Series PPQQA/1

SET~1

प्रश्न-पत्र कोड
Q.P. Code **30/1/1**

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 **11** हैं ।	(I)	*Please check that this question paper contains* ***11*** *printed pages.*
(II)	प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।	(II)	*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.*
(III)	कृपया जाँच कर लें कि इस प्रश्न-पत्र में **14** प्रश्न हैं ।	(III)	*Please check that this question paper contains* ***14*** *questions.*
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	***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 ।	(V)	*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 : 2 घण्टे | अधिकतम अंक : 40

Time allowed : 2 hours | *Maximum Marks : 40*

सामान्य निर्देश :

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

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । सभी प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – **खण्ड क, ख** तथा **ग** ।*

(iii) ***खण्ड क** में **6** प्रश्न (प्र.सं. **1** से **6**) हैं, जिनमें प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) ***खण्ड ख** में **4** प्रश्न (प्र.सं. **7** से **10**) हैं, जिनमें प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) ***खण्ड ग** में **4** प्रश्न (प्र.सं. **11** से **14**) हैं, जिनमें प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में दो प्रकरण अध्ययन आधारित प्रश्न भी शामिल हैं ।*

(vi) *कैल्कुलेटर के उपयोग की अनुमति **नहीं** है ।*

खण्ड क

*प्रश्न संख्या **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।*

1. (क) समांतर श्रेढ़ी : $-30, -24, -18, ...$ के प्रथम 30 पदों का योगफल ज्ञात कीजिए । *2*

अथवा

(ख) एक समांतर श्रेढ़ी में यदि $S_n = n(4n + 1)$ है, तो समांतर श्रेढ़ी ज्ञात कीजिए । *2*

2. 10·5 सेमी त्रिज्या वाले धातु के एक ठोस गोले को पिघलाकर, 3·5 सेमी त्रिज्या और 3 सेमी ऊँचाई के कुछ छोटे-छोटे शंकु बनाए जाते हैं । इस प्रकार बनाए गए शंकुओं की संख्या ज्ञात कीजिए । *2*

3. (क) m के किस मान के लिए द्विघात समीकरण

$$(m - 1)x^2 + 2(m - 1)x + 1 = 0$$

के दो बराबर और वास्तविक मूल होंगे ? *2*

अथवा

(ख) निम्न द्विघात समीकरण को, x के लिए हल कीजिए : *2*

$$\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$$

4. निम्न बारंबारता बंटन का बहुलक ज्ञात कीजिए : *2*

वर्ग	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
बारंबारता	15	10	12	17	4

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This question paper is divided into **three** sections – **Sections A**, **B** and **C**.*

(iii) ***Section A** comprises of **6** questions (Q.no. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) ***Section B** comprises of **4** questions (Q.no. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) ***Section C** comprises of **4** questions (Q.no. **11** to **14**) of **4** marks each. Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *Use of calculator is **not** permitted.*

SECTION A

*Question numbers **1** to **6** carry **2** marks each.*

1. (a) Find the sum of first 30 terms of AP : $-30, -24, -18, \ldots\ldots$. *2*

OR

(b) In an AP if $S_n = n(4n + 1)$, then find the AP. *2*

2. A solid metallic sphere of radius 10·5 cm is melted and recast into a number of smaller cones, each of radius 3·5 cm and height 3 cm. Find the number of cones so formed. *2*

3. (a) Find the value of m for which the quadratic equation

$$(m - 1)x^2 + 2(m - 1)x + 1 = 0$$

has two real and equal roots. *2*

OR

(b) Solve the following quadratic equation for x : *2*

$$\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$$

4. Find the mode of the following frequency distribution : *2*

Class	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	15	10	12	17	4

5. रेहान की 5 वर्ष पूर्व आयु (वर्षों में) तथा अब से 7 वर्ष उपरान्त उसकी आयु का गुणनफल उसकी वर्तमान आयु के दो गुने से एक अधिक है । उसकी वर्तमान आयु ज्ञात कीजिए । *2*

6. दो संकेंद्रीय वृत्तों की त्रिज्याएँ 4 सेमी तथा 3 सेमी हैं । बड़े वृत्त की उस जीवा की लम्बाई ज्ञात कीजिए जो छोटे वृत्त को स्पर्श करती हो । *2*

खण्ड ख

*प्रश्न संख्या **7** से **10** तक प्रत्येक प्रश्न के **3** अंक हैं ।*

7. x के किस मान के लिए निम्नलिखित बारंबारता बंटन का माध्यक 34·5 है ? *3*

वर्ग	*बारंबारता*
0 – 10	3
10 – 20	5
20 – 30	11
30 – 40	10
40 – 50	x
50 – 60	3
60 – 70	2

8. 3 सेमी त्रिज्या का एक वृत्त खींचिए । इसके किसी बढ़ाए गए व्यास पर केंद्र से 7 सेमी की दूरी पर दो बिंदु P और Q लीजिए । इन दोनों बिंदुओं P और Q से वृत्त पर स्पर्श-रेखाओं की रचना कीजिए । *3*

9. (क) एक मीनार के पाद-बिंदु से एक भवन के शिखर का उन्नयन कोण 30° है और भवन के पाद-बिंदु से मीनार के शिखर का उन्नयन कोण 60° है । यदि मीनार 50 मी. ऊँची है, तो भवन की ऊँचाई ज्ञात कीजिए । *3*

अथवा

(ख) एक नदी के पुल के एक बिंदु से नदी के सम्मुख किनारों के अवनमन कोण क्रमशः 30° और 45° हैं । यदि पुल किनारों से 3 मी. की ऊँचाई पर हो, तो नदी की चौड़ाई ज्ञात कीजिए । *3*

5. The product of Rehan's age (in years) 5 years ago and his age 7 years from now, is one more than twice his present age. Find his present age. *2*

6. Two concentric circles are of radii 4 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle. *2*

SECTION B

*Question numbers **7** to **10** carry **3** marks each.*

7. For what value of x, is the median of the following frequency distribution 34·5 ? *3*

Class	*Frequency*
0 – 10	3
10 – 20	5
20 – 30	11
30 – 40	10
40 – 50	x
50 – 60	3
60 – 70	2

8. Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Construct tangents to the circle from these two points P and Q. *3*

9. (a) The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building. *3*

OR

(b) From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 3 m from the banks, then find the width of the river. *3*

10. किसी कम्पनी के 30 कर्मचारियों के खाने के दैनिक खर्च निम्न हैं :

दैनिक खर्च (रुपयों में)	*कर्मचारियों की संख्या*
100 – 120	8
120 – 140	3
140 – 160	8
160 – 180	6
180 – 200	5

कर्मचारियों का माध्य दैनिक खर्च ज्ञात कीजिए । *3*

खण्ड ग

*प्रश्न संख्या **11** से **14** तक प्रत्येक प्रश्न के **4** अंक हैं ।*

11. (क) ऊँचाई 30 सेमी तथा त्रिज्या 7 सेमी वाले एक ठोस बेलन में से 24 सेमी ऊँचाई तथा इसी त्रिज्या वाला एक शंक्वाकार खोल काटकर निकाल लिया जाता है । शेष बचे ठोस का सम्पूर्ण पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *4*

अथवा

(ख) 8 मी. चौड़ी तथा 6 मी. गहरी एक नहर में पानी 12 किमी/घंटे की चाल से बह रहा है । 1 घंटे में यह नहर कितने क्षेत्रफल की सिंचाई कर पाएगी, यदि सिंचाई के लिए 0·05 मी. अप्रवाही पानी की आवश्यकता होती है ? *4*

10. Following is the daily expenditure on lunch by 30 employees of a company :

Daily Expenditure (in Rupees)	*Number of Employees*
100 – 120	8
120 – 140	3
140 – 160	8
160 – 180	6
180 – 200	5

Find the mean daily expenditure of the employees. *3*

SECTION C

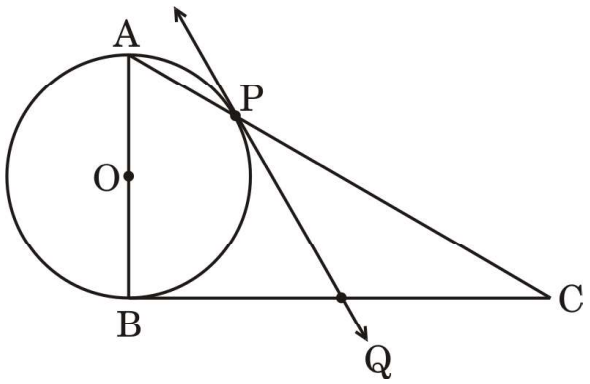
*Question numbers **11** to **14** carry **4** marks each.*

11. (a) From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid. *4*

OR

(b) Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0·05 m of standing water is required ? *4*

12. आकृति 1 में, त्रिभुज ABC दर्शाया गया है जिसमें $\angle B = 90°$ है । AB को व्यास लेते हुए एक वृत्त खींचा गया है, जो AC को बिंदु P पर प्रतिच्छेद करता है । सिद्ध कीजिए कि बिंदु P पर खींची गई स्पर्श रेखा BC को समद्विभाजित करती है । *4*

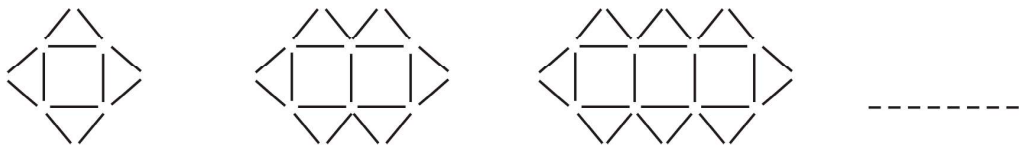


आकृति 1

प्रकरण अध्ययन – 1

13. गणित में संबंधों को कई प्रकार से व्यक्त किया जा सकता है । माचिस की तीलियों से बनाए गए पैटर्न रेखीय संबंधों पर आधारित हैं । अलग-अलग आकृतियों में प्रयुक्त माचिस की तीलियों की संख्या ज्ञात करने के लिए भिन्न युक्तियाँ प्रयुक्त की जा सकती हैं ।

एक ऐसा ही पैटर्न नीचे दर्शाया गया है । पैटर्न को ध्यानपूर्वक देखिए तथा समांतर श्रेढ़ी का उपयोग करते हुए निम्न प्रश्नों के उत्तर दीजिए :



आकृति 1 *आकृति 2* *आकृति 3* --------

(क) आकृतियों में प्रयुक्त त्रिभुजों की संख्या को दर्शाने वाली एक समांतर श्रेढ़ी लिखिए । इस समांतर श्रेढ़ी का nवाँ पद भी लिखिए । *2*

(ख) किस आकृति में 61 माचिस की तीलियों का उपयोग हुआ है ? *2*

12. In Figure 1, a triangle ABC with $\angle B = 90°$ is shown. Taking AB as diameter, a circle has been drawn intersecting AC at point P. Prove that the tangent drawn at point P bisects BC. *4*

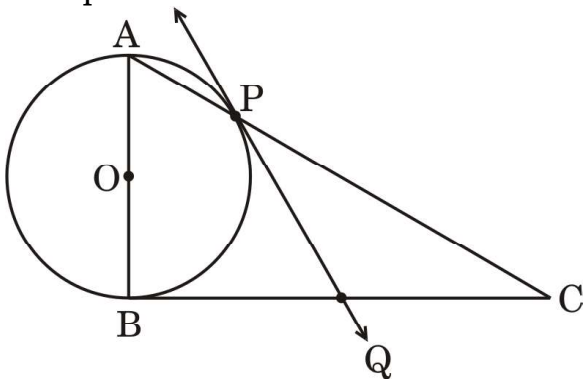


Figure 1

Case Study – 1

13. In Mathematics, relations can be expressed in various ways. The matchstick patterns are based on linear relations. Different strategies can be used to calculate the number of matchsticks used in different figures.

One such pattern is shown below. Observe the pattern and answer the following questions using Arithmetic Progression :

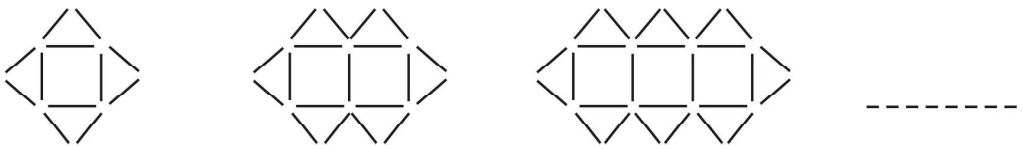


Figure 1 *Figure 2* *Figure 3*

(a) Write the AP for the number of triangles used in the figures. Also, write the n^{th} term of this AP. *2*

(b) Which figure has 61 matchsticks ? *2*

प्रकरण अध्ययन – 2

14. गड़ीसर झील राजस्थान के जैसलमेर जिले में स्थित है । इसको जैसलमेर के राजा ने बनवाया था तथा 14वीं शताब्दी में गड़सी सिंह ने इसे दुबारा बनवाया । इस झील में बहुत-सी छतरियाँ बनी हुई हैं । उनमें से एक छतरी को नीचे दर्शाया गया है :

चित्र को ध्यानपूर्वक देखिए । पानी की सतह से h मी. ऊँचाई पर स्थित बिंदु A से छतरी के शीर्ष (बिंदु B) का उन्नयन कोण $45°$ है तथा इसी बिंदु से पानी में छतरी के प्रतिबिम्ब (बिंदु C) का अवनमन कोण $60°$ है । पानी की सतह के ऊपर छतरी की ऊँचाई यदि 10 मी. हो, तो

(क) उपर्युक्त सूचना के आधार पर अच्छी प्रकार से अंकित एक आकृति खींचिए । *2*

(ख) पानी की सतह से बिंदु A की ऊँचाई (h) ज्ञात कीजिए ।
($\sqrt{3}$ = 1·73 का प्रयोग कीजिए) *2*

Case Study – 2

14. Gadisar Lake is located in the Jaisalmer district of Rajasthan. It was built by the King of Jaisalmer and rebuilt by Gadsi Singh in 14^{th} century. The lake has many Chhatris. One of them is shown below :

Observe the picture. From a point A h m above from water level, the angle of elevation of top of Chhatri (point B) is 45° and angle of depression of its reflection in water (point C) is 60°. If the height of Chhatri above water level is (approximately) 10 m, then

(a) draw a well-labelled figure based on the above information; *2*

(b) find the height (h) of the point A above water level.
(Use $\sqrt{3}$ = 1·73) *2*

Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)

[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. 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 Newspaper/ Website, etc., may invite action under IPC.**’’

3. Evaluation is to be done as per instruction 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 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, marks should be awarded.**

4. 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. 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.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer ‘7’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. 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.

7. 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.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday 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).

12. 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 a reply
    - Wrong transfer of marks from the inside pages of the answer book to the title page
    - Wrong questionwise 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
    - 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 7 for incorrect answer).
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. 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.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME

Secondary School Examination TERM–II, 2022

MATHEMATICS (Standard) (Subject Code–041)

[Paper Code : 30/1/1]

***Instructions* :**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
2. 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.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.a	Find the sum of first 30 terms of AP : – 30, – 24, – 18, ...	
Sol.	Here $a = -30,\ d = 6,\ n = 30$	1
	$S_{30} = \frac{30}{2}[-60 + 29 \times 6]$	½
	$= 1710$	½
	Or	
b.	In an AP if $S_n = n\,(4n + 1)$, then find the AP.	
Sol.	$a = S_1 = 1(4 \times 1 + 1) = 5$	½
	$a + (a + d) = S_2 = 2(4 \times 2 + 1) = 18$ $\therefore d = 8$	1
	Hence, AP is 5, 13, 21, ...	½
2.	A solid metallic sphere of radius 10·5 cm is melted and recast into a number of smaller cones, each of radius 3·5 cm and height 3 cm. Find the number of cones so formed.	

Sol. $n \times \frac{1}{3}.\pi.(3.5)^2(3) = \frac{4}{3}\pi(10.5)^3$ — 1

$\Rightarrow\ n = 126$ — 1

3.a. Find the value of m for which the quadratic equation

$$(m-1)\,x^2 + 2\,(m-1)\,x + 1 = 0$$

has two real and equal roots.

Sol. For real and equal roots

$4(m-1)^2 - 4(m-1) = 0$ — ½

$\Rightarrow m = 1$ or $m = 2$ — 1

$m \neq 1 \Rightarrow m = 2$ — ½

Or

b. Solve the following quadratic equation for x :

$$\sqrt{3}\,x^2 + 10x + 7\sqrt{3} = 0$$

Sol. $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$

or $\sqrt{3}x^2 + 3x + 7x + 7\sqrt{3} = 0$ — 1

or $(\sqrt{3}x + 7)\,(x + \sqrt{3}) = 0$

$\Rightarrow\ x = -\frac{7}{\sqrt{3}},\ -\sqrt{3}$ or $-\frac{7}{3}\sqrt{3},\ -\sqrt{3}$ — 1

4. Find the mode of the following frequency distribution :

Class	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	15	10	12	17	4

Sol. Modal class is 40–50 — ½

Mode = $40 + 10 \times \frac{17-12}{34-12-4}$ — 1

$= 42{\cdot}7$ or $42\frac{7}{9}$ — ½

5. The product of Rehan's age (in years) 5 years ago and his age 7 years from now, is one more than twice his present age. Find his present age.

Sol. Let Rehan's present age be *x* years

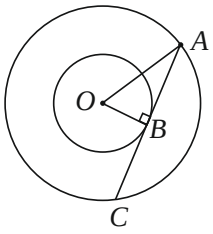
$\therefore\ (x-5)\,(x+7) = 2x+1$ — 1

$\Rightarrow x^2 = 36$ — ½

$\Rightarrow x = 6$ — ½

6. Two concentric circles are of radii 4 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.

Sol.



For correct figure ½

Here $OB = 3$ cm, $OA = 4$ cm

$OB \perp AC$

$\therefore\ AB = \sqrt{4^2 - 3^2} = \sqrt{7}$ cm 1

Hence $AC = 2\sqrt{7}$ cm ½

SECTION—B

7. For what value of x, is the median of the following frequency distribution 34·5 ?

Class	*Frequency*
0 – 10	3
10 – 20	5
20 – 30	11
30 – 40	10
40 – 50	x
50 – 60	3
60 – 70	2

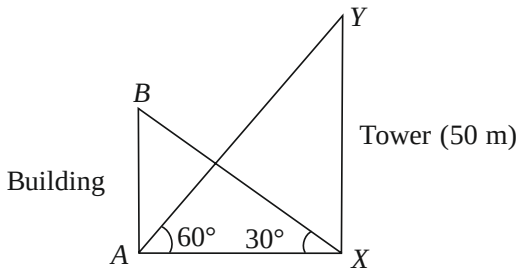
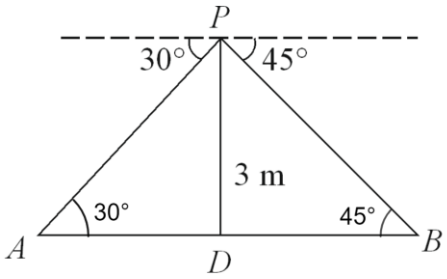
Sol. Median class is 30–40 ½

Class	*Frequency*	*c.f.*
0–10	3	3
10–20	5	8
20–30	11	19
30–40	10	29
40–50	x	$29 + x$
50–60	3	$32 + x$
60–70	2	$34 + x$

Correct table 1

$\therefore\ 34{\cdot}5 = 30 + \frac{10}{10}\left(\frac{34 + x}{2} - 19\right)$ 1

$\Rightarrow x = 13$ ½

8.	Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Construct tangents to the circle from these two points P and Q.	
Sol.	Correct Construction.	3
9.a.	The angle of elevation of the top of a building from the foot of the tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.	
Sol.	For correct figure	1
	$\tan 30° = \frac{AB}{AX}$ and $\tan 60° = \frac{50}{AX}$	
		
	$\Rightarrow AB = \frac{1}{\sqrt{3}} AX$ and $AX = \frac{50}{\sqrt{3}}$	½+½
	$\therefore\ AB = \frac{1}{\sqrt{3}} \cdot \frac{50}{\sqrt{3}} = \frac{50}{3}$ m	1
	OR	
b.	From a point on a bridge across a river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 3 m from the banks, then find the width of the river.	
Sol.	For correct figure	1
		
	Here, $\frac{PD}{AD} = \tan 30° = \frac{1}{\sqrt{3}} \Rightarrow AD = 3\sqrt{3}$ m	½
	and $\frac{PD}{BD} = \tan 45° = 1 \Rightarrow BD = 3$ m	½
	So, AB= $AD + BD = (3\sqrt{3} + 3)$ m $= 3(\sqrt{3} + 1)$ m	1

10. Following is the daily expenditure on lunch by 30 employees of a company :

Daily Expenditure (in Rupees)	*Number of Employees*
100 – 120	8
120 – 140	3
140 – 160	8
160 – 180	6
180 – 200	5

Find the mean daily expenditure of the employees.

Sol.

Class	***x***	***f***	***d***	***f.d***
100–120	110	8	–40	–320
120–140	130	3	–20	–60
140–160	150	8	0	0
160–180	170	6	20	120
180–200	190	5	40	200
		30		–60

For correct table — 2

Mean = $150 + \frac{-60}{30} = 148$ — 1

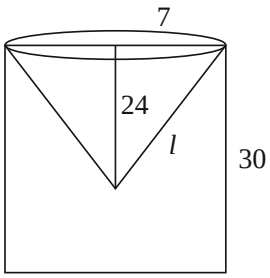
Therefore, mean expenditure = Rs. 148

SECTION—C

11. a. From a solid cylinder of height 30 cm and radius 7 cm, a conical cavity of height 24 cm and same radius is hollowed out. Find the total surface area of the remaining solid.

Sol.

$$l = \sqrt{576 + 49} = 25\ cm$$ — 1



$$\text{TSA} = 2\pi rh + \pi r^2 + \pi rl$$

$$= \frac{22}{7} \times 7\ [60 + 7 + 25] \qquad 2$$

$$= 2024\ \text{cm}^2 \qquad 1$$

Or

b. Water in a canal, 8 m wide and 6 m deep, is flowing with a speed of 12 km/hour. How much area will it irrigate in one hour, if 0·05 m of standing water is required ?

Sol. Distance covered by water in 1 hr = 12000 m ½

$\therefore$ Volume of water flown in 1 hr

$= 8 \times 6 \times 12000\ \text{m}^3$ 1½

Hence area of field × 0·05 = 8 × 6 × 12000 1½

$\Rightarrow$ Area of field $= 1152 \times 10^4\ \text{m}^2$ or 11520000 m² ½

12. In Figure 1, a triangle ABC with $\angle B = 90°$ is shown. Taking AB as diameter, a circle has been drawn intersecting AC at point P. Prove that the tangent drawn at point P bisects BC.

