{1}{365}$ (B) $\frac{364}{365}$

(C) $\frac{1}{366}$ (D) $\frac{365}{366}$

13. A ladder 14 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is :

(A) $14\sqrt{3}$ m (B) 7 m

(C) 14 m (D) $7\sqrt{3}$ m

14. If the area of a sector is one-twelfth that of a complete circle, then the angle of the sector is :

(A) 36° (B) 30°

(C) 60° (D) 45°

15. The minute hand of a clock is 21 cm long. The area swept by it in 10 minutes is :

(A) 121 cm^2 (B) 131 cm^2

(C) 231 cm^2 (D) 172·5 cm^2

16. A box contains cards numbered 6 to 50. A card is drawn at random from the box. The probability that the drawn card has a number which is a perfect square, is :

(A) $\frac{5}{44}$ (B) $\frac{1}{9}$

(C) $\frac{1}{11}$ (D) $\frac{7}{45}$

17. Two friends were born in the year 2000. The probability that they have the same birthday is :

(A) $\frac{1}{365}$ (B) $\frac{364}{365}$

(C) $\frac{1}{366}$ (D) $\frac{365}{366}$

18.

अंक :	10 से कम	20 से कम	30 से कम	40 से कम	50 से कम
विद्यार्थियों की संख्या :	3	12	27	57	75

उपर्युक्त बंटन का बहुलक वर्ग है :

(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

*प्रश्न संख्या **19** और **20** अभिकथन एवं तर्क आधारित प्रश्न हैं । दो कथन दिए गए हैं जिनमें एक को अभिकथन (A) तथा दूसरे को तर्क (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।*

(A) अभिकथन (A) और तर्क (R) दोनों सही हैं और तर्क (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और तर्क (R) दोनों सही हैं, परन्तु तर्क (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु तर्क (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु तर्क (R) सही है ।

19. *अभिकथन (A) :* 14 m व्यास तथा 24 m ऊँचाई वाले चावल के एक शंक्वाकार ढेर को पूरा ढकने के लिए $175\ \pi$ वर्ग मीटर कैनवास की आवश्यकता है ।

तर्क (R) : त्रिज्या r तथा तिर्यक ऊँचाई l वाले शंकु का वक्र पृष्ठीय क्षेत्रफल $\pi r l$ है ।

20. *अभिकथन (A) :* समांतर श्रेढ़ी 21, 18, 15, 12, ... के प्रथम 15 पदों का योगफल शून्य है ।

तर्क (R) : प्रथम पद 'a' तथा सार्व अंतर 'd' वाली समांतर श्रेढ़ी के प्रथम n पदों का योगफल $S_n = \frac{n}{2}[a + (n-1)d]$ है ।

18.

Marks :	Below 10	Below 20	Below 30	Below 40	Below 50
Number of Students :	3	12	27	57	75

For the above distribution, the modal class is :

(A) 10 – 20 (B) 20 – 30

(C) 30 – 40 (D) 40 – 50

*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.*

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

19. *Assertion (A) :* The area of canvas cloth required to just cover a heap of rice in the form of a cone of diameter 14 m and height 24 m is 175π sq.m.

Reason (R) : The curved surface area of a cone of radius r and slant height l is $\pi r l$.

20. *Assertion (A) :* The sum of the first fifteen terms of the AP 21, 18, 15, 12, … is zero.

Reason (R) : The sum of the first n terms of an AP with first term 'a' and common difference 'd' is given by $S_n = \frac{n}{2}[a + (n-1)d]$.

खण्ड ख

इस खण्ड में अति लघु-उत्तरीय (VSA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 2 अंकों का है ।

21. वह छोटी-से-छोटी संख्या ज्ञात कीजिए जो 8, 9 तथा 10 प्रत्येक से भाज्य हो ।

22. (a) एक Δ ABC की भुजाओं AB तथा AC पर क्रमशः बिंदु D तथा E इस प्रकार हैं कि BD = CE है । यदि $\angle$ B = $\angle$ C है, तो दर्शाइए कि DE || BC.

अथवा

(b) यदि Δ ABC ~ Δ DEF तथा AB = 4 cm, DE = 6 cm, EF = 9 cm तथा FD = 12 cm है, तो Δ ABC का परिमाप ज्ञात कीजिए ।

23. यदि एक षट्भुज ABCDEF एक वृत्त के परिगत है, तो सिद्ध कीजिए कि AB + CD + EF = BC + DE + FA.

24. (a) यदि $\tan\theta + \sec\theta = m$ है, तो सिद्ध कीजिए कि $\sec\theta = \frac{m^2+1}{2m}$.

अथवा

(b) यदि $\sin A = \frac{3}{5}$ तथा $\cos B = \frac{12}{13}$ है, तो (tan A + tan B) का मान ज्ञात कीजिए ।

25. एक 35 m, 40 m तथा 50 m लम्बाई की भुजाओं वाले त्रिभुजाकार घास के मैदान ABC के सिरों A, B तथा C से क्रमशः एक घोड़ा, एक गाय तथा एक बकरी, प्रत्येक 14 m लंबी रस्सियों से बंधे हैं । ज्ञात कीजिए कि वह मैदान के कितने क्षेत्र की घास चर पाएँगे ।

SECTION B

This section comprises Very Short Answer (VSA) type questions of 2 marks each.