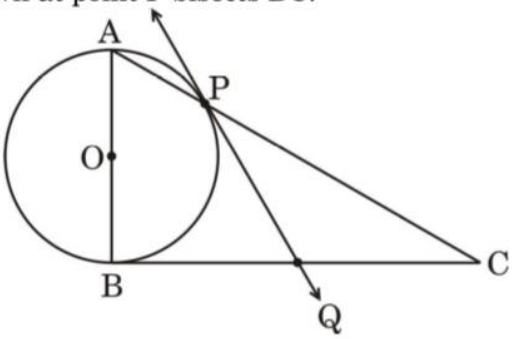
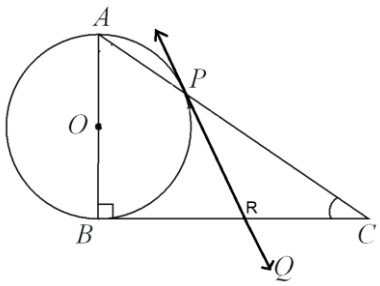
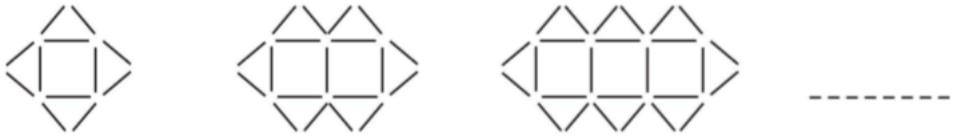
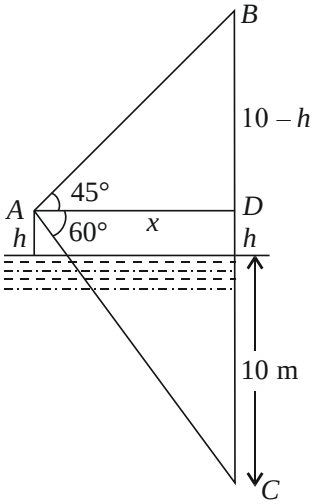


Figure 1

Sol.	 PR=RB (tangents from external point)……(i) Proving $\angle$ RPC = $\angle$ RCP ⇒ PR =CR ……(ii) Using equations (i) and (ii) BR= RC Hence the tangent drawn at point P bisects BC	1 2 ½ ½
13.	In Mathematics, relations can be expressed in various ways. The matchstick patterns are based on linear relations. Different strategies can be used to calculate the number of matchsticks used in different figures. One such pattern is shown below. Observe the pattern and answer the following questions using Arithmetic Progression :  *Figure 1* *Figure 2* *Figure 3* (a) Write the AP for the number of triangles used in the figures. Also, write the n^{th} term of this AP. (b) Which figure has 61 matchsticks ?	
Sol.	(a) Number of triangles in figures are 4, 6, 8, ... This is an A.P. with $a = 4$, $d = 2$ $\therefore\ a_n = 4 + (n-1) \times 2 = 2n + 2$ (b) Number of matchsticks in figures are 12, 19, 26, ...	½ 1 ½ ½

	This is an A.P. with $a = 12,\ d = 7$ $\therefore\ 61 = 12 + (n-1)\times 7$ $\Rightarrow\ n = 8$	1 ½
14.	**Case Study—2** Gadisar Lake is located in the Jaisalmer district of Rajasthan. It was built by the King of Jaisalmer and rebuilt by Gadsi Singh in 14th century. The lake has many Chhatris. One of them is shown below :  Observe the picture. From a point A h m above from water level, the angle of elevation of top of Chhatri (point B) is 45° and angle of depression of its reflection in water (point C) is 60°. If the height of Chhatri above water level is (approximately) 10 m, then (a) draw a well-labelled figure based on the above information; (b) find the height (h) of the point A above water level. (Use $\sqrt{3} = 1{\cdot}73$)	
Sol.	(a)  Correct Figure	2

	(b) $\tan 45° = 1 = \frac{10-h}{x}$ $\Rightarrow x = 10 - h$ ... (i) $\tan 60° = \sqrt{3} = \frac{10+h}{x}$ $\Rightarrow x = \frac{10+h}{\sqrt{3}}$ ... (ii) Solving (i) and (ii) $10(\sqrt{3}-1) = h(\sqrt{3}+1)$ $\Rightarrow h = \frac{10(\sqrt{3}-1)^2}{2}$ = 2·67 m or 2.7m	½ ½ 1

* * *

Series : PPQQC/2

SET ~ 2

प्रश्न–पत्र कोड
Q.P. Code **30/2/2**

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 **16** हैं ।	(I)	Please check that this question paper contains **16** printed pages.
(II)	प्रश्न–पत्र में दाहिने हाथ की ओर दिए गए प्रश्न–पत्र कोड को छात्र उत्तर–पुस्तिका के मुख–पृष्ठ पर लिखें ।	(II)	Q.P. Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(III)	कृपया जाँच कर लें कि इस प्रश्न–पत्र में **14** प्रश्न हैं ।	(III)	Please check that this question paper contains **14** questions.
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	**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 ।	(V)	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) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

*निर्धारित समय : **2** घण्टे* | *अधिकतम अंक : **40***

*Time allowed : **2** hours* | *Maximum Marks : **40***

सामान्य निर्देश :

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । **सभी** प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – खण्ड-**क**, **ख** तथा **ग** ।*

(iii) *खण्ड-**क** में **6** प्रश्न (प्र.सं. **1** से **6** तक) प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) *खण्ड-**ख** में **4** प्रश्न (प्र.सं. **7** से **10** तक) प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) *खण्ड-**ग** में **4** प्रश्न (प्र.सं. **11** से **14** तक) प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में **दो** प्रकरण आधारित प्रश्न भी शामिल हैं ।*

(vi) *कैलकुलेटर के उपयोग की अनुमति नहीं है ।*

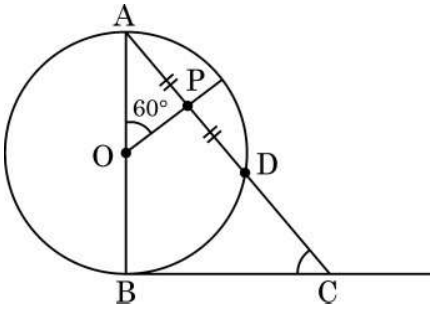
*

खण्ड – क

प्रश्न संख्या **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।

1. विमाओं 11 सेमी × 7 सेमी × 7 सेमी वाले धातु से बने एक ठोस घनाभ को पिघलाकर, त्रिज्या $\frac{7}{2}$ सेमी के 'n' ठोस गोले बनाये गये । n का मान ज्ञात कीजिए ।

2. (क) आकृति-1 में, केन्द्रबिंदु O वाले वृत्त का व्यास AB है । BC, बिंदु B पर खींची गयी एक स्पर्श-रेखा है । यदि OP, जीवा AD को समद्विभाजित करता है और $\angle AOP = 60°$ हो, तो $m\angle C$ ज्ञात कीजिए ।



आकृति-1

अथवा

General Instructions :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This Question Paper is divided into 3 Sections – **Section A, B** and **C**.*

(iii) *Section–**A** comprises of **6** questions (Q. Nos. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) *Section–**B** comprises of **4** questions (Q. Nos. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) *Section–**C** comprises of **4** questions (Q. Nos. **11** to **14**) of **4** marks each. An internal choice has been provided in **one** question. It also contains **two** case study based questions.*

(vi) *Use of calculator is not permitted.*

SECTION – A

Question Numbers **1** to **6** carry **2** marks each.

1. A solid piece of metal in the form of a cuboid of dimensions 11 cm × 7 cm × 7 cm is melted to form 'n' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of n.

2. (a) In Fig. 1, AB is diameter of a circle centered at O. BC is tangent to the circle at B. If OP bisects the chord AD and $\angle AOP = 60°$, then find $m\angle C$.

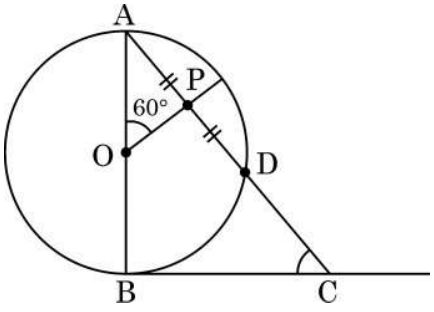
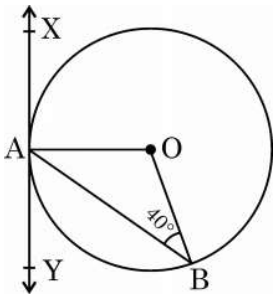


Fig. 1

OR

(ख) आकृति-2 में, XAY केन्द्रबिंदु O वाले वृत्त पर खींची गयी स्पर्श-रेखा है । यदि $\angle ABO = 40°$ है, तो $m\angle BAY$ तथा $m\angle AOB$ ज्ञात कीजिए ।



आकृति-2

3. (क) समान्तर श्रेढ़ी $-\frac{11}{2}, -3, -\frac{1}{2}, \ldots$ में कौन सा पद $\frac{49}{2}$ है ?

अथवा

(ख) a तथा b के ऐसे मान ज्ञात कीजिए कि संख्याएँ

a, 7, b, 23

समांतर श्रेढ़ी में हों ।

4. एक समांतर श्रेढ़ी का nवाँ पद $a_n = 5 - 2n$ द्वारा प्रदत्त है । इस श्रेढ़ी के प्रथम 20 पदों का योग ज्ञात कीजिए ।

5. द्विघात समीकरण $x^2 - 2ax + (a^2 - b^2) = 0$ को x के लिये हल कीजिए ।

(b) In Fig. 2, XAY is a tangent to the circle centered at O. If $\angle ABO = 40°$, then find $m\angle BAY$ and $m\angle AOB$.

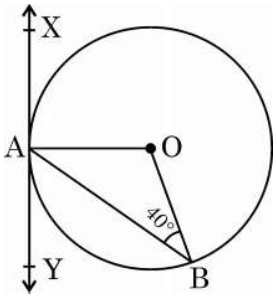


Fig. 2

3. (a) Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, \ldots$ is $\frac{49}{2}$?

OR

(b) Find a and b so that the numbers

a, 7, b, 23 are in A.P.

4. Find the sum of first 20 terms of an A.P. whose n^{th} term is given as $a_n = 5 - 2n$.

5. Solve the quadratic equation : $x^2 - 2ax + (a^2 - b^2) = 0$ for x.

6. निम्नलिखित बारंबारता बंटन का बहुलक 55 है । x का मान ज्ञात कीजिए ।

वर्ग :	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
बारंबारता :	10	7	x	15	10	12

खण्ड – ख

प्रश्न संख्या **7** से **10** तक प्रत्येक प्रश्न के **3** अंक हैं ।

7. एक विद्यालय की कक्षा X के 50 विद्यार्थियों की ऊँचाइयों का सर्वेक्षण किया गया तथा निम्न आँकड़े प्राप्त हुये :

ऊँचाई (सेमी में)	130-135	135-140	140-145	145-150	150-155	155-160
विद्यार्थियों की संख्या	4	11	12	7	10	6

विद्यार्थियों की माध्यक ऊँचाई ज्ञात कीजिए ।

6. If mode of the following frequency distribution is 55, then find the value of x.

Class :	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency :	10	7	x	15	10	12

SECTION – B

Question Numbers from **7** to **10** carry **3** marks each.

7. Heights of 50 students of class X of a school are recorded and following data is obtained :

Height (in cm) :	130-135	135-140	140-145	145-150	150-155	155-160
Number of Students :	4	11	12	7	10	6

Find the median height of the students.

8. (क) निम्नलिखित बारंबारता बंटन का माध्य 25 है । f का मान ज्ञात कीजिए ।

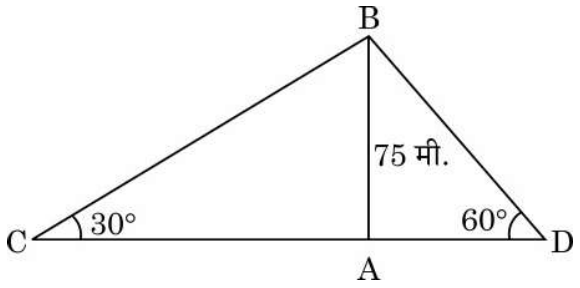
वर्ग :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
बारंबारता :	5	18	15	f	6

अथवा

(ख) कल्पित माध्य विधि की सहायता से निम्नलिखित आँकड़ों का माध्य ज्ञात कीजिए :

वर्ग :	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
बारंबारता :	8	7	10	13	12

9. 75 मी ऊँची पहाड़ी (cliff) के दोनों ओर खड़े दो व्यक्ति पहाड़ी के शिखर के उन्नयन कोण 30° तथा 60° देखते हैं । दोनों व्यक्तियों के बीच की दूरी ज्ञात कीजिए ।



आकृति 3

10. 3 सेमी त्रिज्या के एक वृत्त पर ऐसी दो स्पर्श-रेखाओं की रचना कीजिए जो परस्पर 60° के कोण पर झुकी हों ।

8. (a) The mean of the following frequency distribution is 25. Find the value of f.

Class :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency :	5	18	15	f	6

OR

(b) Find the mean of the following data using assumed mean method :

Class :	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency :	8	7	10	13	12

9. Two men on either side of a cliff 75 m high observe the angles of elevation of the top of the cliff to be 30° and 60°. Find the distance between the two men.

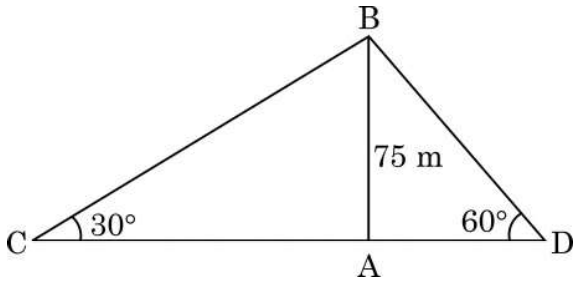


Fig. 3

10. Construct a pair of tangents to a circle of radius 3 cm which are inclined to each other at an angle of 60°.

खण्ड – ग

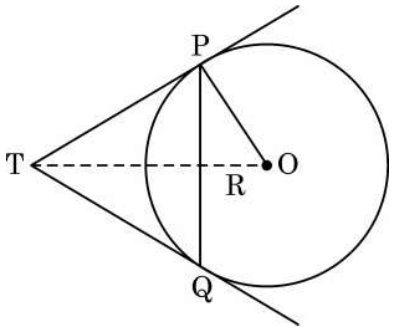
प्रश्न संख्या **11** से **14** तक प्रत्येक प्रश्न के **4** अंक हैं ।

11. (क) दो संख्याओं का योग 34 है । एक संख्या में से 3 घटाने पर तथा दूसरी संख्या में 2 जोड़ने पर इन दो संख्याओं का गुणनफल 260 आता है । संख्याएँ ज्ञात कीजिए ।

अथवा

(ख) एक समकोण त्रिभुज के कर्ण की लम्बाई (सेमी में) सबसे छोटी भुजा की लंबाई के दुगुने से 6 सेमी अधिक है । तीसरी भुजा की लम्बाई सबसे छोटी भुजा के तीन गुने से 6 सेमी कम हो, तो त्रिभुज की विमायें ज्ञात कीजिए ।

12. आकृति 4 में, 5 सेमी त्रिज्या के एक वृत्त की 8 सेमी लंबी एक जीवा PQ है । P और Q पर स्पर्श-रेखाएँ परस्पर एक बिंदु T पर मिलती हैं । TP की लम्बाई ज्ञात कीजिए ।



आकृति 4

SECTION – C

Question Numbers from **11** to **14** carry **4** marks each.

11. (a) The sum of two numbers is 34. If 3 is subtracted from one number and 2 is added to another, the product of these two numbers becomes 260. Find the numbers.

OR

(b) The hypotenuse (in cm) of a right angled triangle is 6 cm more than twice the length of the shortest side. If the length of third side is 6 cm less than thrice the length of shortest side, then find the dimensions of the triangle.

12. In Fig. 4, PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at P and Q meet at a point T. Find the length of TP.

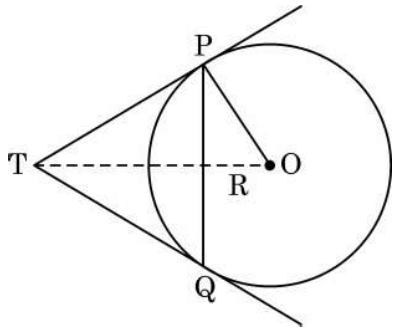


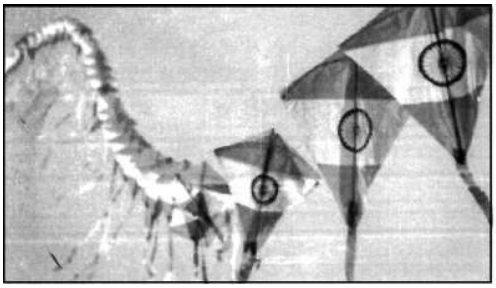
Fig. 4

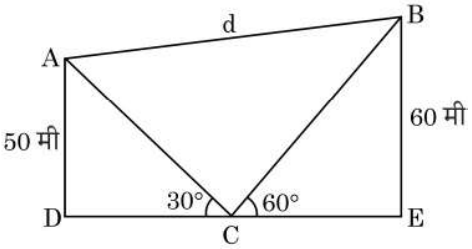
13. **प्रकरण अध्ययन – 1 :**

पतंग महोत्सव

वर्ष के अलग–अलग समय पर, कई देशों में पतंग उड़ाने का त्योहार मनाया जाता है । भारत में, प्रत्येक वर्ष 14 जनवरी अन्तर्राष्ट्रीय पतंग दिवस के रूप में मनाया जाता है । इस दिन दुनियाभर से लोग भारत आते हैं और भिन्न–भिन्न प्रकार की पतंगों को उड़ाने का मज़ा लेते हैं ।

नीचे दिए गए चित्र में तीन पतंगों को एक साथ उड़ते हुये देखा जा सकता है ।





आकृति 5

आकृति 5 में, एक आदमी के हाथ (बिन्दु C) से दो पतंगों (बिन्दु A तथा बिन्दु B) के उन्नयन कोण क्रमशः 30° तथा 60° हैं । यदि AD = 50 मी तथा BE = 60 मी हो, तो

(1) पतंगों A तथा B में प्रयुक्त धागे की लम्बाई ज्ञात कीजिए (मानें कि धागे एकदम खिंचे हुए हैं) **2**

(2) बिन्दु A तथा B के बीच की दूरी 'd' ज्ञात कीजिए । **2**

13. **Case Study – 1 :**

Kite Festival

Kite festival is celebrated in many countries at different times of the year. In India, every year 14th January is celebrated as International Kite Day. On this day many people visit India and participate in the festival by flying various kinds of kites.

The picture given below, shows three kites flying together.

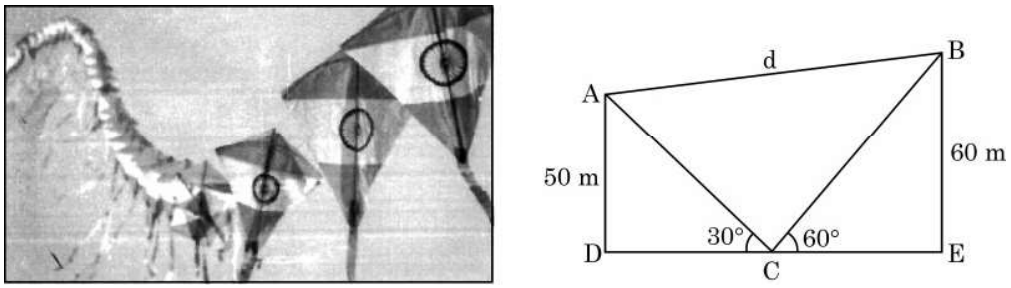


Fig. 5

In Fig. 5, the angles of elevation of two kites (Points A and B) from the hands of a man (Point C) are found to be 30° and 60° respectively. Taking AD = 50 m and BE = 60 m, find

(1) the lengths of strings used (take them straight) for kites A and B as shown in the figure. **2**

(2) the distance 'd' between these two kites **2**

14. **प्रकरण अध्ययन – 2 :**

सर्कस एक प्रकार का मनोरंजन का साधन है जिसमें कलाबाज़, जोकर आदि अपने–अपने करतब दिखाते हैं । लगभग 250 वर्ष पहले सर्कस खुले मैदानों में आयोजित किया जाता था परन्तु आजकल तंबूओं में आयोजित किया जाता है ।

एक ऐसा ही तंबू बेलन के आकार का है जिस पर एक शंकु अध्यारोपित है । यदि बेलनाकार भाग की ऊँचाई तथा व्यास क्रमशः 9 मी तथा 30 मी हैं तथा शंकु की ऊँचाई 8 मी है जबकि शंकु का व्यास बेलन के व्यास के समान है, तो

(1) तंबू को बनाने में उपयोग हुए कैनवस का क्षेत्रफल ज्ञात कीजिए । **3**

(2) ₹ 200 प्रति वर्ग मी की दर से खरीदे गये कैनवस की लागत ज्ञात कीजिए, यदि तंबू बनाने में 30 वर्ग मी कैनवस सिलाई में बरबाद हो गया है । **1**

14. **Case Study – 2**

A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents.

One such 'Circus Tent' is shown below.

The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find

(1) the area of the canvas used in making the tent; **3**

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq m, if 30 sq m canvas was wasted during stitching. **1**

*

Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

Marking Scheme: MATHEMATICS (Standard) (Subject Code : 041)

[Paper Code : 30/2/2]

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 Newspaper/ Website, etc., may invite action under IPC.**''

3. Evaluation is to be done as per instruction 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 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, marks should be awarded.**

4. 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. 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.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer '7' be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. 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.

7. 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.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday 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).

12. 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 a reply
    - Wrong transfer of marks from the inside pages of the answer book to the title page
    - Wrong questionwise 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
    - 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 7 for incorrect answer).
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. 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.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME

Secondary School Examination Term–II, 2022

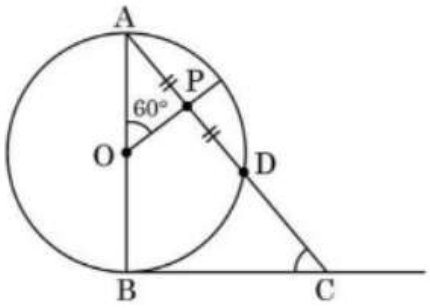
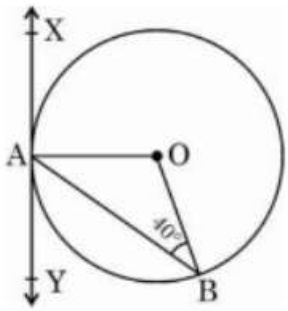
MATHEMATICS (Standard) (Subject Code : 041)

[Paper Code : 30/2/2]

Instructions **:**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
2. 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.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.	A solid piece of metal in the form of a cuboid of dimensions 11 cm × 7 cm × 7 cm is melted to form 'n' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of n.	
Sol	$n \times \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3 = 11 \times (7)^2$	1
	$\Rightarrow n = 3$	1

2.a	In Fig. 1, AB is diameter of a circle centered at O. BC is tangent to the circle at B. If OP bisects the chord AD and $\angle AOP = 60°$, then find $m\angle C$.  **Fig. 1**	
Sol	$\because AP = PD \Rightarrow OP \perp AD$ $\therefore \angle OAP = 30°$ Also $\angle ABC = 90°$ $\Rightarrow \angle C = 60°$	½ ½ ½ ½
	Or	
b.	In Fig. 2, XAY is a tangent to the circle centered at O. If $\angle ABO = 40°$, then find $m\angle BAY$ and $m\angle AOB$.  **Fig. 2**	
Sol	$OA = OB \Rightarrow \angle OAB = 40°$ $OA \perp AY \Rightarrow \angle BAY = 50°$ $\angle AOB = 180° - 80° = 100°$	½ ½ 1
3. a	Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, \ldots$ is $\frac{49}{2}$?	1
Sol	Here $a = \frac{-11}{2}$, $d = \frac{5}{2}$, $a_n = \frac{49}{2}$	

b	$\frac{49}{2}=\frac{-11}{2}+(n-1)\frac{5}{2}$	½
	$\Rightarrow n=13$	½
	Or	
	Find a and b so that the numbers	
	a, 7, b, 23 are in A.P.	
Sol	Numbers are in AP	
	$Therefore,\ a+b=14$ and $2b=30$	½+½
	$\Rightarrow b=15,\ a=-1$	½+½
4.	Find the sum of first 20 terms of an A.P. whose n^{th} term is given as $a_n = 5-2n$.	
Sol	$a_1=5-2=3$	½
	$a_{20}=5-40=-35$	½
	$S_{20}=\frac{20}{2}(3-35)=-320$	1
5.	Solve the quadratic equation : $x^2-2ax+(a^2-b^2)=0$ for x.	
Sol	D=$4b^2$	½
	$x=\frac{2a\pm 2b}{2}$	½
	$\Rightarrow x=a+b,\ a-b$	1
6.	If mode of the following frequency distribution is 55, then find the value of x.	

Class :	0 – 15	15 – 30	30 – 45	45 – 60	60 – 75	75 – 90
Frequency :	10	7	x	15	10	12

Sol	Modal class is 45–60	½
	Therefore, $55=45+15\times\frac{15-x}{30-x-10}$	1

	$\Rightarrow x = 5$	½
	SECTION—B	
7.	Heights of 50 students of class X of a school are recorded and following data is obtained :	

Height (in cm) :	130-135	135-140	140-145	145-150	150-155	155-160
Number of Students :	4	11	12	7	10	6

Find the median height of the students.

Sol

Class	*f*	*cf*
130–135	4	4
135–140	11	15
140–145	**12**	**27**
145–150	7	34
150–155	10	44
155–160	6	50 = *N*

Correct table — 1

Median class is 140–145 — ½

$$\text{Median} = 140 + \frac{5}{12}(25 - 15) \quad 1$$

$$= 144 \cdot 1 \text{ (approx)} \quad ½$$

Hence, Median height is 144.1cm

8.a The mean of the following frequency distribution is 25. Find the value of f.

Class :	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency :	5	18	15	f	6

Sol

Class	***x***	***f***	***fx***
0–10	5	5	25
10–20	15	18	270
20–30	25	15	375
30–40	35	f	$35f$
40–50	45	6	270
		$44 + f$	$940 + 35f$

Correct table — 1½

$$\bar{x} = 25 = \frac{940 + 35f}{44 + f}$$ — 1

$$\Rightarrow f = 16$$ — ½

b

Or

Find the mean of the following data using assumed mean method :

Class :	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency :	8	7	10	13	12

Sol

Class	***x***	***f***	$d = x - 12 \cdot 5$	***fd***
0–5	2·5	8	–10	–80
5–10	7·5	7	–5	–35
10–15	12·5	10	0	0
15–20	17·5	13	5	65
20–25	22·5	12	10	120
		50		70

Correct table — 1½

$$\bar{x} = 12 \cdot 5 + \frac{70}{50}$$ — 1

$$= 13 \cdot 9$$ — ½

9. Two men on either side of a cliff 75 m high observe the angles of elevation of the top of the cliff to be 30° and 60°. Find the distance between the two men.

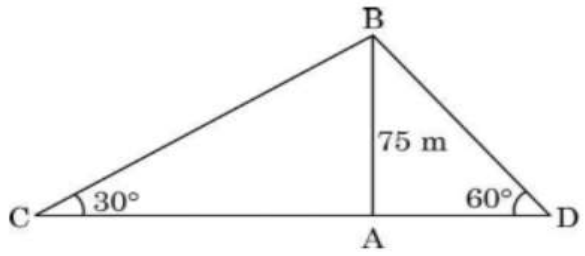


Fig. 3

Sol

$$\tan 30° = \frac{1}{\sqrt{3}} = \frac{75}{AC}$$

$$\Rightarrow AC = 75\sqrt{3}\ \text{m} \ldots \ldots \ldots (i)$$ — 1

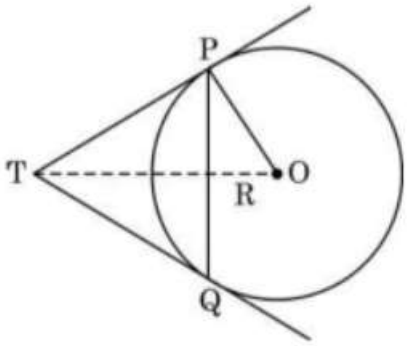
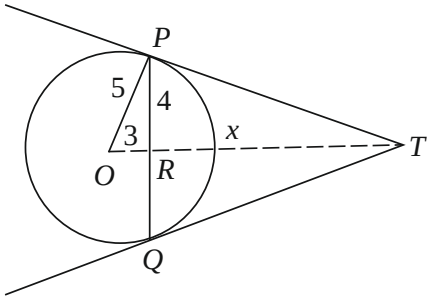
$$\tan 60° = \sqrt{3} = \frac{75}{AD}$$

$$\Rightarrow AD = 25\sqrt{3}\ \text{m} \ldots \ldots \ldots (ii)$$ — 1

Adding *(i)* and *(ii)*

	$CD = (75\sqrt{3} + 25\sqrt{3})$m $= 100\sqrt{3}$ m	1
10.	Construct a pair of tangents to a circle of radius 3 cm which are inclined to each other at an angle of 60°.	
Sol	Correct construction	3

	SECTION—C	
11. a	The sum of two numbers is 34. If 3 is subtracted from one number and 2 is added to another, the product of these two numbers becomes 260. Find the numbers.	
Sol	Let the numbers be x and y. $x + y = 34$ ... ... *(i)* $(x-3)(y+2) = 260$ ... ... *(ii)* Using *(i)* and *(ii)* $x^2 - 39x + 368 = 0$ $\Rightarrow (x-23)(x-16) = 0$ $\Rightarrow x = 23, 16$ Therefore $y = 11$ *when* $x = 23$ and $y = 18$ *when* $x = 16$ Hence numbers are 23, 11 or 16, 18	½ ½ 1 1 1
	OR	
b	The hypotenuse (in cm) of a right angled triangle is 6 cm more than twice the length of the shortest side. If the length of third side is 6 cm less than thrice the length of shortest side, then find the dimensions of the triangle.	
Sol	Let the shortest side be x cm $\therefore$ Hypotenuse is $2x+6$ cm and other side is $3x-6$ cm Hence $(2x+6)^2 = x^2 + (3x-6)^2$ $\Rightarrow 6x^2 - 60x = 0$	1 1½

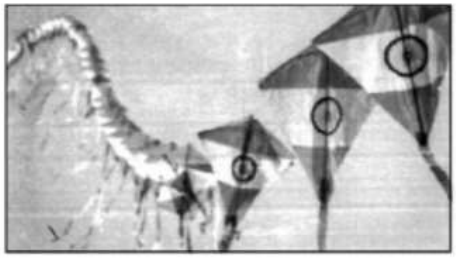
	$\Rightarrow x = 10$ Dimensions of the triangle are 10 cm, 24 cm and 26 cm.	½ 1
12.	In Fig. 4, PQ is a chord of length 8 cm of a circle of radius 5 cm. tangents at P and Q meet at a point T. Find the length of TP.  **Fig. 4**	
Sol	 $OP = 5$ cm, $PR = \frac{1}{2}PQ = 4$ cm $\therefore \Delta PRT \cong \Delta QRT$ $\Rightarrow TR \perp PQ$ $\therefore OR = \sqrt{25-16} = 3$ cm Let $TR = x \Rightarrow x^2 + 16 = TP^2$ ... ... *(i)* Also $(3+x)^2 - 25 = TP^2$ ... ... *(ii)* Solving *(i)* and *(ii)* $x = \frac{16}{3}$ cm $\therefore TP = \sqrt{\frac{256}{9} + 16} = \frac{20}{3}$ cm	1 1 1 ½ ½

13. **Case Study – 1 :**

Kite Festival

Kite festival is celebrated in many countries at different times of the year. In India, every year 14th January is celebrated as International Kite Day. On this day many people visit India and participate in the festival by flying various kinds of kites.

The picture given below, shows three kites flying together.



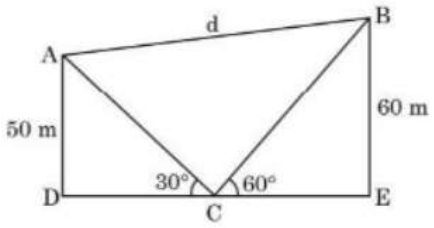


Fig. 5

In Fig. 5, the angles of elevation of two kites (Points A and B) from the hands of a man (Point C) are found to be 30° and 60° respectively. Taking AD = 50 m and BE = 60 m, find

(1) the lengths of strings used (take them straight) for kites A and B as shown in the figure.

(2) the distance 'd' between these two kites

Sol

1. $\sin 60° = \frac{\sqrt{3}}{2} = \frac{60}{BC}$

$\Rightarrow BC = 40\sqrt{3}$ m — 1

$\sin 30° = \frac{1}{2} = \frac{50}{AC}$

$\Rightarrow AC = 100$ m — 1

2. Since DE is a straight line therefore $\angle ACB = 90°$

$\therefore d^2 = AC^2 + BC^2 = (100)^2 + (40\sqrt{3})^2$ — 1½

$\Rightarrow d = \sqrt{14800} or 20\sqrt{37} m$ — ½

14. **Case Study – 2**

A 'circus' is a company of performers who put on shows of acrobats, clowns etc. to entertain people started around 250 years back, in open fields, now generally performed in tents.

One such 'Circus Tent' is shown below.

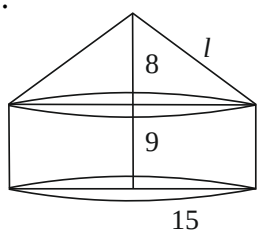
The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find

(1) the area of the canvas used in making the tent;

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq m, if 30 sq m canvas was wasted during stitching.

Sol

1. $l = \sqrt{8^2 + 15^2} = 17$ m — 1



Area of canvas used = $\pi rl + 2\pi rh$

$= \pi r(l + 2h)$

$= \frac{22}{7} \times 15(17 + 18)$ — 1½

$= 1650 \text{ m}^2$ — ½

2. Canvas used = $1650 + 30 = 1680 \text{ m}^2$ — ½

$\therefore$ cost of canvas used = 200 × 1680

= ₹ 3,36,000 — ½

* * *

Series PPQQB/3

SET~2

प्रश्न-पत्र कोड
Q.P. Code **30/3/2**

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 **11** हैं ।	(I)	Please check that this question paper contains **11** printed pages.
(II)	प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।	(II)	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.
(III)	कृपया जाँच कर लें कि इस प्रश्न-पत्र में **14** प्रश्न हैं ।	(III)	Please check that this question paper contains **14** questions.
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	**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 ।	(V)	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 : 2 घण्टे | अधिकतम अंक : 40

Time allowed : 2 hours | Maximum Marks : 40

सामान्य निर्देश :

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

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । सभी प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – **खण्ड क, ख** तथा **ग** ।*

(iii) ***खण्ड क** में **6** प्रश्न (प्र.सं. **1** से **6**) हैं, जिनमें प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) ***खण्ड ख** में **4** प्रश्न (प्र.सं. **7** से **10**) हैं, जिनमें प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) ***खण्ड ग** में **4** प्रश्न (प्र.सं. **11** से **14**) हैं, जिनमें प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में दो प्रकरण अध्ययन आधारित प्रश्न भी शामिल हैं ।*

(vi) *कैल्कुलेटर के उपयोग की अनुमति **नहीं** है ।*

खण्ड क

*प्रश्न संख्या **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।*

1. दिए गए बारंबारता बंटन का बहुलक ज्ञात कीजिए : *2*

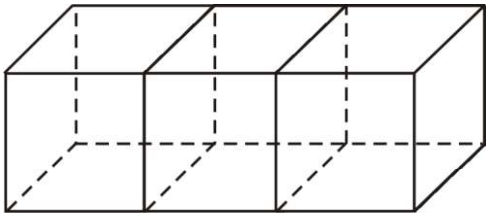
वर्ग	*बारंबारता*
15 – 25	6
25 – 35	11
35 – 45	22
45 – 55	23
55 – 65	14
65 – 75	5

2. 'n' के किस मान के लिए, समांतर श्रेढ़ियों 9, 7, 5, ... और 15, 12, 9, ... के nवें पद समान होंगे ? *2*

3. (क) 7 सेमी व्यास के बेलनाकार बर्तन, जिसमें कुछ पानी भरा है, में 1·4 सेमी व्यास के 150 गोलाकार संगमरमर के टुकड़े इस प्रकार डाले जाते हैं कि पूर्ण रूप से पानी में डूब जाएँ । बेलनाकार बर्तन में जल स्तर की वृद्धि ज्ञात कीजिए । *2*

अथवा

(ख) आकृति 1 में, 6 सेमी भुजा वाले तीन घन चित्रानुसार परस्पर जोड़ दिए गए हैं । इस प्रकार बने घनाभ का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए । *2*



आकृति 1

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This question paper is divided into **three** sections – **Sections A**, **B** and **C**.*

(iii) ***Section A** comprises of **6** questions (Q.no. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) ***Section B** comprises of **4** questions (Q.no. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) ***Section C** comprises of **4** questions (Q.no. **11** to **14**) of **4** marks each. Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *Use of calculator is **not** permitted.*

SECTION A

*Question numbers **1** to **6** carry **2** marks each.*

1. Find the mode of the given frequency distribution : *2*

Class	*Frequency*
15 – 25	6
25 – 35	11
35 – 45	22
45 – 55	23
55 – 65	14
65 – 75	5

2. For what value of 'n', are the n^{th} terms of the APs : 9, 7, 5, ... and 15, 12, 9, ... the same ? *2*

3. (a) 150 spherical marbles, each of diameter 1·4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel. *2*

OR

(b) Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid. *2*

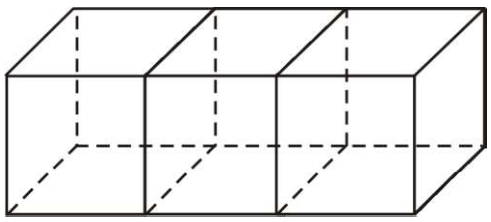


Figure 1

4. (क) m के किस मान के लिए द्विघात समीकरण

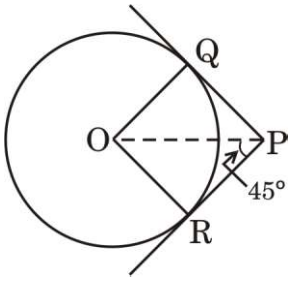
$$mx^2 - 2(m-1)x + (m+2) = 0$$

के मूल वास्तविक तथा बराबर होंगे ? *2*

अथवा

(ख) एक आयताकार खेत का विकर्ण उसकी छोटी भुजा से 60 मी. अधिक लम्बा है । यदि बड़ी भुजा छोटी भुजा से 30 मी. अधिक हो, तो खेत की भुजाएँ ज्ञात कीजिए । *2*

5. आकृति 2 में, केंद्र O वाले वृत्त पर PQ तथा PR स्पर्श-रेखाएँ खींची गई हैं । यदि $\angle OPR = 45°$ है, तो सिद्ध कीजिए कि ORPQ एक वर्ग है । *2*



आकृति 2

6. एक समांतर श्रेढ़ी में $d = 5$ तथा $a_{20} = 135$ है । इस श्रेढ़ी के प्रथम 20 पदों का योगफल ज्ञात कीजिए । *2*

खण्ड ख

*प्रश्न संख्या **7** से **10** तक प्रत्येक प्रश्न के **3** अंक हैं ।*

7. आँधी आने से एक पेड़ टूट जाता है और टूटा हुआ भाग इस तरह मुड़ जाता है कि पेड़ का शिखर जमीन को छूने लगता है और इसके साथ 30° का कोण बनाता है । जहाँ से पेड़ टूटा है उस बिन्दु की भूमि से ऊँचाई 2 मी. है । पेड़ की पूरी ऊँचाई ज्ञात कीजिए । *3*

8. एक परीक्षा में 100 विद्यार्थियों द्वारा प्राप्तांकों का प्रतिशत नीचे दिया गया है :

प्राप्तांक प्रतिशत	*विद्यार्थियों की संख्या*
30 – 35	16
35 – 40	14
40 – 45	18
45 – 50	20
50 – 55	18
55 – 60	12
60 – 65	2

प्राप्तांक प्रतिशत का माध्यक ज्ञात कीजिए । *3*

4. (a) For what value of m, the quadratic equation

$$mx^2 - 2(m-1)x + (m+2) = 0$$

has two real and equal roots ? *2*

OR

(b) The diagonal of a rectangular field is 60 metres more than the shorter side. If the longer side is 30 metres more than the shorter side, find the sides of the field. *2*

5. In Figure 2, PQ and PR are tangents to the circle centred at O. If $\angle OPR = 45°$, then prove that ORPQ is a square. *2*

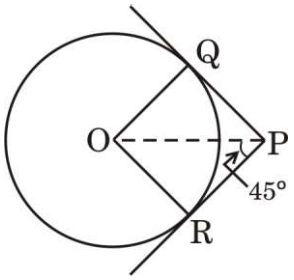


Figure 2

6. Find the sum of first 20 terms of an AP in which d = 5 and $a_{20} = 135$. *2*

SECTION B

*Question numbers **7** to **10** carry **3** marks each.*

7. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with it. The height of the breaking point from the ground is 2 m. Find the total height of the tree. *3*

8. The percentage of marks obtained by 100 students in an examination are given below :

Percentage of Marks	*Number of Students*
30 – 35	16
35 – 40	14
40 – 45	18
45 – 50	20
50 – 55	18
55 – 60	12
60 – 65	2

Determine the median percentage of marks. *3*

9. (क) 8 सेमी लम्बा एक रेखाखंड AB खींचिए । इस रेखाखंड AB पर बिंदु P को इस प्रकार अंकित कीजिए कि AP : PB = 1 : 5 हो । *3*

अथवा

(ख) 3 सेमी त्रिज्या का एक वृत्त खींचिए । केंद्र बिंदु से 6 सेमी की दूरी पर स्थित बिंदु P से वृत्त पर दो स्पर्श-रेखाओं PA तथा PB की रचना कीजिए । *3*

10. एक राष्ट्रीय उद्यान में 50 जंगली जानवरों के भार (kg में) रिकॉर्ड किए गए तथा निम्न आँकड़े प्राप्त हुए :

भार (kg में)	*जानवरों की संख्या*
100 – 110	4
110 – 120	12
120 – 130	23
130 – 140	8
140 – 150	3

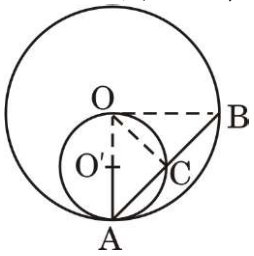
कल्पित माध्य विधि द्वारा जानवरों का माध्य भार (kg में) ज्ञात कीजिए । *3*

खण्ड ग

*प्रश्न संख्या **11** से **14** तक प्रत्येक प्रश्न के **4** अंक हैं ।*

11. भूमि के एक बिंदु से एक हवाई जहाज का उन्नयन कोण 60° है । 30 सेकण्ड की उड़ान के बाद भूमि के उसी बिंदु से उन्नयन कोण 30° हो जाता है । यदि हवाई जहाज $3000\sqrt{3}$ मी. की समान ऊँचाई पर उड़ रहा हो, तो हवाई जहाज की गति ज्ञात कीजिए । *4*

12. (क) आकृति 3 में, केंद्र O और O′ वाले दो वृत्त जो क्रमशः त्रिज्या 2r और r के हैं, एक-दूसरे को आंतरिक रूप से A पर स्पर्श करते हैं । बड़े वृत्त की एक जीवा AB छोटे वृत्त को C पर मिलती है । दर्शाइए कि C, AB को समद्विभाजित करता है । *4*



आकृति 3

अथवा

9. (a) Draw a line segment AB of length 8 cm and locate a point P on AB such that AP : PB = 1 : 5. *3*

OR

(b) Draw a circle of radius 3 cm. From a point P lying outside the circle at a distance of 6 cm from its centre, construct two tangents PA and PB to the circle. *3*

10. The weights (in kg) of 50 wild animals of a National Park were recorded and the following data was obtained :

Weight (in kg)	*Number of animals*
100 – 110	4
110 – 120	12
120 – 130	23
130 – 140	8
140 – 150	3

Find the mean weight (in kg) of animals, using assumed mean method. *3*

SECTION C

*Question numbers **11** to **14** carry **4** marks each.*

11. The angle of elevation of an aeroplane from a point on the ground is 60°. After a flight of 30 seconds, the angle of elevation from the same point becomes 30°. If the aeroplane is flying at a constant height of $3000\sqrt{3}$ m, find the speed of the aeroplane. *4*

12. (a) In Figure 3, two circles with centres at O and O′ of radii 2r and r respectively, touch each other internally at A. A chord AB of the bigger circle meets the smaller circle at C. Show that C bisects AB. *4*

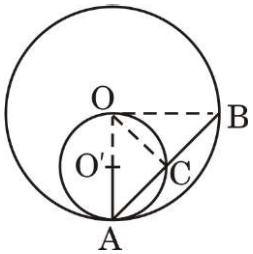
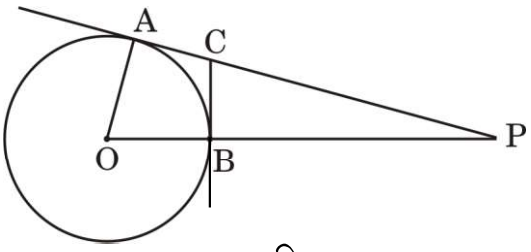


Figure 3

OR

(ख) आकृति 4 में, 5 सेमी त्रिज्या वाले वृत्त का केंद्र बिंदु O है । PA तथा BC क्रमशः बिंदु A तथा B पर खींची गई स्पर्श-रेखाएँ हैं । यदि OP = 13 सेमी है, तो स्पर्श-रेखाओं PA तथा BC की लम्बाई ज्ञात कीजिए । *4*



आकृति 4

प्रकरण अध्ययन – 1

13. नीचे दिए गए चित्र में, एक परिवार ने अपने घर के पीछे की जमीन पर एक आयताकार स्विमिंग पूल बनवाया । पूल के चारों तरफ x मी. चौड़ा सीमेंट (कंक्रीट) से बना पक्का फुटपाथ है । फुटपाथ की बाहरी भुजाएँ 7 मी. तथा 12 मी. हैं । पूल का क्षेत्रफल 36 वर्ग मी. है ।

(क) उपर्युक्त सूचना के आधार पर x के पदों में एक द्विघात समीकरण बनाइए । *2*

(ख) पूल के चारों ओर बने फुटपाथ की चौड़ाई ज्ञात कीजिए । *2*

(b) In Figure 4, O is centre of a circle of radius 5 cm. PA and BC are tangents to the circle at A and B respectively. If OP = 13 cm, then find the length of tangents PA and BC. *4*

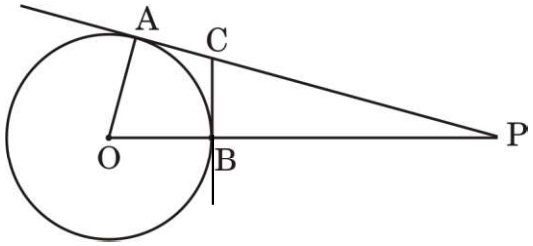
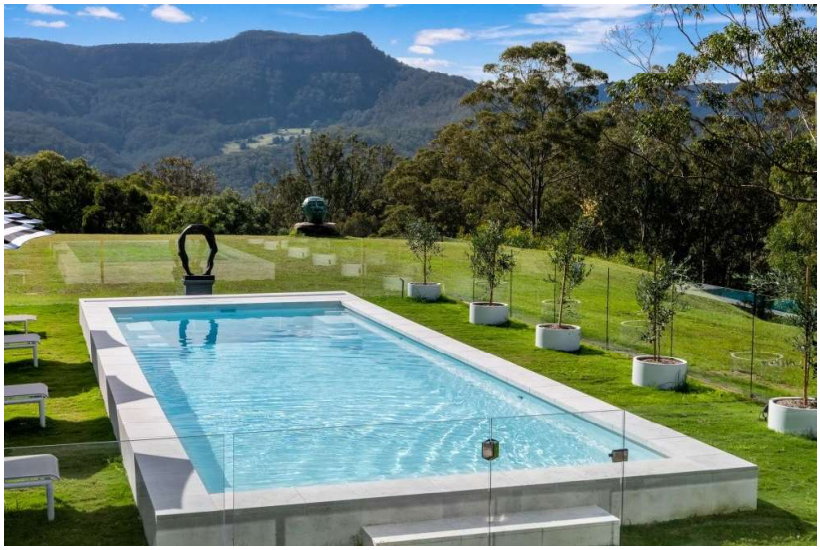


Figure 4

Case Study – 1

13. In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width x m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.