21. Find the smallest number that is divisible by each of 8, 9 and 10.

22. (a) In a Δ ABC, D and E are points on the sides AB and AC respectively such that BD = CE. If $\angle$ B = $\angle$ C, then show that DE $||$ BC.

OR

(b) If Δ ABC ~ Δ DEF and AB = 4 cm, DE = 6 cm, EF = 9 cm and FD = 12 cm, find the perimeter of Δ ABC.

23. If a hexagon ABCDEF circumscribes a circle, prove that AB + CD + EF = BC + DE + FA.

24. (a) If $\tan\theta + \sec\theta = m$, then prove that $\sec\theta = \frac{m^2+1}{2m}$.

OR

(b) If $\sin A = \frac{3}{5}$ and $\cos B = \frac{12}{13}$, then find the value of $(\tan A + \tan B)$.

25. A horse, a cow and a goat are tied, each by ropes of length 14 m, at the corners A, B and C respectively, of a grassy triangular field ABC with sides of lengths 35 m, 40 m and 50 m. Find the total area of grass field that can be grazed by them.

खण्ड ग

इस खण्ड में लघु-उत्तरीय (SA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 3 अंकों का है ।

26. सिद्ध कीजिए कि $\sqrt{3}$ एक अपरिमेय संख्या है ।

27. (a) यदि α तथा β एक द्विघात बहुपद $f(x) = 6x^2 + 11x - 10$ के शून्यक हैं, तो $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ का मान ज्ञात कीजिए ।

अथवा

(b) बहुपद $f(t) = t^2 + 4\sqrt{3}\,t - 15$ के शून्यक ज्ञात कीजिए तथा शून्यकों एवं बहुपद के गुणांकों के बीच संबंध सत्यापित कीजिए ।

28. A तथा B की मासिक आय में 8 : 7 का अनुपात है तथा उनके खर्चों में 19 : 16 का अनुपात है । यदि दोनों अलग-अलग प्रति माह ₹ 2500 बचा लेते हैं, तो प्रत्येक की मासिक आय ज्ञात कीजिए ।

29. (a) एक समकोण त्रिभुज ABC, जिसमें B पर समकोण है, के अंतर्गत एक वृत्त खींचा गया । यदि BC = 7 cm तथा AB = 24 cm है, तो वृत्त की त्रिज्या ज्ञात कीजिए ।

अथवा

(b) केंद्र O वाले वृत्त के एक बाह्य बिंदु P से वृत्त पर दो स्पर्श-रेखाएँ PA तथा PB खींची गई हैं । वृत्त के एक अन्य बिंदु E पर एक अन्य स्पर्श-रेखा इस प्रकार खींची गई कि यह PA को C तथा PB को D पर काटती है । यदि PA = 10 cm है, तो ΔPCD का परिमाप ज्ञात कीजिए ।

SECTION C

This section comprises Short Answer (SA) type questions of 3 marks each.

26. Prove that $\sqrt{3}$ is an irrational number.

27. (a) If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + 11x - 10$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

OR

(b) Find the zeroes of the polynomial $f(t) = t^2 + 4\sqrt{3}\,t - 15$ and verify the relationship between the zeroes and the coefficients of the polynomial.

28. The monthly incomes of A and B are in the ratio 8 : 7 and their expenditures are in the ratio 19 : 16. If each saves ₹ 2500 per month, find the monthly income of each.

29. (a) A circle is inscribed in a right-angled triangle ABC, right-angled at B. If BC = 7 cm and AB = 24 cm, find the radius of the circle.

OR

(b) From an external point P, two tangents PA and PB are drawn to a circle with centre O. At a point E on the circle, a tangent is drawn which intersects PA and PB at C and D respectively. If PA = 10 cm, find the perimeter of Δ PCD.

30. सिद्ध कीजिए कि : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta$

31. निम्नलिखित आँकड़ों का माध्य ज्ञात कीजिए :

वर्ग :	4 – 6	7 – 9	10 – 12	13 – 15
बारंबारता :	5	4	9	10

खण्ड घ

इस खण्ड में दीर्घ-उत्तरीय (LA) प्रकार के प्रश्न हैं, जिनमें प्रत्येक प्रश्न 5 अंकों का है ।

32. (a) दो संख्याओं का योगफल 18 है तथा उनके व्युत्क्रमों का योगफल $\frac{1}{4}$ है । संख्याएँ ज्ञात कीजिए ।

अथवा

(b) x के लिए हल कीजिए : $\frac{4}{x} - \frac{5}{2x+3} = 3$

33. ABCD एक समलंब है जिसमें AB || DC है । AC तथा BD बिंदु E पर प्रतिच्छेद करते हैं । यदि Δ AED $\sim$ Δ BEC है, तो सिद्ध कीजिए कि AD = BC.

34. (a) एक भवन का आंतरिक भाग एक बेलनाकार प्रकार का है जिसकी आधार त्रिज्या 12 m तथा ऊँचाई 3·5 m है । इस बेलनाकार भाग के ऊपर एक शंक्वाकार भाग अध्यारोपित है जिसकी आधार त्रिज्या बेलनाकार भाग के समान है तथा तिर्यक ऊँचाई 14 m है । इस भवन का अन्तः वक्र पृष्ठीय क्षेत्रफल ज्ञात कीजिए ।

अथवा

30. Prove that : $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta} = 1 + \tan\theta + \cot\theta$

31. Calculate the mean of the following data :

Class :	4 – 6	7 – 9	10 – 12	13 – 15
Frequency :	5	4	9	10

SECTION D

This section comprises Long Answer (LA) type questions of 5 marks each.