(a) Based on the information given above, form a quadratic equation in terms of x. *2*

(b) Find the width of the sidewalk around the pool. *2*

प्रकरण अध्ययन – 2

14. जॉन ने अपनी छोटी बहन के लिए अपने दोस्तों के साथ मिलकर जन्मदिन की पार्टी की योजना बनाई । बच्चों ने तय किया कि जन्मदिन पार्टी की टोपियाँ वो खुद बनाएँगे तथा केक बेकरी की दुकान से खरीदेंगे । इन दोनों चीज़ों के लिए उन्होंने निम्न विमाएँ निश्चित कीं :

केक : 24 सेमी व्यास तथा 14 सेमी ऊँचाई का बेलनाकार

टोपी : शंक्वाकार टोपी जिसकी ऊँचाई 24 सेमी तथा वृत्ताकार आधार की परिधि 44 सेमी है ।

उपर्युक्त सूचना के आधार पर, निम्नलिखित प्रश्नों के उत्तर दीजिए :

(क) इस प्रकार की 4 टोपियाँ बनाने में कितना वर्ग सेमी कागज प्रयुक्त होगा ? *2*

(ख) बेकरी की दुकान पर केक भार (0·5 kg, 1 kg, 1·5 kg, इत्यादि) के हिसाब से मिलता है । अपनी आवश्यकतानुसार बच्चों को कितना केक ऑर्डर करना चाहिए, यदि 650 सेमी^{3} केक 100 g केक के बराबर है ? *2*

Case Study – 2

14. John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions :

Cake : Cylindrical shape with diameter 24 cm and height 14 cm.

Cap : Conical shape with base circumference 44 cm and height 24 cm.

Based on the above information, answer the following questions :

(a) How many square cm paper would be used to make 4 such caps ? *2*

(b) The bakery shop sells cakes by weight (0·5 kg, 1 kg, 1·5 kg, etc.). To have the required dimensions, how much cake should they order, if 650 cm^3 equals 100 g of cake ? *2*

Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)

[Paper Code : 30/3/2]

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 Newspaper/ Website, etc., may invite action under IPC.**''

3. Evaluation is to be done as per instruction 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 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, marks should be awarded.**

4. 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. 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.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer '7' be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. 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.

7. 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.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday 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).

12. 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 a reply
    - Wrong transfer of marks from the inside pages of the answer book to the title page
    - Wrong questionwise 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
    - 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 7 for incorrect answer).
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. 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.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME

Secondary School Examination TERM–II, 2022

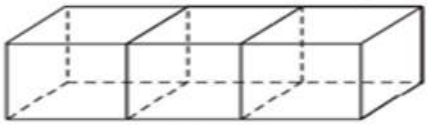
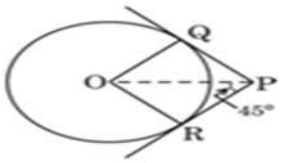
MATHEMATICS (Standard) (Subject Code–041)

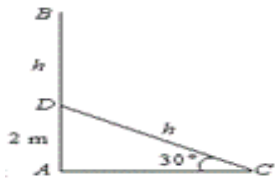
[Paper Code : 30/3/2]

General Instructions:

1. *The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.*
2. *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.*
3. *Alternative methods are accepted. Proportional marks are to be awarded.*
4. *If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.*
5. *A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.*
6. *Separate Marking Scheme for all the three sets has been given.*
7. *As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.*

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.	**Find the mode of the given frequency distribution** *Class* | *Frequency* 15 – 25 | 6 25 – 35 | 11 35 – 45 | 22 45 – 55 | 23 55 – 65 | 14 65 – 75 | 5	
Sol.	Modal class is $45-55$	½
	Mode $= 45+10\times\dfrac{23-22}{46-22-14}$	1
	$=46$	½
2.	**For what value of 'n', are the n^{th} terms of the APs : 9, 7, 5, ... and 15, 12, 9, ... the same ?**	
Sol.	nth terms are $9+(n-1)(-2)$ and $15+(n-1)(-3)$	½+½
	Thus, $9-2(n-1)=15-3(n-1)$ gives $n=7$	1

3.	(a) **150 spherical marbles, each of diameter 1·4 cm, are dropped in a cylindrical vessel of diameter 7 cm containing some water, and are completely immersed in water. Find the rise in the level of water in the cylindrical vessel.**	
Sol.	Let h cm be the rise in the water level. Then	
	$\pi(3\cdot5)^2 h = \frac{4\pi}{3}(0\cdot7)^3(150)$	1½
	$\Rightarrow h = 5\cdot6$ cm	½
	Or	
	(b) **Three cubes of side 6 cm each, are joined as shown in Figure 1. Find the total surface area of the resulting cuboid.**  *Figure 1*	
Sol.	Length of cuboid=18cm	½
	Total surface area of solid =2(18x6+6x6+6x18)	1
	$= 504\ \text{cm}^2$	½
4.	(a) **For what value of m, the quadratic equation** $mx^2 - 2(m-1)x + (m+2) = 0$ **has two real and equal roots ?**	
Sol.	For equal roots $4(m-1)^2 - 4m(m+2) = 0$	1
	$\Rightarrow m = \frac{1}{4}$	1
	Or	
	(b) **The diagonal of a rectangular field is 60 metres more than the shorter side. If the longer side is 30 metres more than the shorter side, find the sides of the field.**	
Sol.	Let shorter side be x m	
	$(x+60)^2=x^2+(x+30)^2$	½
	$x^2-60x-2700=0$	½
	x=90	½
	Sides are 90m,120m,150m	½
5.	**In Figure 2, PQ and PR are tangents to the circle centred at O. If ∠ OPR = 45°, then prove that ORPQ is a square.**  *Figure 2*	

Sol.	$\Delta OQP \cong \Delta ORP \Rightarrow \angle QPO = \angle RPO = 45°$ $\Rightarrow \angle QPR = 90°$. Also $\angle OQP = \angle ORP = \angle QOR = 90°$ Also $OR = OQ$. This implies $ORPQ$ is a square.	½ 1 ½
6.	**Find the sum of first 20 terms of an AP in which d = 5 and a_{20} = 135.**	
Sol.	$a + 19 \times 5 = 135 \Rightarrow a = 40$ $S_{20} = \frac{20}{2}[80 + 19 \times 5] = 1750$	1 1
	SECTION—B	
7.	A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with it. The height of the breaking point from the ground is 2 m. Find the total height of the tree.	
Sol.	 Correct Figure Let h be the height of broken part $\sin 30° = \frac{1}{2} = \frac{2}{h}$ $\Rightarrow h = 4$ Total height of tree = $4 + 2 = 6$ m	1 1 ½ ½

8. The percentage of marks obtained by 100 students in an examination are given below :

Percentage of Marks	*Number of Students*
30 – 35	16
35 – 40	14
40 – 45	18
45 – 50	20
50 – 55	18
55 – 60	12
60 – 65	2

Determine the median percentage of marks.

Sol.

Class	*f*	*Cf*
30–35	16	16
35–40	14	30
40–45	18	48
45–50	20	68
50–55	18	86
55–60	12	98
60–65	2	100 = *N*

Correct Table — 1

Median class is 45–50 — ½

Median = $45+\frac{5}{20}(50-48)$ — 1

$= 45 \cdot 5$ — ½

Therefore, Median percentage of marks is 45.5

9. (a) Draw a line segment AB of length 8 cm and locate a point P on AB such that AP : PB = 1 : 5.

OR

(b) Draw a circle of radius 3 cm. From a point P lying outside the circle at a distance of 6 cm from its centre, construct two tangents PA and PB to the circle.

Sol. Correct construction — 3

10. The weights (in kg) of 50 wild animals of a National Park were recorded and the following data was obtained :

Weight (in kg)	*Number of animals*
100 – 110	4
110 – 120	12
120 – 130	23
130 – 140	8
140 – 150	3

Find the mean weight (in kg) of animals, using assumed mean method.

Sol.

Class	x	f	$d = x - 125$	fd
100–110	105	4	–20	–80
110–120	115	12	–10	–120
120–130	125	23	0	0
130–140	135	8	10	80
140–150	145	3	20	60
		50		–60

Correct Table — 2

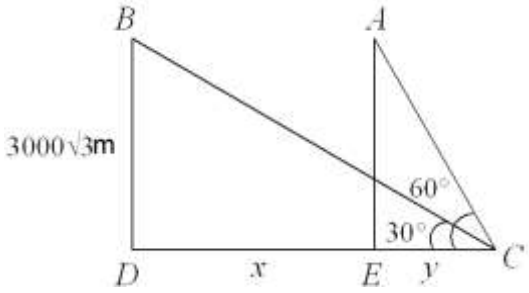
$\bar{x} = 125 - \frac{60}{50} = 123 \cdot 8$ — 1

∴ Mean Weight of animals is 123.8kg

SECTION—C

11. The angle of elevation of an aeroplane from a point on the ground is 60°. After a flight of 30 seconds, the angle of elevation from the same point becomes 30°. If the aeroplane is flying at a constant height of $3000\sqrt{3}$ m, find the speed of the aeroplane.

Sol.



Correct Figure — 1

Let points *A* and *B* represent the position of aeroplane.

$\tan 60° = \frac{3000\sqrt{3}}{y} = \sqrt{3}$

$\Rightarrow y = 3000$ — 1

$\tan 30° = \frac{1}{\sqrt{3}} = \frac{3000\sqrt{3}}{x + y}$

$\Rightarrow x = 6000$ — 1

∴ Distance = 6000 m, time = 30 sec

Speed $= \frac{6000}{30} = 200$ m/s. — 1

12. (a) In Figure 3, two circles with centres at O and O′ of radii 2r and r respectively, touch each other internally at A. A chord AB of the bigger circle meets the smaller circle at C. Show that C bisects AB.

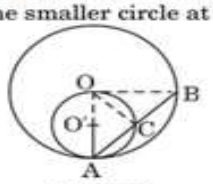


Figure 3

Sol. $\angle OCA = 90°$ — 1

In Δs OCA and OCB, we have

$OA = OB,\ \angle OCA = \angle OCB = 90°$

and $OC = OC$ — 2

So, $\Delta OCA \cong \Delta OCB$ — 1

$\Rightarrow AC = BC \Rightarrow C$ bisects AB

Or

(b) In Figure 4, O is centre of a circle of radius 5 cm. PA and BC are tangents to the circle at A and B respectively. If OP = 13 cm, then find the length of tangents PA and BC.

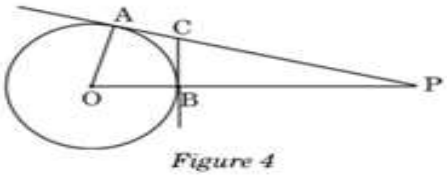
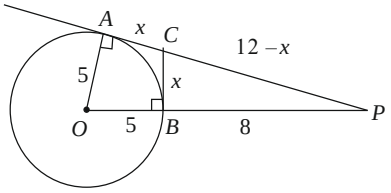


Figure 4

Sol.



$PA^2 = OP^2 - OA^2 = 169 - 25$ — 1

$\Rightarrow PA = 12$ cm

Let $BC = x \Rightarrow AC = x$ — 1

$\therefore\ PC = 12 - x$

$OP \perp BC \Rightarrow (12 - x)^2 = x^2 + 8^2$ — 1

$\Rightarrow x = \frac{10}{3}$ cm

$\therefore$BC= $\frac{10}{3}$ cm — 1

13.

Case Study – 1

In the picture given below, one can see a rectangular in-ground swimming pool installed by a family in their backyard. There is a concrete sidewalk around the pool of width x m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.

(a) Based on the information given above, form a quadratic equation in terms of x.

(b) Find the width of the sidewalk around the pool.

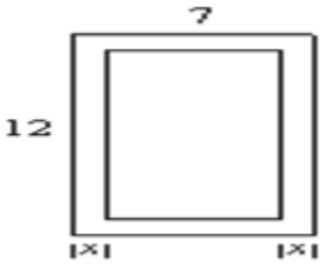
Sol.

(a) Sides of pool are $7-2x$ and $12-2x$ ½

Area = 36 sq. m

$\Rightarrow (7-2x)(12-2x)=36$ 1

$\Rightarrow 4x^2-38x+48=0$ ½



(b) $\Rightarrow 2x^2-19x+24=0$

$\Rightarrow (x-8)(2x-3)=0$ 1

$x \neq 8\text{m} \therefore x=\frac{3}{2}\text{ m}$

$\therefore$ width of sidewalk around the pool is $\frac{3}{2}$ m 1

14.

Case Study – 2

John planned a birthday party for his younger sister with his friends. They decided to make some birthday caps by themselves and to buy a cake from a bakery shop. For these two items, they decided the following dimensions :

Cake : Cylindrical shape with diameter 24 cm and height 14 cm.

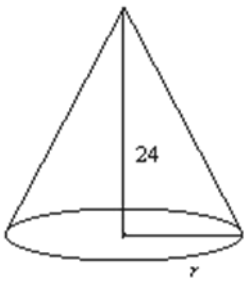
Cap : Conical shape with base circumference 44 cm and height 24 cm.

Based on the above information, answer the following questions :

(a) How many square cm paper would be used to make 4 such caps ?

(b) The bakery shop sells cakes by weight (0·5 kg, 1 kg, 1·5 kg, etc.). To have the required dimensions, how much cake should they order, if 650 cm^3 equals 100 g of cake ?

Sol.



(a) $2\pi r = 44$

$\Rightarrow r = 7$ ½

Therefore, $l = \sqrt{24^2 + 7^2} = 25$ cm ½

Paper required for 4 caps = $4 \times \pi r l$

$= 4 \times \frac{22}{7} \times 7 \times 25$

$= 2200 cm^2$ or $700\ \pi\ cm^2$ 1

(b) Volume of cake $= \frac{22}{7}$ X 12 X 12 X 14

$= 6336\ cm^3$ 1

6336 cm^3 is nearest to 6500 cm^3

Now, $650\ cm^3 = 100$ g

$\Rightarrow 6500\ cm^3 = 1$ kg

∴ 1 kg cake should be ordered. 1

* * *

Series : PPQQD/4

SET ~ 2

प्रश्न–पत्र कोड
Q.P. Code **30/4/2**

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 **12** हैं ।	(I)	Please check that this question paper contains **12** printed pages.
(II)	प्रश्न–पत्र में दाहिनें हाथ की ओर दिए गए प्रश्न–पत्र कोड को छात्र उत्तर–पुस्तिका के मुख–पृष्ठ पर लिखें ।	(II)	Q.P. Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(III)	कृपया जाँच कर लें कि इस प्रश्न–पत्र में **14** प्रश्न हैं ।	(III)	Please check that this question paper contains **14** questions.
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	**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 ।	(V)	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) – सैद्धान्तिक

MATHEMATICS (Standard) – Theory

*निर्धारित समय : **2** घण्टे* | *अधिकतम अंक : **40***

*Time allowed : **2** hours* | *Maximum Marks : **40***

सामान्य निर्देश :

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । **सभी** प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – खण्ड-**क**, **ख** तथा **ग** ।*

(iii) *खण्ड-**क** में **6** प्रश्न (प्र.सं. **1** से **6** तक) **2-2** अंक के हैं । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) *खण्ड-**ख** में **4** प्रश्न (प्र.सं. **7** से **10** तक) **3-3** अंक के हैं । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) *खण्ड-**ग** में **4** प्रश्न (प्र.सं. **11** से **14** तक) **4-4** अंक के हैं । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में **दो** प्रकरण आधारित प्रश्न भी शामिल हैं ।*

(vi) *प्रश्न-पत्र में कोई समग्र विकल्प नहीं है । हालाँकि, कुछ प्रश्नों में आंतरिक विकल्प का चयन प्रदान किया गया है । इस प्रकार के प्रश्नों में से केवल एक ही प्रश्न का उत्तर लिखिए ।*

(vii) *कैलकुलेटर के उपयोग की अनुमति नहीं है ।*

*

खण्ड – क

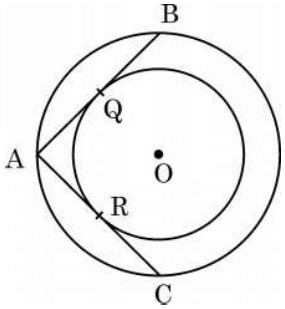
प्र.सं. **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।

1. (क) यदि द्विघात समीकरण $ky^2 - 11y + (k - 23) = 0$ के मूलों का योगफल, मूलों के गुणनफल से $\frac{13}{21}$ अधिक है, तो k का मान ज्ञात कीजिए । **2**

अथवा

(ख) यदि $x = -2$, द्विघात समीकरणों $ax^2 + x - 3a = 0$ और $x^2 + bx + b = 0$ का सार्व हल (common solution) है, तो a^2b का मान ज्ञात कीजिए । **2**

2. आकृति-1 में, केन्द्र O वाले दो सकेंद्रीय वृत्त दिए गए हैं । यदि बड़े वृत्त के एक बिन्दु A से, छोटे वृत्त पर ARC और AQB दो स्पर्श-रेखाएँ हैं, तो AC की लम्बाई ज्ञात कीजिए, यदि AQ = 5 सेमी है । **2**



आकृति – 1

General Instructions :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This Question Paper is divided into 3 Sections – Section **A, B** and **C**.*

(iii) *Section–**A** comprises of **6** questions (Q. Nos. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) *Section–**B** comprises of **4** questions (Q. Nos. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) *Section–**C** comprises of **4** questions (Q. Nos. **11** to **14**) of **4** marks each. An Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *There is no overall choice in the question paper. However, internal choice has been provided in some questions. Attempt any one choice in such questions.*

(vii) *Use of calculator is not permitted.*

SECTION – A

Question Numbers **1** to **6** carry **2** marks each.

1. (a) If the sum of the roots of the quadratic equation $ky^2 - 11y + (k - 23) = 0$ is $\frac{13}{21}$ more than the product of the roots, then find the value of k. **2**

OR

(b) If $x = -2$ is the common solution of quadratic equations $ax^2 + x - 3a = 0$ and $x^2 + bx + b = 0$, then find the value of a^2b. **2**

2. In Fig. 1, there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm. **2**

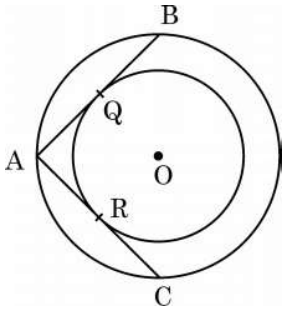


Fig. – 1

3. (क) एक लंब वृत्तीय बेलन का वक्र पृष्ठीय क्षेत्रफल 176 वर्ग सेमी और आयतन 1232 घन सेमी है । बेलन की ऊँचाई कितनी है ? **2**

अथवा

(ख) 21 सेमी भुजा वाले एक ठोस घन में से बड़े से बड़ा गोला काटकर निकाला गया है । गोले का आयतन ज्ञात कीजिए । **2**

4. यदि एक समांतर श्रेढ़ी का पहला पद 5, अंतिम पद 15 और पहले n पदों का योग 30 हो, तो n का मान ज्ञात कीजिए । **2**

5. निम्न बारम्बारता बंटन का बहुलक ज्ञात कीजिए : **2**

वर्ग	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50
बारंबारता	12	5	14	8	9

6. यदि निम्न बारंबारता बंटन का माध्य 18 है, तो लुप्त बारंबारता 'f' ज्ञात कीजिए : **2**

वर्ग	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
बारंबारता	3	6	9	13	f	5	4

खण्ड – ख

प्रश्न संख्या **7** से **10** तक प्रत्येक प्रश्न के **3** अंक हैं ।

7. (क) 'p' का मान ज्ञात कीजिए जिसके लिए द्विघात समीकरण $p(x-4)(x-2)+(x-1)^2=0$ के मूल वास्तविक तथा बराबर हैं । **3**

अथवा

(ख) यदि आरूष ने, 35 अंकों वाली, गणित की एक परीक्षा में 8 अधिक अंक प्राप्त किए होते, तो इन अंकों का 7 गुना उसके वास्तविक अंकों के वर्ग से 4 कम होता । उसने इस परीक्षा में कितने अंक प्राप्त किए थे ? **3**

8. 4 सेमी त्रिज्या के एक वृत्त पर ऐसी दो स्पर्श–रेखाओं की रचना कीजिए, जो परस्पर $60°$ के कोण पर झुकी हों । **3**

9. 100 मीटर चौड़ी नदी के बीच में एक छोटा सा द्वीप है और द्वीप में एक ऊँचा पेड़ खड़ा है । P और Q नदी के दो किनारों पर और पेड़ की सीध में एक दूसरे के विपरीत बिंदु हैं । यदि P और Q से पेड़ के शीर्ष के उन्नयन कोण क्रमशः $30°$ और $45°$ हैं, तो पेड़ की ऊँचाई ज्ञात कीजिए । ($\sqrt{3}=1.732$ लीजिए) **3**

3. (a) The curved surface area of a right circular cylinder is 176 sq. cm and its volume is 1232 cu. cm. What is the height of the cylinder ? **2**

OR

(b) The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere. **2**

4. If the first term of an A.P. is 5, the last term is 15 and the sum of first n terms is 30, then find the value of n. **2**

5. For the following frequency distribution, find the mode : **2**

Class	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50
Frequency	12	5	14	8	9

6. If the mean of the following frequency distribution is 18, then find the missing frequency 'f'. **2**

Class	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Frequency	3	6	9	13	f	5	4

SECTION – B

Question Numbers **7** to **10** carry **3** marks each.

7. (a) Find the value of 'p' for which the quadratic equation $p(x - 4)(x - 2) + (x - 1)^2 = 0$ has real and equal roots. **3**

OR

(b) Had Aarush scored 8 more marks in a Mathematics test, out of 35 marks, 7 times these marks would have been 4 less than square of his actual marks. How many marks did he get in the test ? **3**

8. Construct a pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 60°. **3**

9. There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. P and Q are points directly opposite to each other on two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively 30° and 45°, find the height of the tree. (Use $\sqrt{3} = 1.732$) **3**

10. एक समांतर श्रेढ़ी में, पहले n पदों का योग $\frac{n}{2}(3n + 5)$ है । इसका 25वाँ पद ज्ञात कीजिए । **3**

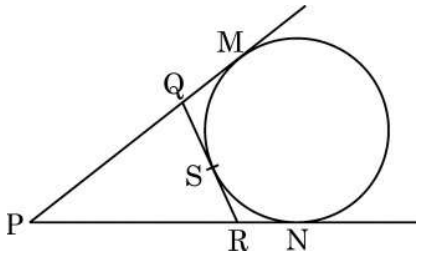
खण्ड – ग

प्रश्न संख्या **11** से **14** तक प्रत्येक प्रश्न के **4** अंक हैं ।

11. 8 मी ऊँचे भवन के शिखर से एक केबल टॉवर के शिखर का उन्नयन कोण $60°$ और इसके पाद का अवनमन कोण $45°$ है । टॉवर की ऊँचाई ज्ञात कीजिए । ($\sqrt{3} = 1.732$ लीजिए) **4**

12. (क) आकृति-2 में, यदि एक वृत्त, त्रिभुज PQR की एक भुजा QR को बिंदु S पर स्पर्श करता है और वर्धित भुजाओं PQ और PR को क्रमश: M और N पर स्पर्श करता है, तो सिद्ध कीजिए कि; **4**

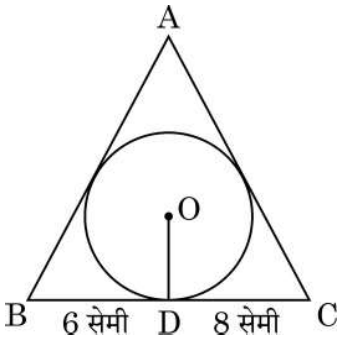
$$PM = \frac{1}{2}(PQ + QR + PR)$$



आकृति – 2

अथवा

(ख) आकृति 3 में 4 सेमी त्रिज्या वाले एक वृत्त के परिगत में एक त्रिभुज ABC इस प्रकार खींचा गया है कि रेखाखण्ड BD और DC, जिनमें स्पर्श बिंदु D द्वारा BC विभाजित है, की लंबाइयाँ क्रमश: 6 सेमी तथा 8 सेमी हैं । यदि ΔABC का क्षेत्रफल 84 वर्ग सेमी है, तो भुजाओं AB तथा AC की लंबाइयाँ ज्ञात कीजिए । **4**



आकृति – 3

10. In an A.P., the sum of first n terms is $\frac{n}{2}(3n + 5)$. Find the 25^{th} term of the A.P. **3**

SECTION – C

Question Numbers **11** to **14** carry **4** marks each.

11. From the top of an 8 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Take $\sqrt{3} = 1.732$). **4**

12. (a) In Fig.-2, if a circle touches the side QR of ΔPQR at S and extended sides PQ and PR at M and N, respectively, then **4**

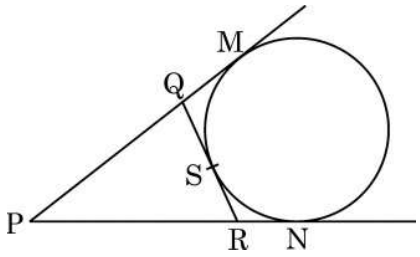


Fig. 2

prove that $PM = \frac{1}{2}(PQ + QR + PR)$

OR

(b) In Fig. 3, a triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 6 cm and 8 cm respectively. If the area of ΔABC is 84 cm^2, find the lengths of sides AB and AC. **4**

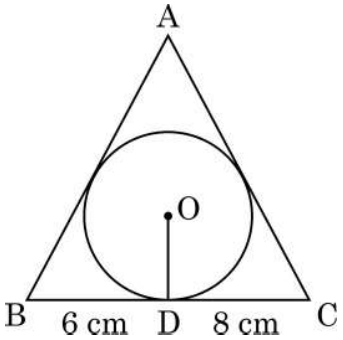
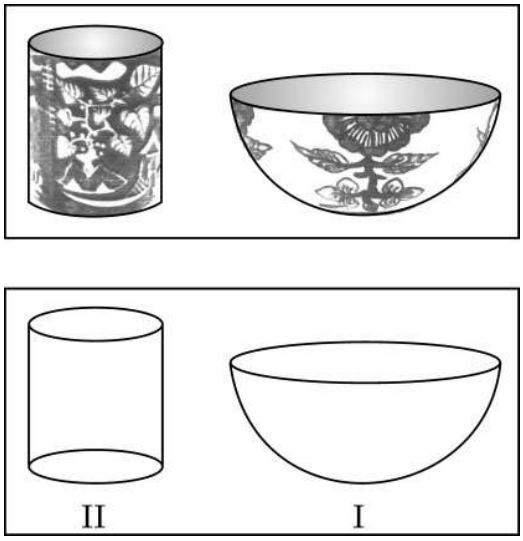


Fig. 3

प्रकरण अध्ययन – 1

13. खुर्जा भारतीय राज्य उत्तर प्रदेश का एक शहर है जो मिट्टी के बर्तनों के लिए प्रसिद्ध है । खुर्जा पॉटरी पारंपरिक भारतीय मिट्टी के बर्तनों का काम है जिसने विभिन्न प्रकार के चाय के सेट, क्रॉकरी और सिरेमिक टाइल के कामों के साथ भारतीयों के साथ-साथ विदेशियों को भी आकर्षित किया है । देश में उपयोग किए जाने वाले सिरेमिक के एक बड़े हिस्से की आपूर्ति खुर्जा द्वारा की जाती है और इसे "सिरेमिक टाऊन" भी कहा जाता है ।

बुलंदशहर के निजी स्कूलों में से एक के कक्षा 10 के छात्रों के लिए खुर्जा में शैक्षिक भ्रमण का आयोजन किया । यात्रा को लेकर छात्र बहुत उत्साहित थे । खुर्जा के मिट्टी से बनी कुछ वस्तुएँ नीचे दिखाई गई हैं ।



छात्रों को इन वस्तुओं के आकार बहुत दिलचस्प लगे और वे उन्हें आसानी से गणितीय आकृतियों जैसे गोला, अर्ध-गोला, बेलन इत्यादि से जोड़ सकते थे । छात्रों के साथ आए गणित के शिक्षक ने निम्नलिखित प्रश्न पूछे :

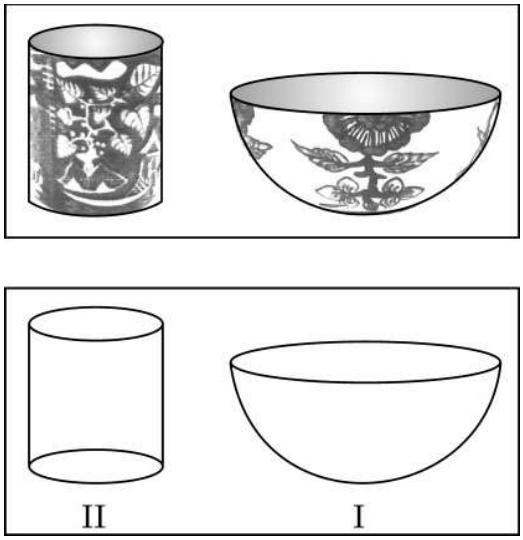
(a) अर्धगोलाकार कटोरे I, जो पूरा पानी से भरा है, की आंतरिक त्रिज्या 9 सेमी है और बेलनाकार जार II की त्रिज्या और ऊँचाई क्रमश: 1.5 सेमी और 4 सेमी हैं । यदि अर्धगोलाकार कटोरे का पूरा पानी बेलनाकार जारों में खाली करना हो, तो कितने बेलनाकार जारों की आवश्यकता होगी ? **2**

(b) यदि पानी से पूरे भरे हुए बेलनाकार जार में समान ऊँचाई और समान व्यास की एक शंक्वाकार कीप डुबाई जाये, तो जार से कितना पानी बाहर बह जाएगा ? **2**

Case Study – 1

13. Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.

One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.



Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc. Maths teacher who was accompanying the students asked following questions :

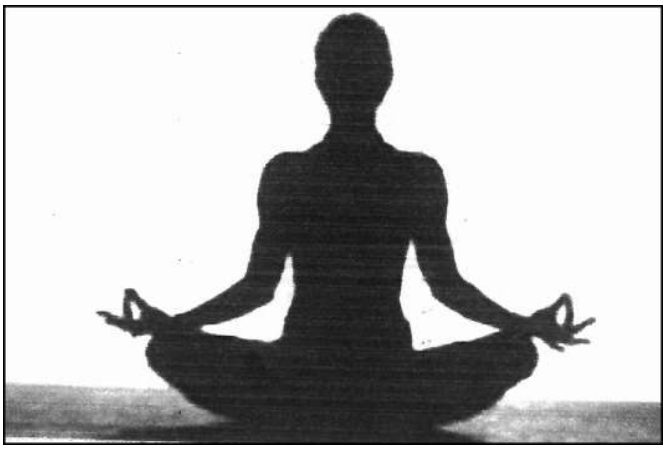
(a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ? **2**

(b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ? **2**

प्रकरण अध्ययन – 2

14. 'योग' एक प्राचीन अभ्यास है जो ध्यान और व्यायाम का एक रूप है । योग का अभ्यास करने से हम न केवल अपने शरीर को स्वस्थ बनाते हैं बल्कि आत्मिक शांति और मन की शांति भी प्राप्त करते हैं । अंतर्राष्ट्रीय योग दिवस 2015 से हर वर्ष 21 जून को मनाया जाता है ।

योग को बढ़ावा देने हेतु पुणे की ग्रीन पार्क सोसायटी ने अपनी सोसायटी में एक 7-दिवसीय योग शिविर का आयोजन किया । इस शिविर में नामांकित विभिन्न आयु वर्ग के लोगों की संख्या नीचे दी गई हैं :



आयु वर्ग	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
लोगों की संख्या	8	10	15	25	40	24	18

उपरोक्त के आधार पर, निम्न ज्ञात कीजिए :

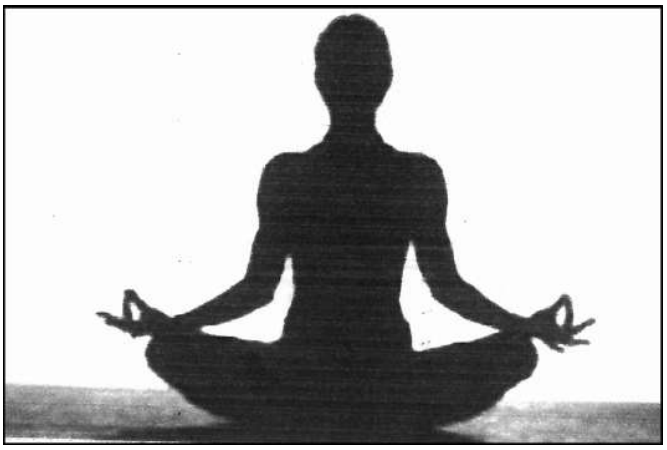
(a) शिविर में नामांकित विभिन्न आयु वर्ग के लोगों की माध्यक आयु ज्ञात कीजिए । **2**

(b) यदि आयु-वर्ग 65 – 75 में x अधिक लोगों ने शिविर में नामांकन कराया होता, तो माध्य आयु 58 वर्ष होती । x का मान ज्ञात कीजिए । **2**

Case Study – 2

14. Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015.

To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows :



Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
Number of People	8	10	15	25	40	24	18

Based on the above, find the following :

(a) Find the median age of people enrolled for the camp. **2**

(b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x. **2**

Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

Marking Scheme : MATHEMATICS (Standard) (Subject Code : 041)

[Paper Code : 30/4/2]

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 Newspaper/ Website, etc., may invite action under IPC.**''

3. Evaluation is to be done as per instruction 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 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, marks should be awarded.**

4. 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. 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.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer '7' be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. 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.

7. 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.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday 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).

12. 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 a reply
    - Wrong transfer of marks from the inside pages of the answer book to the title page
    - Wrong questionwise 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
    - 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 7 for incorrect answer).
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. 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.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME

Secondary School Examination TERM–II, 2022

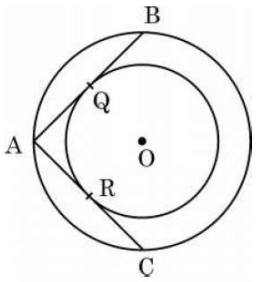
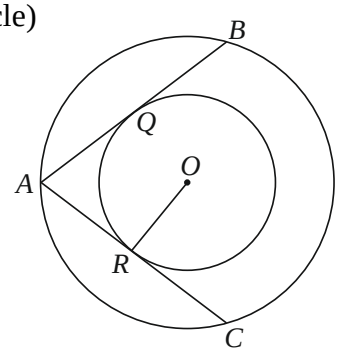
MATHEMATICS (Standard) (Subject Code–041)

[Paper Code : 30/4/2]

Instructions **:**

1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
2. 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.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION—A	
1.(a)	If the sum of the roots of the quadratic equation $ky^2 - 11y + (k - 23) = 0$ is $\frac{13}{21}$ more than the product of the roots, then find the value of k.	
Sol.	$ky^2 - 11y + (k-23) = 0$. Here $a = k$, $b = -11$, $c = k - 23$	
	Sum of roots = $\frac{11}{k}$	½
	Product of roots = $\frac{k-23}{k}$	½
	ATQ, $\frac{11}{k} = \frac{k-23}{k} + \frac{13}{21}$	½
	Solving, we get $k = 21$	½
	Or	
1.(b)	If $x = -2$ is the common solution of quadratic equations $ax^2 + x - 3a = 0$ and $x^2 + bx + b = 0$, then find the value of a^2b.	
Sol.	$x = -2$ is the common solution of $ax^2 + x - 3a = 0$ and $x^2 + bx + b = 0$.	
	$\therefore\ a(-2)^2 + (-2) - 3a = 0 \Rightarrow 4a - 2 - 3a = 0$	½
	$a = 2$	½

	And $(-2)^2 + b(-2) + b = 0 \Rightarrow 4 - 2b + b = 0 \Rightarrow b = 4$ $a^2b = 4\times4 = 16$	½ ½
2.	In Fig. 1, there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if AQ = 5 cm.  	
Sol.	$AQ = AR$ (tangents drawn from external point to the circle) $\therefore AR = 5$ cm Join OR $\therefore OR \perp AC$ (radius tangent) Now AC is the chord of larger circle and we know that perpendicular from the centre bisects the chord $\therefore AR = RC = 5$ cm $\Rightarrow$ AC = 5 + 5 = 10 cm  	½ ½ ½ ½
3.(a)	The curved surface area of a right circular cylinder is 176 sq cm and its volume is 1232 cu cm. What is the height of the cylinder ?	
Sol.	Let h be the height of cylinder CSA of cylinder = 176 $\Rightarrow 2\pi rh = 176$ ... (i) Volume of cylinder = 1232 $\Rightarrow \pi r^2 h = 1232$ on dividing, $\frac{\pi r^{\cancel{2}} h}{2\pi r h} = \frac{1232}{176}$ we get, $r = 14$ cm $\therefore (i) \Rightarrow 2\times\frac{22}{\cancel{7}}\times\cancel{14}^{2}\times h = 176$ $\Rightarrow h = 2$ cm	½ ½ ½ ½
	Or	
3.(b)	The largest sphere is carved out of a solid cube of side 21 cm. Find the volume of the sphere.	
Sol.	Diameter of sphere = side of cube = 21 cm $\therefore$ radius $r = \frac{21}{2}$ cm	½

	Volume of sphere $= \frac{4}{3}\pi r^3 = \frac{4}{3}\times\frac{22}{7}\times\frac{21}{2}\times\frac{21}{2}\times\frac{21}{2}$	1
	$= 4851\,\text{cm}^3$	½
4.	If the first term of an A.P. is 5, the last term is 15 and the sum of first n terms is 30, then find the value of n.	
Sol.	$a = 5$, last term $l = 15$	
	$S_n = 30 \Rightarrow \frac{n}{2}(a+l) = 30$	1
	$\Rightarrow \frac{n}{2}(5+15) = 30 \Rightarrow n = 3$	1
5.	For the following frequency distribution, find the mode :	

Class	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50
Frequency	12	5	14	8	9

Sol.

Class	25–30	30–35	35–40	40–45	45–50
Mode	12	5	14	8	9

Maximum frequency is 14

∴ Modal class is 35–40; $l = 35$ ½

$f_1 = 14$, $f_0 = 6$, $f_2 = 8$, $h = 5$

Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right)\times h$

$= 35 + \left(\frac{14-5}{28-13}\right)\times 5 = 35 + \frac{9\times 5}{15} = 38$ 1+½

6. If the mean of the following frequency distribution is 18, then find the missing frequency 'f'.

Class	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Frequency	3	6	9	13	f	5	4

Sol.

Class Interval	x_i	f_i	$x_i f_i$
11–13	12	3	36
13–15	14	6	84
15–17	16	9	144
17–19	18	13	234
19–21	20	f	$20f$
21–23	22	5	110
23–25	24	4	96
		$40 + f$	$704 + 20f$

1 for correct table

Mean = 18 $\Rightarrow \frac{\Sigma x_i f_i}{\Sigma f_i} = 18$

$\Rightarrow \frac{704 + 20f}{40 + f} = 18 \Rightarrow 704 + 20f = 720 + 18f$ ½

$20f - 18f = 720 - 704 \Rightarrow 2f = 16$

$f = 8$ ½

SECTION—B

7.(a) Find the value of 'p' for which the quadratic equation $p(x - 4)(x - 2) + (x-1)^2 = 0$ has real and equal roots.

Sol.

$p(x-4)(x-2) + (x-1)^2 = 0$

$p(x^2 - 6x + 8) + x^2 - 2x + 1 = 0$

$(p+1)x^2 - (6p+2)x + (8p+1) = 0$ ½

$a = p+1,\ b = 6p+2,\ c = 8p+1$

For real and equal roots,

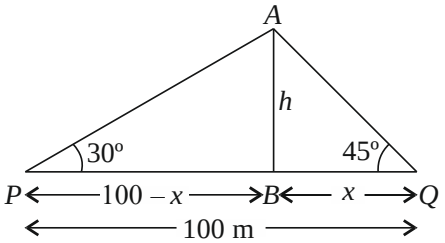
$\therefore D = 0 \Rightarrow b^2 - 4ac = 0$

$\Rightarrow \quad (6p+2)^2 - 4(p+1)(8p+1) = 0$ 1

$36p^2 + 24p + 4 - 4(8p^2 + 9p + 1) = 0$

$4p^2 - 12p = 0 \Rightarrow 4p(p-3) = 0$ 1

$\Rightarrow \quad p = 0, 3$ ½

	Or	
7.(b)	Had Aarush scored 8 more marks in a Mathematics test, out of 35 marks, 7 times these marks would have been 4 less than square of his actual marks. How many marks did he get in the test ?	
Sol.	Let actual marks be x	
	ATQ $\quad 7(x+8) = x^2 - 4$	1
	$x^2 - 7x - 60 = 0$	½
	$x^2 - 12x + 5x - 60 = 0$	
	$(x-12)(x+5) = 0$	1
	$x = 12,\ x = -5$ (rejecting)	½
	∴ Actual marks obtained by Aarush = 12	
8.	Construct a pair of tangents to a circle of radius 4 cm which are inclined to each other at an angle of 60°.	
Sol.	For Correct Construction	3
9.	There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. P and Q are points directly opposite to each other on two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively 30° and 45°, find the height of the tree. (Use $\sqrt{3} = 1.732$)	
Sol.	Correct Figure 	1
	Let AB = height of tree = h	
	$\angle APB = 30°,\ \angle AQB = 45°$	
	Let $BQ = x$	
	$\therefore PB = 100 - x$	
	In ΔABQ, $\tan 45° = \frac{h}{x} \Rightarrow h = x$	½
	In ΔABP, $\tan 30° = \frac{h}{100-x}$	½
	$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100-x} \Rightarrow 100 - x = h\sqrt{3}$	
	$100 - h = h\sqrt{3} \Rightarrow 100 = h(\sqrt{3}+1)$	
	$h = \frac{100}{\sqrt{3}+1} = \frac{100(\sqrt{3}-1)}{(\sqrt{3}+1)(\sqrt{3}-1)} = \frac{100(\sqrt{3}-1)}{(\sqrt{3})^2 - (1)^2}$	
	$h = \frac{\overset{50}{\cancel{100}}(\sqrt{3}-1)}{\cancel{2}} = 50(1\cdot732 - 1) = 36\cdot6$ m	½+½

10. In an A.P., the sum of first n terms is $\frac{n}{2}(3n + 5)$. Find the 25^{th} term of the A.P.

Sol. $S_n = \frac{3n^2}{2} + \frac{5_n}{2}$

$n = 1, S_1 = \frac{3}{2} + \frac{5}{2} = 4 \rightarrow$ 1st term a_1 ½

$n = 2, S_2 = \frac{3 \times 4}{2} + \frac{5(2)}{2} = 11$ (1st term + 2nd term) ½

$\therefore\ a_2 = S_2 - S_1 = 11 - 4 = 7$ ½

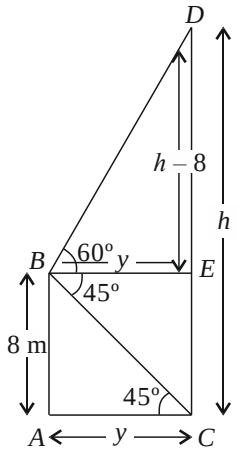
$d = a_2 - a_1 = 7 - 4 = 3$ ½

$a_{25} = a + 24d = 4 + 24(3) = 76$ 1

SECTION—C

11. From the top of an 8 m high building, the angle of elevation of the top of a cable tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower. (Take $\sqrt{3} = 1.732$).