32. (a) The sum of two numbers is 18 and the sum of their reciprocals is $\frac{1}{4}$. Find the numbers.

OR

(b) Solve for x : $\frac{4}{x} - \frac{5}{2x+3} = 3$

33. ABCD is a trapezium with AB || DC. AC and BD intersect at E. If Δ AED ~ Δ BEC, then prove that AD = BC.

34. (a) The interior of a building is in the form of a cylinder of base radius 12 m and height 3·5 m surmounted by a cone of equal base and slant height 14 m. Find the internal curved surface area of the building.

OR

(b) एक घन तथा एक ऐसे गोले, जो घन में पूरा-पूरा फिट आ जाए, के आयतनों में अनुपात ज्ञात कीजिए ।

35. एक चतुर्भुज ABCD के शीर्ष A(6, – 2), B(9, 2), C(5, – 1) तथा D(2, – 5) हैं । सिद्ध कीजिए कि ABCD एक समचतुर्भुज है, न कि एक वर्ग ।

खण्ड ङ

इस खण्ड में 3 प्रकरण अध्ययन आधारित प्रश्न हैं जिनमें प्रत्येक प्रश्न 4 अंकों का है ।

प्रकरण अध्ययन – 1

36. छात्र-शिक्षक अनुपात किसी स्कूल में नामांकित छात्रों की संख्या और स्कूल में कार्यरत शिक्षकों की संख्या के बीच के संबंध को व्यक्त करता है । यह अनुपात कई कारणों से महत्त्वपूर्ण है । इसका उपयोग शिक्षकों के कार्यभार के साथ-साथ संसाधनों के आबंटन को मापने के लिए एक उपकरण के रूप में किया जा सकता है । एक राज्य के 100 माध्यमिक स्कूलों में एक सर्वे किया गया तथा निम्नलिखित बारंबारता बंटन सारणी बनाई गई :

छात्र प्रति शिक्षक	*स्कूलों की संख्या*
20 – 25	5
25 – 30	15
30 – 35	25
35 – 40	30
40 – 45	15
45 – 50	10

(b) Determine the ratio of the volume of a cube to that of the sphere which will exactly fit inside the cube.

35. The vertices of a quadrilateral ABCD are A(6, – 2), B(9, 2), C(5, – 1) and D(2, – 5). Prove that ABCD is a rhombus, and not a square.

SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study – 1

36. Student-teacher ratio expresses the relationship between the number of students enrolled in a school and the number of teachers employed by the school. This ratio is important for a number of reasons. It can be used as a tool to measure teachers' workload as well as the allocation of resources. A survey was conducted in 100 secondary schools of a state and the following frequency distribution table was prepared :

Number of students per Teacher	*Number of Schools*
20 – 25	5
25 – 30	15
30 – 35	25
35 – 40	30
40 – 45	15
45 – 50	10

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) माध्यक वर्ग की निचली सीमा क्या है ? *1*

(ii) बहुलक वर्ग की उच्च सीमा क्या है ? *1*

(iii) (a) आँकड़ों का माध्यक मान ज्ञात कीजिए । *2*

अथवा

(b) आँकड़ों का बहुलक मान ज्ञात कीजिए । *2*

प्रकरण अध्ययन – 2

37. रेडियो टावरों का उपयोग रेडियो और टेलीविज़न सहित कई संचार सेवाओं को प्रसारित करने के लिए किया जाता है । टावर या तो स्वयं एंटेना के रूप में कार्य करेगा या इसकी संरचना पर एक या एक से अधिक एंटेना का टेक होगा ।

ऐसी ही अवधारणा पर, दो स्टेशनों A और B (A के लंबवत् नीचे B) में एक रेडियो स्टेशन टावर बनाया गया था । टावर भूमि पर एक बिंदु O से तारों AO और BO द्वारा आलंबित है । टावर के आधार C और बिंदु O के बीच की दूरी 36 m है । O से, स्टेशन B और स्टेशन A के शीर्षों के उन्नयन कोण क्रमश: 30° और 45° हैं ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) स्टेशन B की ऊँचाई ज्ञात कीजिए । *1*

(ii) स्टेशन A की ऊँचाई ज्ञात कीजिए । *1*

(iii) (a) तार OA की लंबाई ज्ञात कीजिए । *2*

अथवा

(b) तार OB की लंबाई ज्ञात कीजिए । *2*

Based on the above, answer the following questions :

(i) What is the lower limit of the median class ? *1*

(ii) What is the upper limit of the modal class ? *1*

(iii) (a) Find the median of the data. *2*

OR

(b) Find the modal of the data. *2*

Case Study – 2

37. Radio towers are used for transmitting a range of communication services including radio and television. The tower will either act as an antenna itself or support one or more antennas on its structure.

On a similar concept, a radio station tower was built in two stations A and B (B vertically below A). The tower is supported by wires AO and BO from a point O on the ground. Distance between the base C of the tower and the point O is 36 m. From O, the angles of elevation of the tops of station B and station A are 30^{o} and 45^{o} respectively.