Sol. Correct figure 1



Let AB = height of building = 8 m

Let CD = height of tower = h m

$\angle DBE = 60°$

$\angle ACB = \angle EBC = 45°$

$AC = BE = y$ (let)

In right ΔABC,

$\tan 45° = \frac{8}{AC}$

$1 = \frac{8}{AC}$

$\Rightarrow AC = 8$ m $\Rightarrow y = 8$ m 1

In right ΔBDE, $\tan 60° = \frac{h-8}{BE}$

$\sqrt{3} = \frac{h-8}{y} \Rightarrow \sqrt{3}y = h - 8$

$\sqrt{3}(8) = h - 8$ 1

$h = 8\sqrt{3} + 8 = 8(\sqrt{3} + 1)$ ½

$h = 8(1 \cdot 732 + 1) = 8(2 \cdot 732) = 21 \cdot 856$ m ½

$\therefore$ Height of tower = 21·856 m

12.(a) In Fig.-2, if a circle touches the side QR of ΔPQR at S and extended sides PQ and PR at M and N, respectively, then

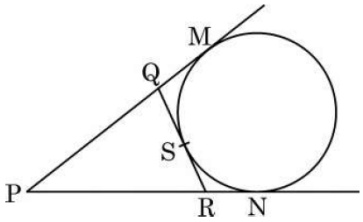


Fig. 2

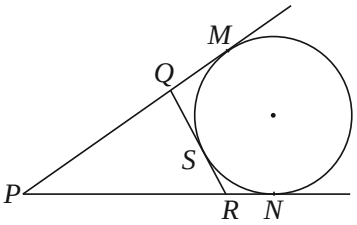
prove that PM = $\frac{1}{2}$(PQ + QR + PR)

Sol. We know that tangents drawn from the external point to the circle are equal

$\therefore\ QS = QM$ — 1

$RS = RN$

$PM = PN$



Now $2PM = PM + PN$ — 1

$= (PQ + QM) + (PR + RN)$ — ½

$= PQ + QS + PR + RS$

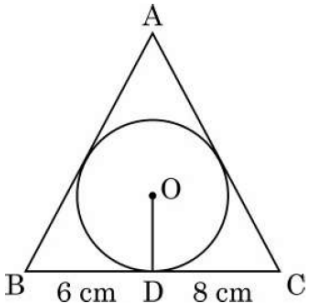
$= PQ + (QS + RS) + PR$

$= PQ + QR + PR$ — 1

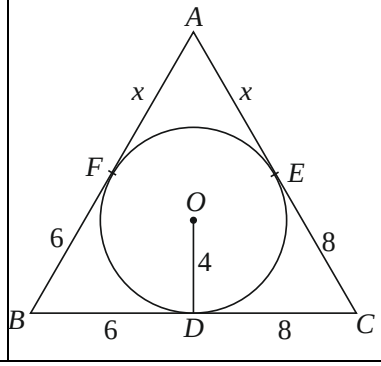
$\therefore$ PM $= \frac{1}{2}(PQ + QR + PR)$ — ½

Or

12.(b) In Fig. 3, a triangle ABC is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC into which BC is divided by the point of contact D are of lengths 6 cm and 8 cm respectively. If the area of ΔABC is 84 cm^2, find the lengths of sides AB and AC.



Sol.



$BF = BD = 6$ cm

$CE = DC = 8$ cm — 1

Let $AF = AE = x$ cm

$\Rightarrow AB = (6 + x)$ cm, $AC = (8 + x)$ cm & $BC = 14$ cm

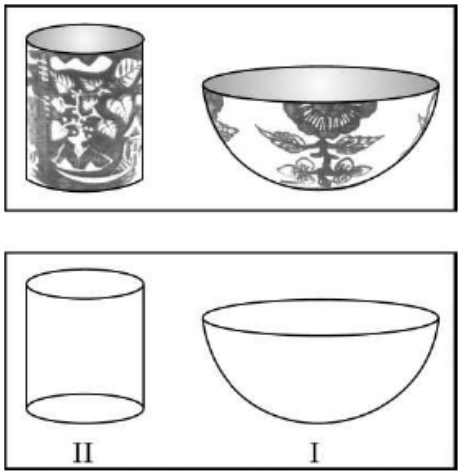
$\text{Ar}(\Delta ABC) = \frac{1}{2}[p] \cdot r = \frac{1}{2} \times (28 + 2x) \times 4 = 84$ — 1

$\Rightarrow 14 + x = 21 \Rightarrow x = 7$ cm — 1

$\Rightarrow AB = 13$ cm, $AC = 15$ cm — ½+½

13. Khurja is a city in the Indian state of Uttar Pradesh famous for the pottery. Khurja pottery is traditional Indian pottery work which has attracted Indians as well as foreigners with a variety of tea-sets, crockery and ceramic tile works. A huge portion of the ceramics used in the country is supplied by Khurja and is also referred as 'The Ceramic Town'.

One of the private schools of Bulandshahr organised an Educational Tour for class 10 students to Khurja. Students were very excited about the trip. Following are the few pottery objects of Khurja.



Students found the shapes of the objects very interesting and they could easily relate them with mathematical shapes viz sphere, hemisphere, cylinder etc. Maths teacher who was accompanying the students asked following questions :

(a) The internal radius of hemispherical bowl (filled completely with water) in I is 9 cm and radius and height of cylindrical jar in II is 1.5 cm and 4 cm respectively. If the hemispherical bowl is to be emptied in cylindrical jars, then how many cylindrical jars are required ?

(b) If in the cylindrical jar full of water, a conical funnel of same height and same diameter is immersed, then how much water will flow out of the jar ?

Sol.

(a) Cylinder— $h = 4$ cm, $r = 1{\cdot}5$ cm $= \frac{3}{2}$ cm

Volume of cylinder $= \pi r^2 h$

$= \pi \times (1.5)^2 \times 4\ cm^3$ ½

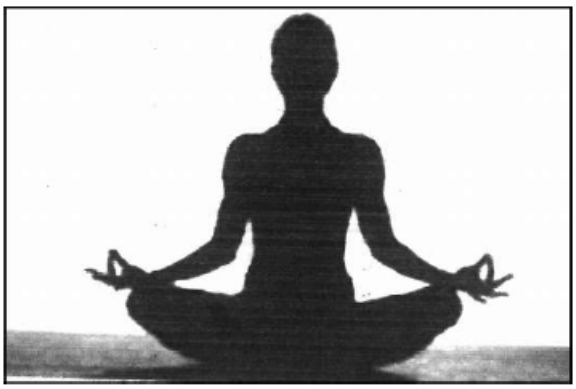
Radius of hemisphere $R = 9$ cm

Volume of hemisphere $= \frac{2}{3}\pi R^3$

$= \frac{2}{3} \times \pi \times (9)^3 cm^3$ ½

Let the number of cylindrical jars be n

$\therefore n \times \pi \times (1.5)^2 \times 4 = \frac{2}{3} \times \pi \times (9)^3$ ½

	$\Rightarrow n = \frac{9\times9\times9\times2}{4\times1.5\times1.5\times3} = 54$ $\therefore$ Number of cylindrical jars required $= 54$	½
	(b) For conical funnel, $r = \frac{3}{2}\ cm, h = 4\ cm$ $\therefore$ Volume of conical funnel $= \frac{1}{3}\pi r^2 h = \frac{1}{3}\times\frac{22}{7}\times\frac{3}{2}\times\frac{3}{2}\times 4$ $= \frac{66}{7}\ cm^3$ of water will flow out.	½ 1 ½
	Or	
14.	Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015. To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows : 	

Age Group	15 – 25	25 – 35	35 – 45	45 – 55	55 – 65	65 – 75	75 – 85
Number of People	8	10	15	25	40	24	18

Based on the above, find the following :

(a) Find the median age of people enrolled for the camp.

(b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x.

Sol. (a)

Age Group	No. of people (f)	Cf
15–25	8	8
25–35	10	18
35–45	15	33
45–55	25	58
55–65	40	98
65–75	24	122
75–85	18	140

½ for table

$N = 140, \ \therefore \frac{N}{2} = 70$, which corresponds to 55–65

∴ Median class = 55–65 ½

∴ $l = 55, \ f = 40, \ cf = 58, \ h = 10$

$$\text{Median} = l + \frac{\frac{N}{2} - cf}{f} \times h$$

$$= 55 + \frac{70-58}{40} \times 10 = 55 + 3 = 58$$ 1

∴ Median = 58

(b) **Any student who has attempted the question (even if deleted) will be awarded full credit of 2 marks**

* * *

SET-5

Series AQ@QA

प्रश्न-पत्र कोड
Q.P. Code **30/B/5**

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.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **14** प्रश्न हैं ।
- **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
- 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 ।
- Please check that this question paper contains **11** printed pages.
- 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.
- Please check that this question paper contains **14** questions.
- **Please write down the serial number of the question in the answer-book before attempting it.**
- 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 : 2 घण्टे | *अधिकतम अंक : 40*

Time allowed : 2 hours | *Maximum Marks : 40*

सामान्य निर्देश :

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

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । **सभी** प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – **खण्ड क, ख** तथा **ग** ।*

(iii) ***खण्ड क** में **6** प्रश्न (प्र.सं. **1** से **6**) हैं, जिनमें प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) ***खण्ड ख** में **4** प्रश्न (प्र.सं. **7** से **10**) हैं, जिनमें प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) ***खण्ड ग** में **4** प्रश्न (प्र.सं. **11** से **14**) हैं, जिनमें प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में दो प्रकरण अध्ययन आधारित प्रश्न भी शामिल हैं ।*

(vi) *कैल्कुलेटर के उपयोग की अनुमति **नहीं** है ।*

खण्ड क

*इस खण्ड में **6** प्रश्न हैं जिनमें प्रत्येक के **2** अंक हैं ।*

1. (क) निम्नलिखित समांतर श्रेढ़ी के पदों की संख्या ज्ञात कीजिए : *2*

5, 11, 17, ..., 203

अथवा

(ख) उस समांतर श्रेढ़ी के प्रथम 20 पदों का योगफल ज्ञात कीजिए जिसका nवाँ पद $a_n = 5 - 3n$ द्वारा प्रदत्त है । *2*

2. द्विघात समीकरण $9x^2 - 6\sqrt{2}\,x + 2 = 0$ के मूल ज्ञात कीजिए । *2*

3. 18 सेमी × 22 सेमी × 6 सेमी विमाओं वाले धातु के एक ठोस घनाभ को पिघलाकर 3 सेमी व्यास वाली कितनी गोलाकार गोलियाँ बनाई जा सकती हैं ? *2*

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This question paper is divided into **three** sections – **Section A**, **B** and **C**.*

(iii) ***Section A** comprises of **6** questions (Q. no. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) ***Section B** comprises of **4** questions (Q. no. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) ***Section C** comprises of **4** questions (Q. no. **11** to **14**) of **4** marks each. Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *Use of calculator is **not** permitted.*

SECTION A

*This section contains **6** questions of **2** marks each.*

1. (a) Find the number of terms in the following AP : *2*

5, 11, 17, ..., 203

OR

(b) Find the sum of the first 20 terms of an AP whose n^{th} term is given as $a_n = 5 - 3n$. *2*

2. Find the roots of the quadratic equation $9x^2 - 6\sqrt{2}\,x + 2 = 0$. *2*

3. How many spherical shots each having diameter 3 cm can be made by melting a cuboidal solid of dimensions 18 cm × 22 cm × 6 cm ? *2*

4. निम्नलिखित बंटन का बहुलक 24 है तथा सभी बारंबारताओं का योगफल 50 है । लुप्त बारंबारताएँ x तथा y के मान ज्ञात कीजिए : *2*

वर्ग	*बारंबारता*
0 – 10	4
10 – 20	x
20 – 30	20
30 – 40	y
40 – 50	6

5. दो संकेंद्री वृत्तों में, बड़े वृत्त की एक जीवा, जिसकी लंबाई 48 सेमी है, छोटे वृत्त की स्पर्श-रेखा है । यदि छोटे वृत्त की त्रिज्या 7 सेमी है, तो बड़े वृत्त की त्रिज्या ज्ञात कीजिए । *2*

6. (क) दो क्रमागत विषम धन पूर्णांकों का गुणनफल 255 है । एक द्विघात समीकरण के सूत्रण की सहायता से ये पूर्णांक ज्ञात कीजिए । *2*

अथवा

(ख) k के वे मान ज्ञात कीजिए जिनके लिए द्विघात समीकरण $(k + 3) x^2 + kx + 1 = 0$ के दो मूल वास्तविक तथा बराबर हों । *2*

खण्ड ख

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

7. 4 सेमी त्रिज्या के एक वृत्त के केंद्र O से 7 सेमी की दूरी पर स्थित एक बिंदु P से खींची जाने वाली दो स्पर्श-रेखाओं की रचना के पद लिखिए । *3*

4. The mode of the following distribution is 24 and the sum of all frequencies is 50. Find the missing frequencies x and y. *2*

Class	*Frequency*
0 – 10	4
10 – 20	x
20 – 30	20
30 – 40	y
40 – 50	6

5. In two concentric circles, a chord of length 48 cm of the larger circle is a tangent to the smaller circle, whose radius is 7 cm. Find the radius of the larger circle. *2*

6. (a) The product of two consecutive odd positive integers is 255. Find the integers, by formulating a quadratic equation. *2*

OR

(b) Find the value(s) of k for the quadratic equation, $(k + 3)x^2 + kx + 1 = 0$, to have two real and equal roots. *2*

SECTION B

*This section contains **4** questions of **3** marks each.*

7. Write the steps of construction for constructing a pair of tangents to a circle of radius 4 cm from a point P, at a distance of 7 cm from its centre O. *3*

8. (क) समुद्र तल से 60 मी. ऊँची लाइट-हाउस के शिखर से देखने पर दो समुद्री जहाजों के अवनमन कोण 45° तथा 60° हैं । यदि लाइट-हाउस के एक ही ओर एक जहाज दूसरे जहाज के ठीक पीछे हो, तो दोनों जहाजों के बीच की दूरी ज्ञात कीजिए । [$\sqrt{3}$ = 1·732 लीजिए] *3*

अथवा

(ख) 1·6 मी. लम्बा एक लड़का, जो एक लैम्प-पोस्ट से 3 मी. की दूरी पर खड़ा है, भूमि पर 4 मी. लंबी छाया बनाता है, तो लैम्प-पोस्ट की ऊँचाई ज्ञात कीजिए । *3*

9. निम्नलिखित बारंबारता बंटन 50 पॉलिसीधारकों की आयु के आँकड़े दर्शाता है । माध्यक आयु ज्ञात कीजिए, यदि पॉलिसी केवल उन्हीं व्यक्तियों को दी जाती है, जिनकी आयु 18 वर्ष या उससे अधिक हो, परन्तु 60 वर्ष से कम हो । *3*

आयु (वर्षों में)	*पॉलिसीधारकों की संख्या*
20 से कम	1
30 से कम	12
40 से कम	39
50 से कम	46
60 से कम	50

10. निम्नलिखित सारणी किसी मोहल्ले के 50 परिवारों में भोजन पर हुए दैनिक व्यय को दर्शाती है । माध्य दैनिक व्यय ज्ञात कीजिए । *3*

दैनिक व्यय (₹ में)	*परिवारों की संख्या*
200 – 250	8
250 – 300	10
300 – 350	12
350 – 400	10
400 – 450	10

8. (a) As observed from the top of a lighthouse 60 m high from the sea level, the angles of depression of two ships are 45° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, then find the distance between the two ships. [Use $\sqrt{3}$ = 1·732] *3*

OR

(b) A 1·6 m tall boy stands at a distance of 3 m from a lamp-post and casts a shadow of length 4 m on the ground. Find the height of the lamp-post. *3*

9. The following frequency distribution shows the ages of 50 policyholders. Calculate the median age, if policies are given only to persons having age 18 years onwards, but less than 60 years. *3*

Age (in years)	*Number of Policyholders*
Below 20	1
Below 30	12
Below 40	39
Below 50	46
Below 60	50

10. The table below shows the daily expenditure on food of 50 households of a locality. Find the mean daily expenditure. *3*

Daily Expenditure (in ₹)	*Number of Households*
200 – 250	8
250 – 300	10
300 – 350	12
350 – 400	10
400 – 450	10

खण्ड ग

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

11. (क) यदि दो वृत्त परस्पर बाह्य स्पर्श करते हैं, तो सिद्ध कीजिए कि स्पर्श बिंदु, वृत्तों के केंद्रों को मिलाने वाली रेखा पर स्थित है । *4*

अथवा

(ख) सिद्ध कीजिए कि एक बाह्य बिंदु से वृत्त पर खींची गई दो स्पर्श-रेखाओं की लंबाइयाँ समान होती हैं । *4*

12. समतल भूमि पर स्थित एक बिंदु से, एक ऊर्ध्वाधर खड़ी मीनार के शिखर का उन्नयन कोण α इस प्रकार पाया गया कि $\tan \alpha = \frac{5}{12}$ है । मीनार की ओर 192 मी. की दूरी चलने पर बना उन्नयन कोण β इस प्रकार पाया गया कि $\tan \beta = \frac{3}{4}$ है । मीनार की ऊँचाई ज्ञात कीजिए । *4*

प्रकरण अध्ययन – 1

13. मकान अथवा कार जैसी महँगी वस्तु खरीदने के लिए एक मध्यम-वर्गीय व्यक्ति के लिए बैंक से ऋण लेकर उसे आसान किश्तों में ब्याज सहित चुकाना आसान हो जाता है ।

अमन एक कार खरीदने के लिए बैंक से ₹ 2,36,000 का ऋण लेता है और उसे मासिक किश्तों में चुकाना शुरू करता है । वह ₹ 2,000 की पहली किश्त चुकाता है तथा उसके बाद प्रति माह किश्त में ₹ 500 की बढ़ोतरी करता है ।

(क) ज्ञात कीजिए कि वह 25वीं किश्त में कितनी राशि चुकाता है । *2*

(ख) ज्ञात कीजिए कि वह पहली 25 किश्तों में कुल कितनी राशि चुकाता है । *2*

SECTION C

*This section contains **4** questions of **4** marks each.*

11. (a) If two circles touch each other externally, then prove that the point of contact lies on the line joining their centres. *4*

OR

(b) Prove that the lengths of two tangents drawn from an external point to a circle are equal. *4*

12. At a point on the level ground, the angle of elevation of the top of a vertical tower is found to be α, such that $\tan \alpha = \frac{5}{12}$. On walking 192 m towards the tower, the angle of elevation β is such that $\tan \beta = \frac{3}{4}$. Find the height of the tower. *4*

Case Study – 1

13. While buying an expensive item like a house or a car, it becomes easier for a middle-class person to take a loan from a bank and then repay the loan along with interest in easy instalments.

Aman buys a car by taking a loan of ₹ 2,36,000 from the bank and starts repaying the loan in monthly instalments. He pays ₹ 2,000 as the first instalment and then increases the instalment by ₹ 500 every month.

(a) Find the amount he pays in the 25^{th} instalment. *2*

(b) Find the total amount paid by him in first 25 instalments. *2*

प्रकरण अध्ययन – 2

14. शंक्वाकार आधार वाले टैंक, जिसके ऊपर एक उसी व्यास का बेलन अध्यारोपित होता है, उद्योग में बहुत लाभकारी होते हैं, विशेषतया तब, जब टैंक से निकाली गई आखिरी बूँद भी बहुत महत्त्व रखती हो ।

विकास ने एक शंक्वाकार आधार वाला टैंक बनाया जहाँ शंक्वाकार भाग की ऊँचाई उसकी त्रिज्या के बराबर है तथा बेलनाकार भाग की ऊँचाई उसकी त्रिज्या की दुगुनी है । टैंक ऊपर से बंद है ।

(क) यदि बेलनाकार भाग की त्रिज्या 3 मी. है, तो टैंक का आयतन ज्ञात कीजिए । *2*

(ख) बेलनाकार भाग के आयतन का शंक्वाकार भाग के आयतन से अनुपात ज्ञात कीजिए । *2*

Case Study – 2

14. Conical bottom tanks in which an inverted cone at the bottom is surmounted by a cylinder of same diameter, are very advantageous in industry, specially where getting every last drop from the tank is important.

Vikas designed a conical bottom tank where the height of the conical part is equal to its radius and the height of the cylindrical part is two times of its radius. The tank is closed from the top.

(a) If the radius of the cylindrical part is 3 m, then find the volume of the tank. *2*

(b) Find the ratio of the volume of the cylindrical part to the volume of the conical part. *2*

Strictly Confidential : (For Internal and Restricted use only)
Secondary School Examination
Term–II, 2022

Marking Scheme : MATHEMATICS (Standard) (For VI)
(Subject Code : 041)

[Paper Code : 30/B/5]

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 Newspaper/ Website, etc., may invite action under IPC.**’’

3. Evaluation is to be done as per instruction 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 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, marks should be awarded.**

4. 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. 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.

5. Evaluators will mark (3) wherever answer is correct. For wrong answer ‘7’ be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing**.

6. 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.

7. 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.

8. If a student has attempted both option given in question, answer of the question deserving more marks should be retained and the other answer scored out.

9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

10. A full scale of marks _____ (example 0–100 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

11. Every examiner has to necessarily do evaluation work for full working hours, i.e., 8 hours everyday 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).

12. 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 a reply
    - Wrong transfer of marks from the inside pages of the answer book to the title page
    - Wrong questionwise 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
    - 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 7 for incorrect answer).
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

13. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (7) and awarded zero (0) Mark.

14. Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidates 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.

15. The examiners should acquaint themselves with the guidelines given in the guidelines for spot evaluation before starting the actual evaluation.

16. 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.

17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

MARKING SCHEME

Secondary School Examination Term–II, 2022

MATHEMATICS (Standard) (For VI) (Subject Code : 041)

[Paper Code : 30/B/5]

General Instructions:

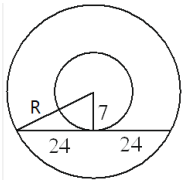
1. The Marking Scheme provides general guidelines to reduce subjectivity in the marking. The answers given in the Marking Scheme are suggested answers. The content is thus indicative. If a student has given any other answer which is different from the one given in the Marking Scheme, but conveys the meaning, such answers should be given full weightage.
2. 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.
3. Alternative methods are accepted. Proportional marks are to be awarded.
4. If a candidate has attempted a question twice, answer of the question deserving more marks should be retained and the other answer scored out.
5. A full scale of marks - 0 to 40 has to be used. Please do not hesitate to award full marks if the answer deserves it.
6. Separate Marking Scheme for all the three sets has been given.
7. As per orders of the Hon'ble Supreme Court. The candidates would now be permitted to obtain photocopy of the Answer book on request on payment of the prescribed fee. All 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.

Q. No.	EXPECTED ANSWER / VALUE POINTS	Marks
	SECTION – A	
1. (a)	Find the number of terms in the following AP : 5, 11, 17, ..., 203 Given	
Sol.	AP is 5, 11, 17, · · ·, 203	
	$\Rightarrow a = 5,\ d = 6$ and $a_n = 203$	1
	$203 = 5 + (n-1)6$	½
	$\Rightarrow n - 1 = \frac{198}{6} = 33 \quad \Rightarrow n = 34$	½
	Or	
(b)	Find the sum of the first 20 terms of an AP whose n^{th} term is given as $a_n = 5 - 3n$.	
Sol.	$a_n = 5 - 3n \Rightarrow a_1 = 2,\ a_2 = -1 \Rightarrow d = -3$	1
	$S_{20} = 10[4 + 19(-3)] = -530$	1
2.	Find the roots of the quadratic equation $9x^2 - 6\sqrt{2}x + 2 = 0$.	
Sol.	$9x^2 - 6\sqrt{2}x + 2 = 0$	

	$\Rightarrow 9x^2 - 3\sqrt{2}x - 3\sqrt{2}x + 2 = 0$	½
	$\Rightarrow 3x(3x - \sqrt{2}) - \sqrt{2}(3x - \sqrt{2}) = 0$	
	$\Rightarrow (3x - \sqrt{2})(3x - \sqrt{2}) = 0$	1
	$\Rightarrow x = \frac{\sqrt{2}}{3}, \frac{\sqrt{2}}{3}$	½
3.	How many spherical shots each having diameter 3 cm can be made by melting a cuboidal solid of dimensions 18 cm × 22 cm × 6 cm ?	
Sol.	Volume of one lead shot = $\frac{4}{3} \times \frac{22}{7} \times \left(\frac{3}{2}\right)^3$ cm^3	½
	$\therefore$ Number of lead shots = $\frac{18 \times 22 \times 6}{\frac{4}{3} \times \frac{22}{7} \times \frac{27}{8}}$	1
	$= \frac{18 \times 22 \times 6 \times 3 \times 7 \times 8}{4 \times 22 \times 27}$	
	$= 168$	½
4.	The mode of the following distribution is 24 and the sum of all frequencies is 50. Find the missing frequencies x and y.	