Based on the above, answer the following questions :

(i) Find the height of station B. *1*

(ii) Find the height of station A. *1*

(iii) (a) Find the length of the wire OA. *2*

OR

(b) Find the length of the wire OB. *2*

प्रकरण अध्ययन – 3

38. रोड-रोलर एक कम्पेक्टर-प्रकार का इंजीनियरिंग वाहन है, जिसका उपयोग सड़कों और नींव के निर्माण में मिट्टी, बजरी, कंक्रीट आदि को कम्पेक्ट करने के लिए किया जाता है । इनका उपयोग लैंडफिल या कृषि में भी किया जाता है । एक कम्पनी ने 10 वर्ष पहले रोड-रोलर बनाने शुरू किए तथा हर वर्ष निश्चित संख्या में समान रूप से अपना उत्पादन बढ़ाया । कम्पनी छठे वर्ष में 800 रोलर बनाती है तथा नौवें वर्ष में 1130 रोलर बनाती है ।

उपर्युक्त के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(i) पहले वर्ष में कम्पनी का कितना उत्पादन हुआ ? *1*

(ii) प्रति वर्ष कम्पनी द्वारा उत्पादन में कितनी बढ़ोतरी होती थी ? *1*

(iii) (a) आठवें वर्ष में कम्पनी का उत्पादन कितना था ? *2*

अथवा

(b) प्रथम 6 वर्षों में कम्पनी का कुल उत्पादन कितना था ? *2*

Case Study – 3

38. A road roller is a compactor-type engineering vehicle, used to compact soil, gravel, concrete, etc, in the construction of roads and foundations. They are also used at landfills or in agriculture. A company started making road rollers 10 years ago and increased its production uniformly by a fixed number every year. The company produces 800 rollers in the 6^{th} year and 1130 rollers in the 9^{th} year.

Based on the above information, answer the following questions :

(i) What is the company's production in the first year ? *1*

(ii) What was the increase in the company's production every year ? *1*

(iii) (a) What was the company's production in the 8^{th} year ? *2*

OR

(b) What was the company's total production in the first 6 years ? *2*

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Supplementary Examination, 2024
MATHEMATICS 041 PAPER CODE 30(B)/S

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and IPC."**
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In class -X, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.
9	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**

10	**<u>In Q21-Q38, if a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".</u>**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
14	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded on an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to online award list. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
15	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
16	Any un assessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
19	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30(B)/S)

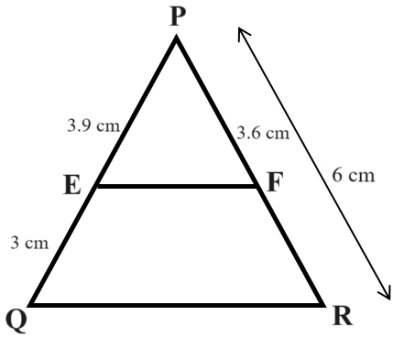
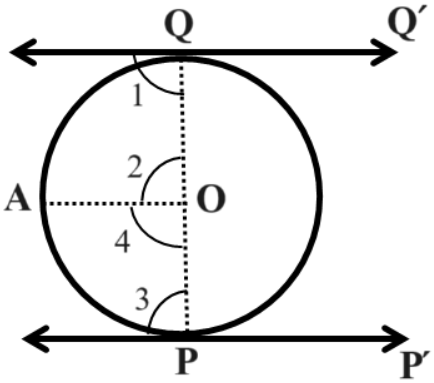
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section comprises Multiple Choice Questions (MCQs) 1 mark each.**	
1	If 5 times the 5^{th} term of an A.P. is equal to 9 times the 9^{th} term, then its 14^{th} term is : (A) 5 (B) 9 (C) 0 (D) 14	
Sol.	(C) 0	1
2	If the sum and the product of the roots of the quadratic equation $ax^2 + 6x + 4a = 0$ are equal, then 'a' is equal to : (A) $\frac{3}{2}$ (B) $-\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $-\frac{2}{3}$	
Sol.	(B) $-\frac{3}{2}$	1
3	If the lines given by $3x + 2ky = 2$ and $2x + 5y = 1$ are parallel, then the value of k is : (A) $-\frac{5}{4}$ (B) $\frac{2}{5}$ (C) $\frac{15}{4}$ (D) $\frac{3}{2}$	
Sol.	(C) $\frac{15}{4}$	1

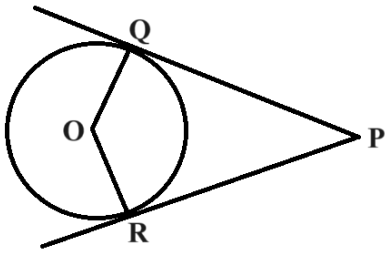
4	If α and β are the zeroes of the polynomial $2x^2 + 5x + 1$, then the value of $\alpha + \beta + 3\alpha\beta$ is : (A) -4 (B) $-\frac{3}{2}$ (C) 1 (D) -1	
Sol.	(D) -1	1
5	If $a = 2^4 \times 3^3$, $b = 2^3 \times 3^2 \times 5$, $c = 3^n \times 5^2$ and LCM $(a, b, c) = (5^2 \times 3^4 \times 2^4)$, then n is : (A) 1 (B) 2 (C) 3 (D) 4	
Sol.	(D) 4	1
6	In the following frequency distribution : Height (in cm) : 120 – 125 | 125 – 130 | 130 – 135 | 135 – 140 | 140 – 145 Number of students : 17 | 12 | 13 | 8 | 10 the sum of the upper limit of the modal class and the lower limit of the median class is : (A) 250 (B) 255 (C) 260 (D) 245	
Sol.	(B) 255	1
7	If the median and mode of a frequency distribution are 26 and 29 respectively, then the mean is : (A) 27·5 (B) 24·5 (C) 28·4 (D) 25·8	
Sol.	(B) 24.5	1

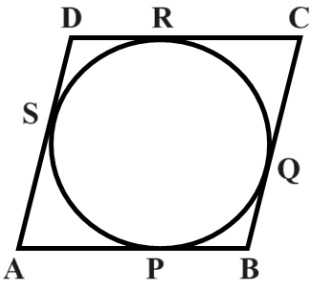
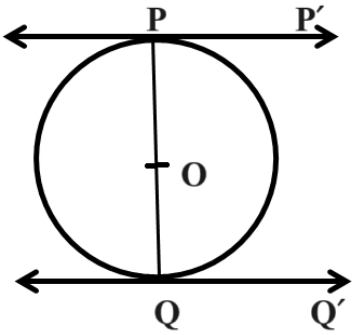
8	The probability for a leap year (selected at random) to have 52 Mondays and 53 Sundays is : (A) $\frac{1}{366}$ (B) $\frac{1}{52}$ (C) $\frac{2}{7}$ (D) $\frac{1}{7}$	
Sol.	(D) $\frac{1}{7}$	1
9	The probability that in a family of three children, there will be at least two boys, is : (A) $\frac{1}{8}$ (B) $\frac{7}{8}$ (C) $\frac{4}{8}$ (D) $\frac{6}{8}$	
Sol.	(C) $\frac{4}{8}$	1
10	A hemispherical bowl is made of steel of thickness 0·30 cm. The inner radius of the bowl is 3 cm. The volume of steel used (in cu cm) is : (A) 595·8 π (B) 5·958 π (C) 6 π (D) 59·58 π	
Sol.	(B) 5.958 π	1
11	A sector of a circle with central angle 120° and area $\frac{264}{7}$ sq cm is cut from a circle. The radius of the circle (in cm) is : (A) 6 (B) 5 (C) 7 (D) 12	
Sol.	(A) 6	1

12	If $\text{cosec}\,\theta = \sqrt{10}$, then the value of $\sec\,\theta$ is : (A) $\frac{3}{\sqrt{10}}$ (B) $\frac{\sqrt{10}}{3}$ (C) $\frac{1}{\sqrt{10}}$ (D) $\frac{2}{\sqrt{10}}$	
Sol.	(B) $\frac{\sqrt{10}}{3}$	1
13	$\frac{\sin^3 A + \cos^3 A}{\sin A + \cos A} + \sin A \cos A$ on simplification gives : (A) 1 (B) 2 (C) $1 + 2 \sin A \cos A$ (D) 0	
Sol.	(A) 1	1
14	The angle of depression of a car parked on the road from the top of a 75 m high tower is 30°. The distance of the car from the base of the tower is : (A) $75\sqrt{3}$ m (B) $50\sqrt{3}$ m (C) $25\sqrt{3}$ m (D) 75 m	
Sol.	(A) $75\sqrt{3}$ m	1
15	In two concentric circles with centre O, the radius of the outer circle is 50 cm. Chord AB of the outer circle is tangent to the inner circle at D. If length of AB is 96 cm, then the radius of the inner circle is : (A) 14 cm (B) 7 cm (C) 24 cm (D) 15 cm	
Sol.	(A) 14 cm	1
16	In two Δs ABC and PQR, if $\frac{AB}{QR} = \frac{BC}{QP} = \frac{AC}{PR}$, then (A) Δ PQR ~ Δ CAB (B) Δ PQR ~ Δ ABC (C) Δ PQR ~ Δ CBA (D) Δ PQR ~ Δ BCA	
Sol.	(C) $\Delta PQR \sim \Delta CBA$	1

17	In a Δ ABC, a line DE is drawn parallel to BC to intersect AB at D and AC at E. If AD = 2 cm, BD = 3 cm and DE = 4 cm, then the length of BC (in cm) is : (A) 6 (B) 10 (C) $\frac{8}{3}$ (D) $\frac{20}{3}$	
Sol.	(B) 10	1
18	The points (– 2, – 2), (6, – 2) and (2, 1) are the vertices of : (A) a right angled triangle (B) an isosceles triangle (C) an isosceles right triangle (D) a scalene triangle	
Sol.	(B) an isosceles triangle	1
	Questions number ***19*** *and* ***20*** *are Assertion and Reason based questions. Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.* (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19	*Assertion (A) :* Two cubes each with 12 cm edge are joined end to end. The surface area of the resulting cuboid = 2 × (surface area of one cube). *Reason (R) :* The surface area of a cuboid = 2 (lb + bh + hl), where l, b, h respectively are its length, breadth and height.	
Sol.	(D) Assertion (A) is false, but Reason (R) is true.	1
20	*Assertion (A) :* The eighth term of the A.P. $\frac{1}{m}, \frac{1+2m}{m}, \frac{1+4m}{m}, \ldots$ is $\frac{1+14m}{m}$. *Reason (R) :* The n^{th} term of A.P. $(a_n) = a + (n-1)\,d$.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1