Class	*Frequency*
0 – 10	4
10 – 20	x
20 – 30	20
30 – 40	y
40 – 50	6

Sol.	$30 + x + y = 50 \Rightarrow x + y = 20$	½
	Modal group is $20 - 30$,	½
	$\Rightarrow 24 = 20 + \frac{20 - x}{40 - x - y} \times 10$	½
	$4 = \frac{20 - x}{40 - 20} \times 10 \quad \Rightarrow x = 12, \ \therefore y = 8$	½

5.	In two concentric circles, a chord of length 48 cm of the larger circle is a tangent to the smaller circle, whose radius is 7 cm. Find the radius of the larger circle.	
Sol.	Let R be the radius $\Rightarrow R^2 = (7)^2 + (24)^2$ $= 49 + 576 = 625$ $\Rightarrow R = 25$ cm  	1 1
6.(a)	The product of two consecutive odd positive integers is 255. Find the integers, by formulating a quadratic equation.	
Sol.	Let two consecutive odd positive integers be x, $x+2$ $\therefore\ x(x+2) = 255$ $\Rightarrow x^2 + 2x - 255 = 0$ $\Rightarrow x^2 + 17x - 15x - 255 = 0$ $\Rightarrow (x+17)(x-15) = 0$ $\Rightarrow x = 15$ $\therefore$ Two consecutive odd positive integers are 15 and 17	½ ½ ½ ½
	Or	
(b)	Find the value(s) of k for the quadratic equation, $(k + 3)\,x^2 + kx + 1 = 0$, to have two real and equal roots.	
Sol.	$(k + 3)x^2 + kx + 1 = 0$ For equal roots, $k^2 - 4(k + 3)1 = 0$ $\Rightarrow k^2 - 4k - 12 = 0$ $\Rightarrow k = 6, -2$	 1 ½ ½
	SECTION – B	
7.	Write the steps of construction for constructing a pair of tangents to a circle of radius 4 cm from a point P, at a distance of 7 cm from its centre O.	
Sol.	*(i)* Draw a circle of radius 4 cm with centre O *(ii)* Take a point P at a distance of 7 cm from O *(iii)* Construct a circle with OP as diameter to intersect the first circle at Q and R *(iv)* Join PQ and PR to get the tangents	 3

8.(a) As observed from the top of a lighthouse 60 m high from the sea level, the angles of depression of two ships are 45° and 60°. If one ship is exactly behind the other on the same side of the lighthouse, then find the distance between the two ships. [Use $\sqrt{3}$ = 1·732]

Sol.

$\frac{AB}{AC} = \tan 60° = \sqrt{3}$

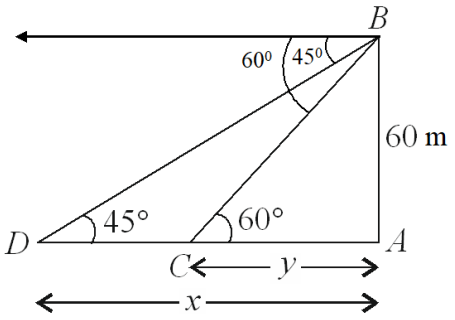
$\Rightarrow AC = y = \frac{60}{\sqrt{3}} = 20\sqrt{3}$ m — 1

$\frac{AB}{AD} = \tan 45° = 1$

$\Rightarrow AD = x = 60$ m — 1

$\therefore CD = 60 - 20\sqrt{3} = 60 - 20 \times 1 \cdot 732$

$= 60 - 34 \cdot 64 = 25 \cdot 36$ m — 1



(b) **Or**

A 1·6 m tall boy stands at a distance of 3 m from a lamp-post and casts a shadow of length 4 m on the ground. Find the height of the lamp-post.

Sol.

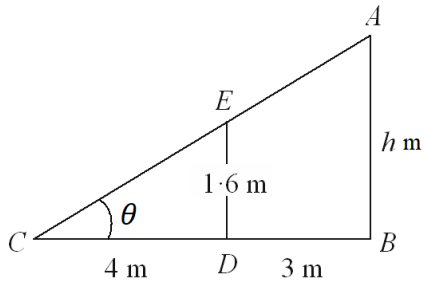
Let the height of lamp post be h m

$\tan \theta = \frac{1.6}{4} = 0.4$ m — 1

Also $\tan \theta = \frac{h}{7}$ — 1

$\therefore \frac{h}{7} = 0.4$

$\Rightarrow$ h = 2.8 m — 1



9. The following frequency distribution shows the ages of 50 policyholders. Calculate the median age, if policies are given only to persons having age 18 years onwards, but less than 60 years.

Age (in years)	*Number of Policyholders*
Below 20	1
Below 30	12
Below 40	39
Below 50	46
Below 60	50

Sol.

	18–20	20–30	30–40	40–50	50–60
f	1	11	27	7	4
c.f.	1	12	39	46	50

Correct table — 1½

Median class = 30–40 ½

Median = $30 + \frac{25-12}{27} \times 10 = 34 \cdot 8$ 1

∴ Median age is 34.8 years

10. The table below shows the daily expenditure on food of 50 households of a locality. Find the mean daily expenditure.

Daily Expenditure (in ₹)	*Number of Households*
200 – 250	8
250 – 300	10
300 – 350	12
350 – 400	10
400 – 450	10

Sol.

x_i	:	225	275	325	375	425
f_i	:	8	10	12	10	10 = 50
$f_i x_i$	:	1800	2750	3900	3750	4250 = 16450

Correct table 2

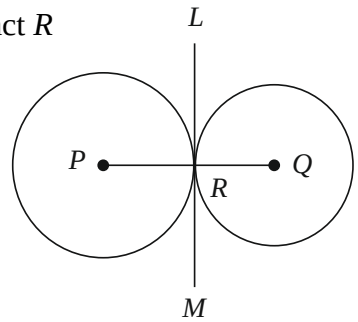
Mean = $\frac{\sum f_i x_i}{\sum f_i} = \frac{16450}{50} = 329$ 1

∴ Mean daily expenditure is ₹ 329

SECTION – C

11.(a) If two circles touch each other externally, then prove that the point of contact lies on the line joining their centres.

Sol. Let LM be the common tangent at the point of contact R



$\Rightarrow \angle PRL = 90°$ 1

$\angle QRL = 90°$ 1

$\Rightarrow PRQ = 180°$ 1

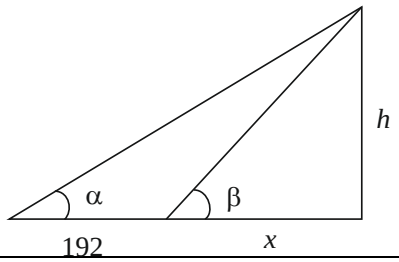
$\Rightarrow R$ lies on PQ 1

Or

(b) Prove that the lengths of two tangents drawn from an external point to a circle are equal.

Sol. Correct given, to prove, construction 1½

Correct proof 2½

12.	At a point on the level ground, the angle of elevation of the top of a vertical tower is found to be α, such that $\tan\alpha = \frac{5}{12}$. On walking 192 m towards the tower, the angle of elevation β is such that $\tan\beta = \frac{3}{4}$. Find the height of the tower.	
Sol.	$\frac{h}{x+192} = \frac{5}{12}$ …….. (i) and $\frac{h}{x} = \frac{3}{4}$ …….. (ii) Solving equation (i) and (ii), we get $h = 180\ m$  	1 1 2
13.	While buying an expensive item like a house or a car, it becomes easier for a middle-class person to take a loan from a bank and then repay the loan along with interest in easy instalments. Aman buys a car by taking a loan of ₹ 2,36,000 from the bank and starts repaying the loan in monthly instalments. He pays ₹ 2,000 as the first instalment and then increases the instalment by ₹ 500 every month. (a) Find the amount he pays in the 25^{th} instalment. (b) Find the total amount paid by him in first 25 instalments.	
Sol.	He pays 2000, 2500, 3000, · · · · It is an A.P. where $a = 2000,\ d = 500$ (a) $a_{25} = 2000 + 24 \times 500$ = ₹ 14,000 The total amount paid in the 25^{th} instalment is ₹ 14,000 *(b)* $S_{25} = \frac{25}{2}[2000 + 14000]$ = ₹ 2,00,000 The total amount paid by him in first 25 instalments is ₹ 2,00,000	1 1 1 1 1

14. Conical bottom tanks in which an inverted cone at the bottom is surmounted by a cylinder of same diameter, are very advantageous in industry, specially where getting every last drop from the tank is important.

Vikas designed a conical bottom tank where the height of the conical part is equal to its radius and the height of the cylindrical part is two times of its radius. The tank is closed from the top.

(a) If the radius of the cylindrical part is 3 m, then find the volume of the tank.

(b) Find the ratio of the volume of the cylindrical part to the volume of the conical part.

Sol. Let radius = r $\Rightarrow$ Height of cone = r

Height of cylinder = $2r$

(a) r = 3m

$$V = \pi r^2 \cdot 2r + \frac{1}{3}\pi r^2 \cdot r \qquad 1$$

$$= \frac{7}{3}\pi r^3$$

$$= \frac{7}{3} \times \frac{22}{7} \times 3 \times 3 \times 3 = 198 \text{ m}^3 \text{ or } 63\pi \text{ m}^3 \qquad 1$$

(b)

$$\frac{\text{Volume of cylinder}}{\text{Volume of cone}} = \frac{\pi r^2 \cdot 2r}{\frac{1}{3}\pi r^2 \cdot r} \qquad 1$$

$$= \frac{6}{1} \qquad 1$$

i.e. 6 : 1

* * *

Series SRQPE/C

SET~1

प्रश्न-पत्र कोड
Q.P. Code 30/6/1

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 **11** हैं ।	(I)	Please check that this question paper contains **11** printed pages.
(II)	प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।	(II)	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.
(III)	कृपया जाँच कर लें कि इस प्रश्न-पत्र में **14** प्रश्न हैं ।	(III)	Please check that this question paper contains **14** questions.
(IV)	**कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**	(IV)	**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 ।	(V)	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 : 2 घण्टे | अधिकतम अंक : 40

Time allowed : 2 hours | Maximum Marks : 40

सामान्य निर्देश :

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

(i) *इस प्रश्न-पत्र में कुल **14** प्रश्न हैं । **सभी** प्रश्न अनिवार्य हैं ।*

(ii) *यह प्रश्न-पत्र **तीन** खण्डों में विभाजित है – **खण्ड क, ख** तथा **ग** ।*

(iii) ***खण्ड क** में **6** प्रश्न (प्र.सं. **1** से **6**) हैं, जिनमें प्रत्येक प्रश्न **2** अंक का है । **दो** प्रश्नों में आंतरिक विकल्प प्रदान किया गया है ।*

(iv) ***खण्ड ख** में **4** प्रश्न (प्र.सं. **7** से **10**) हैं, जिनमें प्रत्येक प्रश्न **3** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है ।*

(v) ***खण्ड ग** में **4** प्रश्न (प्र.सं. **11** से **14**) हैं, जिनमें प्रत्येक प्रश्न **4** अंक का है । **एक** प्रश्न में आंतरिक विकल्प प्रदान किया गया है । इस खण्ड में दो प्रकरण अध्ययन आधारित प्रश्न भी शामिल हैं ।*

(vi) *कैल्कुलेटर के उपयोग की अनुमति **नहीं** है ।*

खण्ड क

*प्रश्न संख्या **1** से **6** तक प्रत्येक प्रश्न के **2** अंक हैं ।*

1. किसी समांतर श्रेढ़ी; $a_1, a_2, a_3, \ldots$ में यदि $\frac{a_4}{a_7} = \frac{2}{3}$ है, तो $\frac{a_6}{a_8}$ ज्ञात कीजिए । *2*

2. (क) x के लिए हल कीजिए : *2*

$$2x^2 - 2\sqrt{2}\,x + 1 = 0$$

अथवा

(ख) k के वे मान ज्ञात कीजिए जिनके लिए द्विघात समीकरण $x^2 + 5kx + 16 = 0$ के वास्तविक तथा समान मूल हैं । *2*

3. (क) समांतर श्रेढ़ी : 293, 285, 277, ..., 53 के पदों की संख्या ज्ञात कीजिए । *2*

अथवा

(ख) ऐसे प्रथम 40 धन पूर्णांकों का योगफल ज्ञात कीजिए जो 7 से विभाज्य हैं । *2*

4. निम्नलिखित संचयी बारंबारता तालिका में, a, b, c तथा d के मान ज्ञात कीजिए । *2*

वर्ग	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
बारंबारता	5	7	a	5	b
संचयी बारंबारता	5	c	18	d	30

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *This question paper contains **14** questions. **All** questions are compulsory.*

(ii) *This question paper is divided into **three** sections – **Sections A**, **B** and **C**.*

(iii) ***Section A** comprises of **6** questions (Q.no. **1** to **6**) of **2** marks each. Internal choice has been provided in **two** questions.*

(iv) ***Section B** comprises of **4** questions (Q.no. **7** to **10**) of **3** marks each. Internal choice has been provided in **one** question.*

(v) ***Section C** comprises of **4** questions (Q.no. **11** to **14**) of **4** marks each. Internal choice has been provided in **one** question. It also contains two case study based questions.*

(vi) *Use of calculator is **not** permitted.*

SECTION A

*Question numbers **1** to **6** carry **2** marks each.*

1. For the A.P.; $a_1, a_2, a_3, \ldots$ if $\frac{a_4}{a_7} = \frac{2}{3}$, then find $\frac{a_6}{a_8}$. *2*

2. (a) Solve for x : *2*

$$2x^2 - 2\sqrt{2}\,x + 1 = 0$$

OR

(b) Find the value(s) of k for which the quadratic equation $x^2 + 5kx + 16 = 0$ has real and equal roots. *2*

3. (a) Find the number of terms of the A.P. :

293, 285, 277, ..., 53 *2*

OR

(b) Find the sum of the first 40 positive integers divisible by 7. *2*

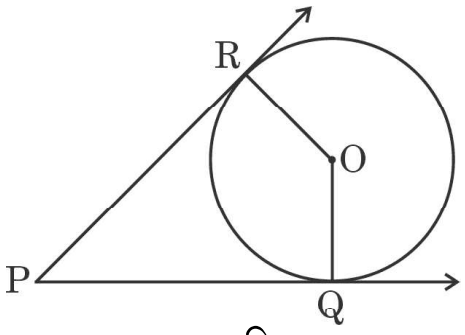
4. In the following cumulative frequency table, find the values of a, b, c and d. *2*

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	7	a	5	b
Cumulative Frequency	5	c	18	d	30

5. यदि निम्नलिखित आँकड़ों का बहुलक 240 है, तो लुप्त बारंबारता 'x' ज्ञात कीजिए : *2*

दैनिक घरेलू खर्च (₹ में)	*परिवारों की संख्या*
0 – 100	140
100 – 200	230
200 – 300	270
300 – 400	x
400 – 500	150

6. आकृति 1 में, O वृत्त का केंद्र है । PQ और PR स्पर्श-रेखा खंड हैं । सिद्ध कीजिए कि चतुर्भुज PQOR चक्रीय है । *2*



आकृति 1

खण्ड ख

*प्रश्न संख्या **7** से **10** तक प्रत्येक प्रश्न के **3** अंक हैं ।*

7. त्रिज्याएँ 3 सेमी और 5 सेमी के दो संकेंद्रीय वृत्त खींचिए । त्रिज्या 5 सेमी वाले वृत्त के एक बिंदु से, त्रिज्या 3 सेमी वाले वृत्त पर स्पर्श-रेखा युग्म की रचना कीजिए । *3*

8. एक जहाज के डेक पर खड़ा एक व्यक्ति जो जल स्तर से 10 मी. ऊपर है, देखता है कि एक पहाड़ी की चोटी का उन्नयन कोण 60° है और पहाड़ी के आधार का अवनमन कोण 30° है । पहाड़ी की ऊँचाई ज्ञात कीजिए । *3*

9. (क) एक ठोस लंब-वृत्तीय बेलन के आधार की त्रिज्या और ऊँचाई का अनुपात 2 : 3 है और इसका आयतन 1617 घन सेमी है । बेलन का कुल पृष्ठीय क्षेत्रफल ज्ञात कीजिए । ($\pi = \frac{22}{7}$ लीजिए) *3*

अथवा

(ख) त्रिज्या 10·5 सेमी वाले धातु के एक ठोस गोले को पिघलाकर त्रिज्या 3·5 सेमी और ऊँचाई 3 सेमी के छोटे ठोस शंकुओं में दुबारा ढाला गया । इस प्रकार बने शंकुओं की संख्या ज्ञात कीजिए । *3*

5. Find the missing frequency 'x' of the following data, if its mode is 240 : *2*

Daily Household Expenditure (in ₹)	Number of Families
0 – 100	140
100 – 200	230
200 – 300	270
300 – 400	x
400 – 500	150

6. In Figure 1, O is the centre of the circle. PQ and PR are tangent segments. Show that the quadrilateral PQOR is cyclic. *2*

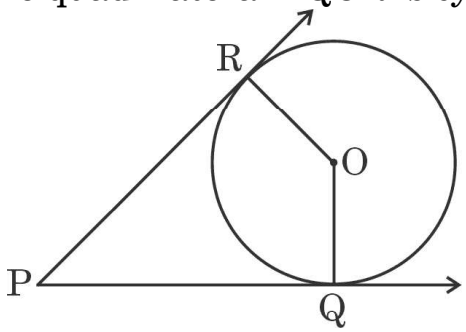


Figure 1

SECTION B

*Question numbers **7** to **10** carry **3** marks each.*

7. Draw two concentric circles of radii 3 cm and 5 cm. By taking a point on the circle of radius 5 cm, construct the pair of tangents to the other circle of radius 3 cm. *3*

8. A man standing on the deck of a ship, which is 10 m above the water level, observes that the angle of elevation of the top of a hill is 60° and the angle of depression of the base of the hill is 30°. Find the height of the hill. *3*

9. (a) The radius of the base and the height of a solid right circular cylinder are in the ratio 2 : 3 and its volume is 1617 cm^3. Find the total surface area of the cylinder. (Take $\pi = \frac{22}{7}$) *3*

OR

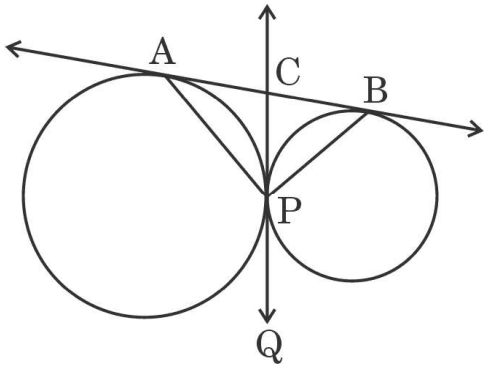
(b) A solid metallic sphere of radius 10·5 cm is melted and recast into a number of smaller solid cones, each of radius 3·5 cm and height 3 cm. Find the number of cones so formed. *3*

10. एक नहर 300 सेमी चौड़ी और 120 सेमी गहरी है । इस नहर से पानी 20 किमी/घण्टे की गति से बह रहा है । 20 मिनट में, यह नहर कितने क्षेत्रफल की सिंचाई कर पाएगी, जबकि सिंचाई के लिए 8 सेमी गहरे पानी की आवश्यकता होती है ? *3*

खण्ड ग

*प्रश्न संख्या **11** से **14** तक प्रत्येक प्रश्न के **4** अंक हैं ।*

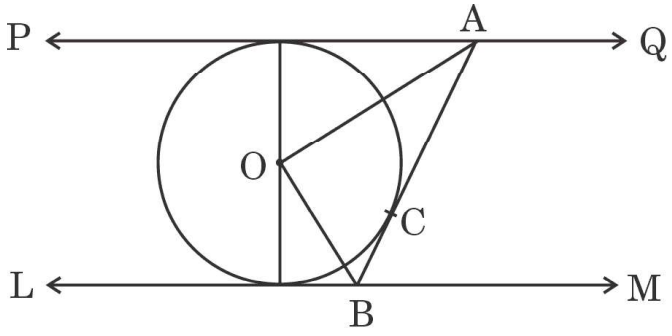
11. (क) आकृति 2 में, दो वृत्त एक बिंदु P पर बाह्यतः स्पर्श करते हैं । उन्हें एक उभयनिष्ठ स्पर्श-रेखा बिंदुओं A तथा B पर स्पर्श करती है तथा P पर एक अन्य उभयनिष्ठ स्पर्श-रेखा, उभयनिष्ठ स्पर्श-रेखा AB को C पर काटती है । सिद्ध कीजिए कि $\angle APB = 90°$. *4*



आकृति 2

अथवा

(ख) आकृति 3 में, PQ तथा LM, O केंद्र वाले किसी वृत्त पर दो समांतर स्पर्श-रेखाएँ हैं । स्पर्श बिंदु C पर एक अन्य स्पर्श-रेखा AB, PQ को A पर तथा LM को B पर काटती है । सिद्ध कीजिए कि $\angle AOB = 90°$. *4*



आकृति 3

10. A canal is 300 cm wide and 120 cm deep. The water in the canal is flowing with a speed of 20 km/h. How much area will it irrigate in 20 minutes, if 8 cm of standing water is desired ? *3*

SECTION C

*Question numbers **11** to **14** carry **4** marks each.*

11. (a) In Figure 2, two circles touch externally at P. A common tangent touches them at A and B and another common tangent is at P, which meets the common tangent AB at C. Prove that $\angle APB = 90°$. *4*

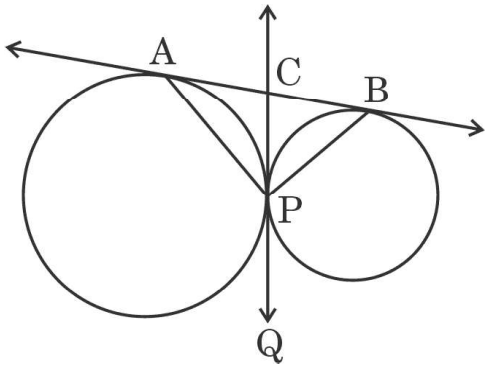


Figure 2

OR

(b) In Figure 3, PQ and LM are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting PQ at A and LM at B. Prove that $\angle AOB = 90°$. *4*