	SECTION B **This section comprises of Very Short Answer (VSA) type questions of 2 marks each.**	
21	E and F are points on the sides PQ and PR respectively of a Δ PQR. If PE = 3·9 cm, EQ = 3 cm, PF = 3·6 cm and PR = 6 cm, find whether EF $\|\|$ QR.	
Sol.	 FR = 6 – 3.6 = 2.4 cm $\frac{PE}{EQ} = \frac{3.9}{3} = 1.3$ and $\frac{PF}{FR} = \frac{3.6}{2.4} = 1.5$ Since $\frac{PE}{EQ} \neq \frac{PF}{FR}$, therefore EF $\nparallel$ QR.	½ ½ + ½ ½
22(a)	Prove that the line segment joining the points of contact of two parallel tangents to a circle passes through its centre.	
Sol.	 QQ′ $\|\|$ PP′ Let P and Q be the points of contact and O is the centre of the circle. Join OP and OQ. Draw OA $\|\|$ QQ′. $\because$ QQ′ $\perp$ OQ $\Rightarrow \angle 1 = 90° \Rightarrow \angle 2 = 90°$ ------ (i) Since OQ′ $\|\|$ PP′ $\therefore$ OA $\|\|$ PP′ and hence $\angle 4 = 90°$ ------ (ii) Adding (i) and (ii), $\angle 2 + \angle 4 = 180°$ or $\angle POQ = 180°$ $\therefore$ POQ is a straight line.	½ ½ ½ ½
	OR	

22(b)	Two tangents PQ and PR are drawn from an external point P to a circle with centre O. Prove that QORP is a cyclic quadrilateral.	
Sol.	 PQ ⊥ OQ ⟹ ∠PQO = 90° and PR ⊥ OR ⟹ ∠PRO = 90° ∴ ∠PQO + ∠PRO = 180° Since opposite angles of quadrilateral QORP are supplementary, therefore QORP is a cyclic quadrilateral.	½ ½ 1
23	If 12 cosec A = 13, then find the value of $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$.	
Sol.	$\sin A = \frac{12}{13} \Longrightarrow \cos A = \frac{5}{13}$ Hence $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A} = \frac{2\times\frac{12}{13} - 3\times\frac{5}{13}}{4\times\frac{12}{13} - 9\times\frac{5}{13}} = 3$	1 1
24	The length of the minute hand of a wall clock is 21 cm. Find the area swept by the minute hand in 45 minutes.	
Sol.	Angle swept by minute hand in 45 minutes = 270° Length of minute hand (r) = 21 cm ∴ Area swept = $\frac{270}{360} \times \frac{22}{7} \times 21 \times 21$ = 1039.5 Therefore, area swept by the minute hand in 45 minutes is 1039.5 cm^2.	½ 1 ½
25(a)	Find whether each of the following is an irrational number or a rational number. (i) $(\sqrt{5}-\sqrt{3})^2$ (ii) $(5+\sqrt{3})(5-\sqrt{3})$	
Sol.	(i) $(\sqrt{5}-\sqrt{3})^2 = 8 - 2\sqrt{15}$ So, $(\sqrt{5}-\sqrt{3})^2$ is an irrational number. (ii) $(5+\sqrt{3})(5-\sqrt{3}) = 25 - 3 = 22$ So, $(5+\sqrt{3})(5-\sqrt{3})$ is a rational number.	1 1
	OR	

25(b)	Find the smallest 4-digit number exactly divisible by 15, 24 and 36.	
Sol.	LCM (15, 24, 36) = 360 Therefore, the smallest 4-digit number which is a multiple of 360 is 360 × 3 = 1080 which is divisible by 15, 24 & 36.	1 1
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26(a)	Prove that the parallelogram circumscribing a circle is a rhombus.	
Sol.	 Here AP = AS, BP = BQ, CR = CQ, DR = DS ∴ AB + CD = AP + BP + CR + DR = AS + BQ + CQ + DS = (AS + DS) + (BQ + CQ) = AD + BC ⟹ 2AB = 2 AD (∵ AB = CD, BC = AD) ⟹ AB = AD or ABCD is a rhombus.	1 1 ½ ½
	OR	
26(b)	Prove that the tangents drawn at the ends of a diameter of a circle are parallel.	
Sol.	 PQ is diameter of the circle. Therefore ∠P′PQ = ∠Q′QP = 90° ⟹ ∠P′PQ + ∠Q′QP = 180° ⟹ PP′ ‖ QQ′	 1 1 1

27	Places A and B are 160 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 4 hours. If they travel towards each other, they meet in 1 hour 36 minutes. What are the speeds of the two cars ?	
Sol.	Let the speed of two cars be x km/h & y km/h respectively ($x > y$). Therefore $4x - 4y = 160$ or $x - y = 40$ ---- (i) 1 hour 36 minutes = 1.6 hours $\therefore 1.6x + 1.6y = 160$ or $x + y = 100$ --- (ii) Solving (i) and (ii), we have $x = 70$ and $y = 30$ $\therefore$ speed of two cars are 70 km/h and 30 km/h respectively.	1 1 1
28(a)	If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + 11x - 10$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	$f(x) = 6x^2 + 11x - 10$ $\alpha + \beta = -\frac{11}{6}$ and $\alpha\beta = -\frac{10}{6}$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$ $\therefore \frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\left(-\frac{11}{6}\right)^2 - 2\left(-\frac{10}{6}\right)}{\left(-\frac{10}{6}\right)}$ $= -\frac{241}{60}$	1 1 1
	OR	
28(b)	Find the zeroes of the polynomial $2t^2 - 9t - 45$ and verify the relationship between the zeroes and the coefficients of the polynomial.	
Sol.	$2t^2 - 9t - 45 = 2t^2 - 15t + 6t - 45$ $= (2t - 15)(t + 3)$ $\therefore$ zeroes of the polynomial are $\frac{15}{2}$ and -3. Sum of the zeroes = $\frac{15}{2} + (-3) = \frac{9}{2} = \frac{-(\text{coefficient of } t)}{\text{coefficient of } t^2}$ Product of the zeroes = $\frac{15}{2} \times (-3) = -\frac{45}{2} = \frac{\text{constant term}}{\text{coefficient of } t^2}$	 1 1 ½ ½
29	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{a}{b}$, where a, b are coprime and $b \neq 0$. $\Rightarrow a^2 = 5b^2 \Rightarrow a^2$ is divisible by 5. $\Rightarrow$ a is divisible by 5. ----- (i)	 ½ 1

Let a = 5m, where 'm' is any natural number.

$\Rightarrow b^2 = 5m^2 \Rightarrow b^2$ is divisible by 5.

$\Rightarrow$ b is divisible by 5. ----- (ii) — 1

From (i) and (ii), a and b have common factors which is contrary to our assumption.

Hence, $\sqrt{5}$ is an irrational number. — ½

30

Prove that $\sqrt{\sec^2 A + \operatorname{cosec}^2 A} = \tan A + \cot A$.

Sol.

L.H.S. $= \sqrt{(1 + \tan^2 A) + (1 + \cot^2 A)}$ — 1

$= \sqrt{\tan^2 A + \cot^2 A + 2}$ — ½

$= \sqrt{(\tan A + \cot A)^2}$ — 1

$= (\tan A + \cot A)$ = R.H.S. — ½

31

The table below shows the daily expenditure on food of 25 households in a locality :

Daily expenditure (in ₹) :	200 – 250	250 – 300	300 – 350	350 – 400	400 – 450
Number of households :	4	5	12	2	2

Find the mean daily expenditure on food.

Sol.

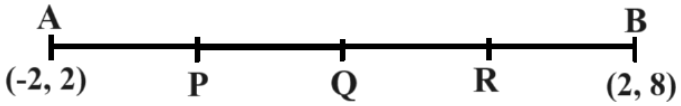
Daily expenditure (in ₹)	Number of households (f_i)	x_i	$u_i = \frac{x_i - 325}{50}$	$f_i u_i$
200 – 250	4	225	– 2	– 8
250 – 300	5	275	– 1	– 5
300 – 350	12	325 = a	0	0
350 – 400	2	375	1	2
400 – 450	2	425	2	4
Total	25			– 7

Correct table — 1½

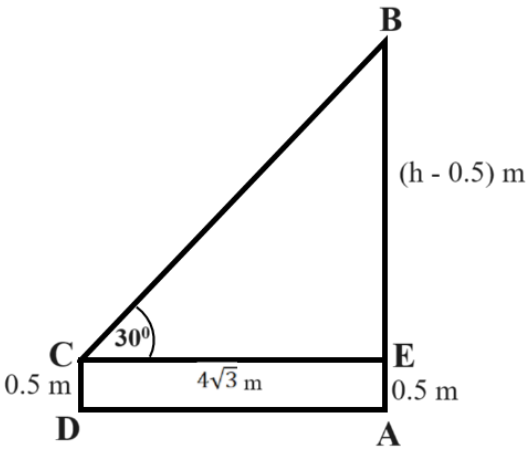
Mean $= 325 + \frac{(-7)}{25} \times 50$ — 1

$= 311$ — ½

Therefore, the mean daily expenditure on food is ₹ 311.

	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32(a)	Some students planned a picnic. The total budget for food was ₹ 500, but 5 of them failed to go and thus the cost of food for each student increased by ₹ 5. How many students attended the picnic ?	
Sol.	Let number of students who attended picnic be x. A.T.Q. $\frac{500}{x} - \frac{500}{x+5} = 5$ $\Rightarrow x^2 + 5x - 500 = 0$ $\Rightarrow (x + 25)(x - 20) = 0$ $\Rightarrow x = -25, x = 20$ But number of students can't be negative. Hence, $x = 20$ Therefore, number of students who attended picnic is 20.	 2 1 1 1
	OR	
32(b)	Find the value of p if the equation $(2p+1)x^2 - (7p+2)x + 7p - 3 = 0$ has real and equal roots.	
Sol.	Given equation has real and equal roots if $\{-(7p + 2)\}^2 - 4(2p + 1)(7p - 3) = 0$ $\Rightarrow 7p^2 - 24p - 16 = 0$ $\Rightarrow (7p + 4)(p - 4) = 0$ $\Rightarrow p = -\frac{4}{7}, p = 4$	 2 1 1 1
33	Find the coordinates of the points which divide the line segment joining A (– 2, 2) and B (2, 8) into four equal parts.	
Sol.	Let points P, Q and R divide the line segment joining A (– 2, 2) and B (2, 8) into four equal parts.  ∴ P divides AB in the ratio 1 : 3 or AP : PB = 1 : 3 So, coordinates of P = $\left(\frac{1\times 2+3\times(-2)}{1+3}, \frac{1\times 8+3\times 2}{1+3}\right) = \left(-1, \frac{7}{2}\right)$ ∴ Q divides AB in the ratio 1 : 1 or AQ : QB = 1 : 1 So, coordinates of P = $\left(\frac{1\times 2+1\times(-2)}{1+1}, \frac{1\times 8+1\times 2}{1+1}\right) = (0, 5)$ ∴ R divides AB in the ratio 3 : 1 or AR : RB = 3 : 1 So, coordinates of P = $\left(\frac{3\times 2+1\times(-2)}{3+1}, \frac{3\times 8+1\times 2}{3+1}\right) = \left(1, \frac{13}{2}\right)$	½ 1½ 1½ 1½
34	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.	
Sol.	Correct given, to prove. Correct proof.	2 3