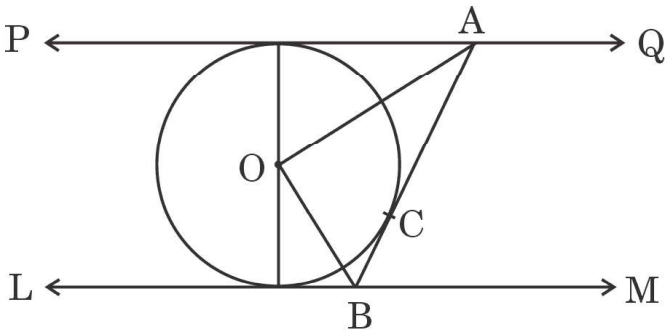


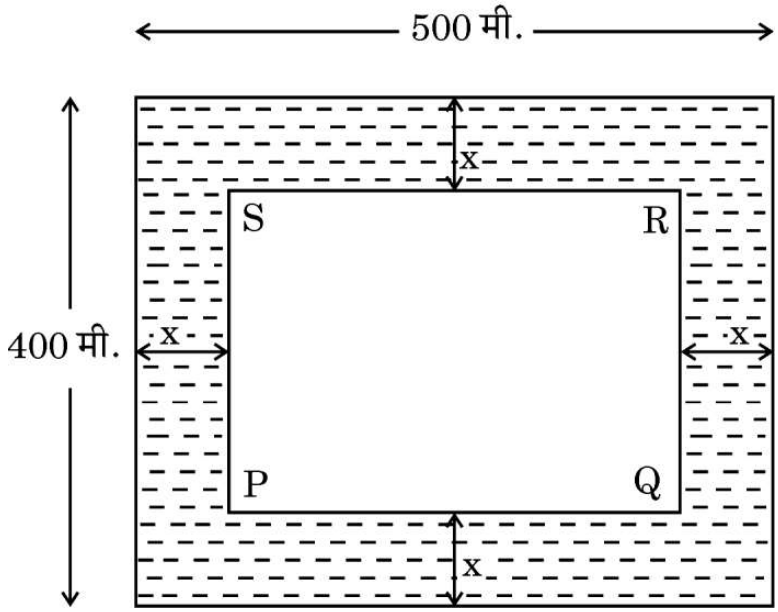
Figure 3

12. भूमि के एक बिंदु X से एक सीधी खड़ी मीनार PQ के शिखर Q का उन्नयन कोण 60° है । बिंदु Y, जो X से ठीक ऊपर 40 मी. की ऊँचाई पर है, से Q का उन्नयन कोण 45° है । मीनार PQ की ऊँचाई और दूरी XP ज्ञात कीजिए । ($\sqrt{3}$ = 1·732 प्रयोग कीजिए) *4*

प्रकरण अध्ययन – 1

13. सामाजिक कार्य का उद्देश्य मानवीय आवश्यकताओं की पूर्ति करना है । सामाजिक कार्यकर्ताओं का उद्देश्य उन लोगों के लिए पहुँच और अवसर के द्वार खोलना है जिन्हें सबसे अधिक आवश्यकता है । मुफ्त शिक्षा एक महान सामाजिक कार्य है । ऐसा करके हम अपने समाज से निरक्षरता को दूर कर सकते हैं ।

रोहन, एक सामाजिक कार्यकर्ता होने के नाते, एक स्कूल खोलने के लिए अपनी जमीन ग्राम पंचायत को दान करना चाहता है ।



आकृति 4

रोहन की भूमि, 500 मी. × 400 मी. की आयत के रूप में है । ग्राम पंचायत घास और फूलों के लिए जमीन के चारों तरफ के कुछ क्षेत्र को छोड़ने का फैसला करती है । यदि x मी. जमीन की चौड़ाई चारों ओर घास और फूलों के लिए रखी जाए (जैसा आकृति 4 में दिखाया गया है), तो

(क) PQ और QR की लम्बाइयाँ ज्ञात कीजिए यदि PQRS के चारों ओर घास और फूलों के क्षेत्र का क्षेत्रफल 118400 वर्ग मीटर है । *2*

(ख) आयत PQRS का परिमाप भी ज्ञात कीजिए । *2*

12. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60°. From a point Y, 40 m vertically above X, the angle of elevation of Q is 45°. Find the height of the tower PQ and the distance XP. (Use $\sqrt{3}$ = 1·732) *4*

Case Study – 1

13. Social work aims at fulfilment of human needs. Social workers aim to open the doors of access and opportunity for those who are in greatest need. Free education is a great social work. By doing so, we can remove illiteracy from our society.

Rohan, being a social worker, wants to donate his land to the Village Panchayat for opening of a school.

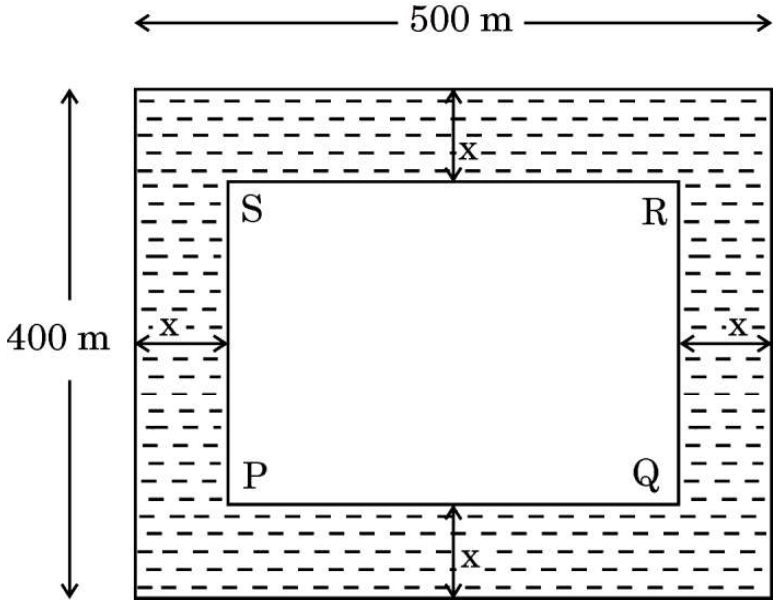


Figure 4

Rohan's land is in the form of a rectangle of dimensions 500 m × 400 m. The Village Panchayat decides to leave the area on all the four sides of the land for grass and flowers. If width of x m land is kept for grass and flowers on all the four sides (as shown in Figure 4);

(a) find the lengths PQ and QR if area of grass and flowers region surrounding PQRS is 118400 m^2. *2*

(b) Also, find the perimeter of the rectangle PQRS. *2*

प्रकरण अध्ययन – 2

14. स्वास्थ्य बीमा एक समझौता है जिसके तहत बीमा कंपनी बीमाधारक व्यक्ति के बीमार पड़ने या दुर्घटना के कारण अस्पताल में भर्ती होने की स्थिति में चिकित्सा व्यय के लिए मुआवजे की गारंटी लेने के लिए सहमत होती है । सरकार भी आयकर से कटौती प्रदान करके स्वास्थ्य बीमा को बढ़ावा देती है ।

SBI स्वास्थ्य बीमा एजेंट ने 100 पॉलिसी धारकों की आयु के वितरण के लिए निम्नलिखित आँकड़े इकट्ठे किए । स्वास्थ्य बीमा नीतियाँ 15 या 15 वर्ष से अधिक लेकिन 60 वर्ष से कम आयु वाले व्यक्तियों को ही दी जाती है ।

आयु (वर्षों में)	*पॉलिसी धारकों की संख्या*
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

(क) पॉलिसी धारकों की बहुलक आयु ज्ञात कीजिए । *2*

(ख) पॉलिसी धारकों की माध्यक आयु ज्ञात कीजिए । *2*

Case Study – 2

14. Health insurance is an agreement whereby the insurance company agrees to undertake a guarantee of compensation for medical expenses in case the insured falls ill or meets with an accident which leads to hospitalisation of the insured. The government also promotes health insurance by providing a deduction from income tax.

An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons having age 15 years and onwards but less than 60 years.

Age (in years)	*Number of Policy Holders*
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

(a) Find the modal age of the policy holders. *2*

(b) Find the median age of the policy holders. *2*

Strictly Confidential — (For Internal and Restricted Use Only)

Secondary School Term II Compartment Examination, 2022

Marking Scheme — Mathematics 30/6/1
Subject Code – 041

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 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 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, marks should be awarded.

4. 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. 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.

5. Evaluators will mark(√) wherever answer is correct. For wrong answer 'X" be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. This is most common mistake which evaluators are committing.

6. 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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.

7. 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.

8. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
9. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
10. A full scale of marks _____(example 0-40 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
11. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 30 answer books per day in main subjects and 35 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.
12. 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 totaling of marks awarded on a reply.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - 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.
13. 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.
14. Any unassessed 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.
15. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
16. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.\
17. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

QUESTION PAPER CODE 30/6/1
EXPECTED ANSWER/VALUE POINTS

SECTION A

Question numbers 1 to 6 carry 2 marks each.

1. For the A.P.; $a_1, a_2, a_3, \ldots$ if $\frac{a_4}{a_7} = \frac{2}{3}$, then find $\frac{a_6}{a_8}$.

Ans. $\frac{a_4}{a_7} = \frac{2}{3} \Rightarrow \frac{a+3d}{a+6d} = \frac{2}{3}$ $\frac{1}{2}$

$\Rightarrow a = 3d$ $\frac{1}{2}$

$\frac{a_6}{a_8} = \frac{a+5d}{a+7d} = \frac{8d}{10d} = \frac{4}{5}$ 1

2. (a) Solve for x:

$2x^2 - 2\sqrt{2}x + 1 = 0$

OR

(b) Find the value (s) of k for which the quadratic equation $x^2 + 5kx + 16 = 0$ has real and equal roots.

Ans. (a) $2x^2 - 2\sqrt{2}x + 1 = 0$

$x = \frac{2\sqrt{2} \pm \sqrt{8 - 8}}{4}$ 1

$\Rightarrow x = \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$ 1

OR

(b) For real and equal roots, Disc = 0

$\therefore 25k^2 - 64 = 0$ 1

$\Rightarrow k^2 = \frac{64}{25}$

$\Rightarrow k = \pm\frac{8}{5}$ 1

3. (a) Find the number of terms of the A.P.:

293, 285, 277, ..., 53

OR

(b) Find the sum of the first 40 positive intergers divisible by 7.

Ans. (a) Here a = 293, d = –8 $\frac{1}{2}$

$t_n = 293 + (n - 1)(-8) = 53$ $\frac{1}{2}$

$293 - 8n + 8 = 53$

$8n = 248$

$\Rightarrow n = 31$ 1

$\therefore$ Number of terms = 31

OR

(b) 7, 14, 21, ..., 40 terms $\frac{1}{2}$

$S_{40} = \frac{40}{2}\{14 + 39 \times 7\}$ 1

$= 20\ (14 + 273)$

$= 20 \times 287$

$= 5740$ $\frac{1}{2}$

4. In the following cumulative frequency table, find the values of a, b, c and d.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	7	a	5	b
Cumulative Frequency	5	c	18	d	30

Ans. Here c = 12, a = 6, d = 23, b = 7 $\frac{1}{2} \times 4 = 2$

5. Find the missing frequency 'x' of the following data, if its mode is 240:

DailyHousehold Expenditure (in ₹)	Number of Families
0 – 100	140
100 – 200	230
200 – 300	270
300 – 400	x
400 – 500	150

Ans. Modal class = 200 – 300 $\frac{1}{2}$

$f_1 = 270$, $f_0 = 230$, $f_2 = x$, $h = 100$, $l = 200$

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) h$$

$$240 = 200 + \left(\frac{270 - 230}{540 - 230 - x}\right) \times 100 \quad 1$$

$$40 = \frac{40 \times 100}{310 - x} \Rightarrow x = 210 \quad \frac{1}{2}$$

6. In Figure 1, O is the centre of the circel, PQ and PR are tangent segments. Show that the quadrilateral PQOR is cyclic.

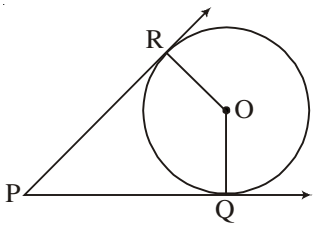


Figure 1

Ans. In quadrilateral PQOR,

$\angle PRO + \angle PQO = 90° + 90° = 180°$ 1

$\therefore$ Quadrilaterl PQOR is Cyclic. 1

SECTION B

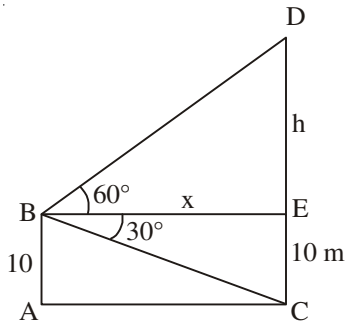
Question numbers 7 to 10 carry 3 marks each.

7. Draw two concentric circles of radii 3 cm and 5 cm. By taking a point on the circle of radius 5 cm, construct the pair of tangents to the other circle of radius 3 cm.

Ans. Correct and accurate construction. 3

8. A man standing on the deck of a ship, which is 10 m above the water level, observes that the angle of elevation of the top of a hill is 60° and the angle of depression of the base of the hill is 30°. Find the height of the hill.

Ans. Let DE = h and AC = BE = x Correct Figure 1



In ΔBDE, $\frac{h}{x} = \tan 60°$ $\frac{1}{2}$

$\Rightarrow \frac{h}{x} = \sqrt{3}$

$\Rightarrow h = \sqrt{3}x$

In ΔBEC, $\frac{10}{x} = \tan 30° = \frac{1}{\sqrt{3}}$ $\frac{1}{2}$

$\Rightarrow x = 10\sqrt{3}$

$\therefore h = \sqrt{3} \times 10\sqrt{3} = 30$ m $\frac{1}{2}$

$\therefore$ Height of hill = (30 + 10) m = 40 m. $\frac{1}{2}$

9. (a) The radius of the base and the height of a solid right circular cylinder are in the ration 2 : 3 and its volume is 1617 cm^3. Find the total surface area of the cylinder. $\left(\text{Take } \pi = \frac{22}{7}\right)$

OR

(b) A solid metallic sphere of radius 10.5 cm is melted and recast into a number of smaller solid cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed.

Ans. (a) Let the height of right cylinder = h

Base = $\frac{2}{3}$ h $\frac{1}{2}$

$\therefore$ Volume = $\pi\left(\frac{2}{3}h\right)^2 \times h = 1617$ $\frac{1}{2}$

$\Rightarrow h^3 = \frac{7^3 \times 3^3}{2^3}$

$\Rightarrow h = \frac{21}{2} = 10.5$ 1

Total surface area = $2\pi r\ (l + r)$

$= 2 \times \frac{22}{7} \times 7\ (17.5)$ $\frac{1}{2}$

$= 770\ cm^2$ $\frac{1}{2}$

OR

(b) Volume of solid sphere = $\frac{4}{3}\pi\ (10.5)^3$ $\frac{1}{2}$

Volume of Cone = $\frac{1}{3}\pi\ (3.5)^2 .\ 3$ $\frac{1}{2}$

Let the number of cones be n

$\therefore\ n \times \frac{1}{3}\pi\ (3.5)^2 .\ 3 = \frac{4}{3}\pi\ (10.5)^3$ 1

$n = \frac{4}{3} \times \frac{(10.5)^3}{(3.5)^2}$

$= 126$ 1

$\therefore$ No. of Cones formed = 126

10. A canal is 300 cm wide and 120 cm deep. The water in the canal is flowing with a speed of 20 km/h. How much area will it irrigate in 20 minutes, if 8 cm of standing water is desired?

Ans. Width of canal = 3m

Depth of canal = 1.2m

Water is flowing at a spead of 20 km/h

$\therefore$ Length of water in $\frac{1}{3}$ hr (20 min) = $\frac{20}{3}$km

$= \frac{20000}{3}$ m. 1

Volume of water flowing in 20 minutes = $\frac{20000}{3} \times 3 \times 1.2$

$= 24{,}000\ m^3$ 1

Area irrigated in 20 Minute = $\frac{24000}{8/100}$

$= 300000\ m^2$ 1

SECTION C

Question numbers 11 to 14 carry 4 marks each.

11. (a) In Figure 2, two circles touch externally at P. A common tangent touches them at A and B and another common tangent is at P, which meets the common tangent AB at C. Prove that $\angle APB = 90°$.

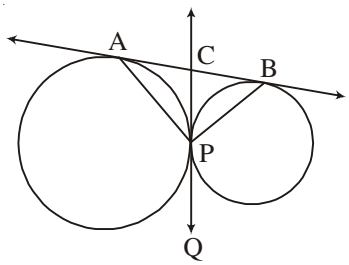


Figure 2

OR

(b) In Figure 3, PQ and LM are two Parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting PQ at A and LM at B. Prove that $\angle AOB = 90°$.

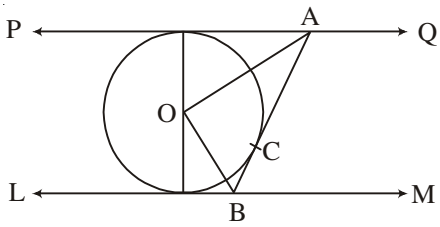
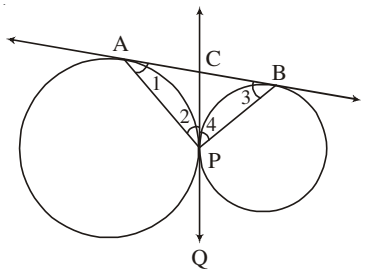


Figure 3

Ans. (a) Here CA = CP

$\Rightarrow \angle 1 = \angle 2$ ...(i) 1



Again CB = CP

$\Rightarrow \angle 3 = \angle 4$ ...(ii) 1

Adding (i) and (ii), we have

$\angle 1 + \angle 3 = \angle 2 + \angle 4$

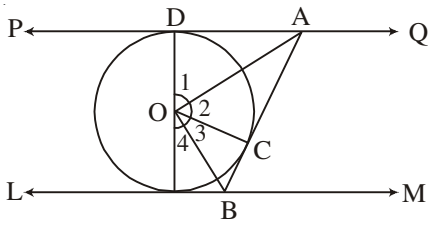
$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ (angles of ΔAPB) 1

$\therefore \angle APB = 90°$ 1

OR

(b) $\Delta ADO \cong \Delta ACO$

$\Rightarrow \angle 1 = \angle 2$ ...(i) 1



Similarly $\angle 3 = \angle 4$ ...(ii) 1

$\therefore \angle 1 + \angle 4 = \angle 2 + \angle 3$ (using (i) and (ii))

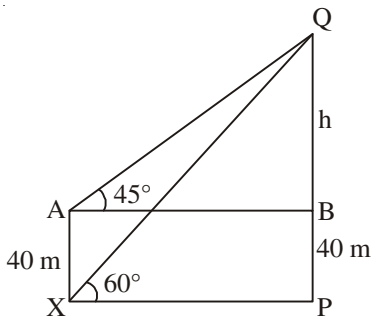
$\angle 1 + \angle 2 + \angle 3 + \angle 4 = 180°$ 1

$\Rightarrow \angle 2 + \angle 3 = 90°$

i.e. $\angle AOB = 90°$ 1

12. The angle of elevation of the top Q of a vertical tower PQ from a point X on the ground is 60°. From a point Y, 40 m vertically above X, the angle of elevation of Q is 45°. Find the height of the tower PQ and the distance XP. (Use $\sqrt{3} = 1.732$)

Ans. Let QB = h, AB = XP = x Correct Figure 1



$\frac{BQ}{AB} = \tan 45°$

$h = x$ ...(i) $\frac{1}{2}$

$\frac{40 + h}{x} = \tan 60° = \sqrt{3}$ $\frac{1}{2}$

$\Rightarrow 40 + h = \sqrt{3}h$

$\Rightarrow 40 = h\left(\sqrt{3} - 1\right)$

$\Rightarrow h = \frac{40}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1} = 20\ (\sqrt{3} + 1)$ 1

$= 20\ (1.732 + 1) = 54.64$

$\therefore$ PQ = h + 40 = 40 + 54.64 = 94.64 m. $\frac{1}{2}$

XP = 54.64 m. $\frac{1}{2}$

Height of the Tower = 94.64 m.

XP = 54.64 m

Case Study – 1

13. Social work aims at fulfilment of human needs. Social workers aim to open the doors of access and opportunity for those who are in greatest need. Free education is a great social work. By doint so, we can remove illiteracy from our society.

Rohan, being a social worker, wants to donate his land to the Village Panchayat for opening of a school.

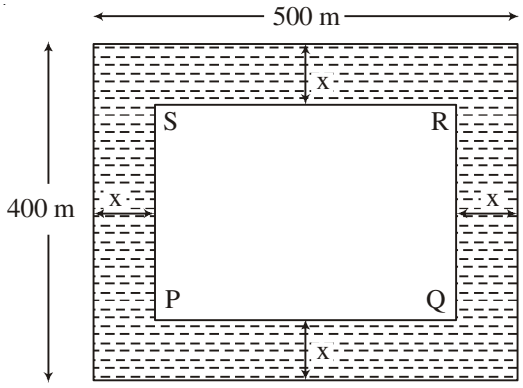


Figure 4

Rohan's land is in the form of a rectangle of dimensions 500 m × 400 m. The Village Panchayat decides to leave the area on all the four sides of the land for grass and flowers. If width fo x m land is kept for grass fand flowers on all the four sides (as shown in Figure 4);

(a) Find the lengths PQ and QR if area of grass and flowers region surrounding PQRS is 118400 m^2.

(b) Also, find the perimeter of the rectangle PQRS.

Ans. (a) Area of rectangle PQRS = 118400

$\therefore$ (500 – 2x) (400 – 2x) = 118400 1

$\Rightarrow x^2 - 450x + 29600 = 0$

$\Rightarrow$ x = 370 or x = 80 $\frac{1}{2}$

x = 370 is not possible,

$\therefore$ x = 80

$\therefore$ PQ = 500 – 160 – 340 m.

QR = 400 – 160 = 240 m. $\frac{1}{2}$

(b) Perimeter = 2(340 + 240) = 1160 m. 2

Case Study – 2

14. Health insurace is an agreement whereby the insurance company agrees to undertake a guarantee of compensation for medical expenses in case the insured falls ill or meets with an accident which leads to hospitalisation of the insured. The government also promotes health insurance by providing a deduction from income tax.

An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons having age 15 years and onwards but less than 60 years.

Age (in years)	Number of Policy Holders
15 – 20	2
20 – 25	4
25 – 30	18
30 – 35	21
35 – 40	33
40 – 45	11
45 – 50	3
50 – 55	6
55 – 60	2

(a) Find the modal age of the policy holders.

(b) Find the median age of the policy holders.

Ans.

Age	Frequency	Cumulative Frequency
15 – 20	2	2
20 – 25	4	6
25 – 30	18	24
30 – 35	21	45
35 – 40	33	78
40 – 45	11	89
45 – 50	3	92
50 – 55	6	98
55 – 60	2	100

(a) Here Max. frequency = 33, $\therefore$ $l = 35$

$f_1 = 33$, $f_0 = 21$, $f_2 = 11$, $h = 5$ $\frac{1}{2}$

$\therefore$ Mode $= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) h$

$= 35 + \left(\frac{33-21}{66-21-11}\right) \times 5$ 1

$= 36.8$ $\frac{1}{2}$

(b) $N = 100$, $\frac{N}{2} = 50$

$\therefore$ Median class is 35 – 40

Here $l = 35$, $f = 33$, $C = 45$ $\frac{1}{2}$

$\therefore$ Median $= l + \left(\frac{\frac{N}{2} - C}{f}\right) \times h$

$= 35 + \frac{50-45}{33} \times 5$ 1

$= 35 + 0.76 = 35.76$ $\frac{1}{2}$

Here Modal age of the policy holders = 36.8 years.

and Median age of the policy holders = 35.76 years.