35(a)	A solid is in the form of a right circular cylinder with hemispherical ends. The total height of the solid is 58 cm and the diameter of the cylinder is 28 cm. Find the total surface area of the solid.	
Sol.	Height of cylindrical part = 58 – 14 – 14 = 30 cm Radius of cylindrical as well as hemispherical parts = 14 cm TSA of the solid = $4 \times \frac{22}{7} \times (14)^2 + 2 \times \frac{22}{7} \times 14 \times 30$ = 5104 cm^2 Therefore, total surface area of the solid is 5104 cm^2.	1 ½ 2 1½
	OR	
35(b)	From a solid cylinder of height 36 cm and diameter 14 cm, a conical cavity of radius 7 cm and height 24 cm is drilled out. Find the volume of the remaining solid.	
Sol.	Radius of cylinder = 7 cm Volume of the remaining solid = $\frac{22}{7} \times (7)^2 \times 36 - \frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 24$ = 5544 – 1232 = 4312 cm^3 Therefore, volume of the remaining solid is 4312 cm^3.	½ 1½+1½ ½ + ½ ½
	SECTION E **This section comprises of 3 case study based questions of 4 marks each.**	
36	**Case Study – 1** Hari wants to participate in a 200 m race. He can currently run that distance in 51 seconds, and with each day of practice, he hopes to take 2 seconds less than the previous day. He wants to do it in 31 seconds. Based on the above information, answer the following questions : (i) Write the A.P. which represents the above situation. (ii) Find the minimum number of days he needs to practice to achieve the goal. (iii) (a) Find the expression for the n^{th} term of the A.P. **OR** (b) If he wants to do it in 21 seconds, how many minimum days will he take ?	
Sol.	(i) 51, 49, 47, 45, …, 31 (ii) Here a = 51 & d = – 2 31 = 51 + (n – 1) (– 2) $\Rightarrow$ n = 11 So, minimum 11 days he need to practice to achieve the goal.	1 ½ ½

	(iii) (a) $a_n = 51 + (n - 1)(-2)$ $\Rightarrow a_n = 53 - 2n$ **OR** (b) $21 = 51 + (n - 1)(-2)$ $\Rightarrow n = 16$ So, minimum 16 days he need to practice to achieve the goal.	1 1 1 1
37	**Case Study – 2** A class VI student went to a park and went up the slide to play. The angle of elevation of the slide is 30°, but the base from which the angle of elevation is measured is 50 cm above the ground level and the distance of this point from the bottom of the staircase (which is vertical) is $4\sqrt{3}$ m. Based on the above information, answer the following questions: (i) Write the angle of depression from the top of the slide to its base. (ii) (a) Find the height of the staircase. **OR** (b) Find the length of the slide. (iii) Will the angle of elevation increase or decrease if the staircase was made taller ?	
Sol.	Let AB be the staircase.  (i) 30° (ii) (a) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{h-0.5}{4\sqrt{3}}$ $\Rightarrow h = 4.5$ So, height of the staircase is 4.5 m **OR** (b) $\cos 30° = \frac{\sqrt{3}}{2} = \frac{4\sqrt{3}}{l}$ $\Rightarrow l = 8$ So, length of the slide is 8 m. (iii) Angle of elevation will increase.	 1 1 1 1 1 1

38

Case Study – 3

A survey was conducted by the Education Ministry of India to record the teacher–student ratio in various higher secondary schools of India. The following distribution was given by the Ministry :

Number of students/teacher :	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45
Number of Schools :	3	8	9	10	3	2

Based on the above information, answer the following questions :

(i) Write the modal class.

(ii) Write the median class.

(iii) (a) Find the mode of the data.

OR

(b) Find the median of the data.

Sol.

Number of students / teachers	Number of school (f)	(cf)
15 – 20	3	3
20 – 25	8	11
25 – 30	9	20
30 – 35	10	30
35 – 40	3	33
40 – 45	2	35

(i) Modal class is 30 – 35. 1

(ii) Median class is 25 – 30. 1

(iii) (a) Mode $= 30 + \frac{(10-9)}{(2\times 10-9-3)} \times 5$ 1½

$= 30.625$ ½

(b) Median $= 25 + \left(\frac{\frac{35}{2}-11}{9}\right) \times 5$ 1½

$= 28.61$ approx. ½