

Class IX Session 2023-24
Subject - Mathematics
Sample Question Paper - 10

Time Allowed: 3 hours

Maximum Marks: 80

General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

Section A

1. $(1296)^{\frac{-1}{4}} =$ [1]
 - a) 6
 - b) $-\frac{1}{6}$
 - c) -6
 - d) $\frac{1}{6}$
2. The graph of $y = 6$ is a line [1]
 - a) Parallel to x-axis at a distance 6 units from the origin
 - b) Making an intercept 6 on the x- axis.
 - c) Making an intercept 6 on both the axes.
 - d) Parallel to y-axis at a distance 6 units from the origin
3. Signs of the abscissa and ordinate of a point in the second quadrant are respectively. [1]
 - a) (-, +)
 - b) (+, -)
 - c) (+, +)
 - d) (-, -)
4. In a histogram the area of each rectangle is proportional to [1]
 - a) the class size of the corresponding class interval
 - b) cumulative frequency of the corresponding class interval
 - c) the class mark of the corresponding class interval
 - d) frequency of the corresponding class interval

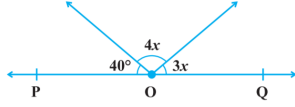
5. If (2, 0) is a solution of the linear equation $2x + 3y = k$, then the value of k is [1]

- a) 2
- b) 4
- c) 5
- d) 6

6. The things which are double of the same things are [1]

- a) equal
- b) halves of the same thing
- c) unequal
- d) double of the same thing

7. In the figure, POQ is a line. The value of x is [1]



- a) 25°
- b) 30°
- c) 20°
- d) 35°

8. If a diagonal AC and BD of a quadrilateral ABCD bisect each other, then ABCD is a [1]

- a) Parallelogram
- b) Rhombus
- c) Rectangle
- d) Triangle

9. If $10x - 4x^2 - 3$, then the value of $p(0) + p(1)$ is [1]

- a) -3
- b) 0
- c) 3
- d) 1

10. **The cost of a notebook is twice the cost of a pen.** The equation to represent this statement is [1]

- a) $2x = 3y$
- b) $x = 3y$
- c) none of these
- d) $x - 2y = 0$

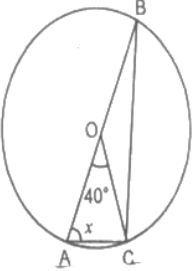
11. In $\triangle ABC$, E is the mid-point of median AD such that BE produced meets AC at F. If $AC = 10.5$ cm, then $AF =$ [1]

- a) 2.5 cm
- b) 5 cm
- c) 3 cm
- d) 3.5 cm

12. D and E are the mid-points of the sides AB and AC of $\triangle ABC$ and O is any point on the side BC, O is joined to [1]

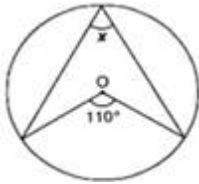
- a) A Triangle
- b) A Rectangle
- c) A Rhombus
- d) A Parallelogram

13. In a figure, O is the centre of the circle with AB as diameter. If $\angle AOC = 40^\circ$, the value of x is equal to [1]



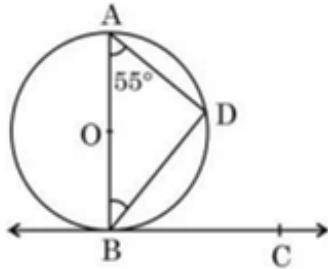
- a) 80°
- b) 50°
- c) 70°
- d) 60°

22. Find an angle marked as x in given figure where O is the centre of the circle: [2]



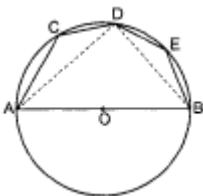
23. A hemispherical bowl made of brass has inner diameter 10.5 cm. Find the cost of tin-plating it on the inside at the rate of ₹32 per 100 cm^2 . [2]

24. In Fig., BC is tangent to the circle at point B of circle centred at O . BD is a chord of the circle so that $\angle BAD = 55^\circ$. Find $m \angle DBC$. [2]



OR

In given figure, AOB is a diameter of the circle and C, D, E are any three points on the semi-circle. Find the value of $\angle ACD + \angle BED$.



25. Express the linear equation in the form $ax + by + c = 0$ and indicate the values of a, b and c in $2x + 3y = 9.3\bar{5}$ [2]

OR

Find whether $(4, 0)$ is the solution of the equation $x - 2y = 4$ or not?

Section C

26. Solve the equation for x : $3^{2x+4} + 1 = 2 \times 3^{x+2}$ [3]
27. Find the value of the polynomial $3x^3 - 4x^2 + 7x - 5$, when $x = 3$ and also when $x = -3$. [3]
28. The perimeter of an isosceles triangle is 32 cm. The ratio of the equal side to its base is 3: 2. Find the area of the triangle. [3]

OR

Find the cost of laying grass in a triangular field of sides 50 m, 65 m and 65 m at the rate of Rs7 per m^2 .

29. Find the solution of the linear equation $x + 2y = 8$ which represents a point on [3]

- i. The x-axis
- ii. The y-axis

30. P is the mid-point of the side CD of a parallelogram $ABCD$. A line through C parallel to PA intersects AB at Q and DA produced at R . Prove that $DA = AR$ and $CQ = QR$. [3]

OR

Show that the quadrilateral formed by joining the mid-points the sides of a rhombus, taken in order, form a rectangle.

31. Write the answer of each of the following questions: [3]
- i. What is the name of horizontal and the vertical lines drawn to determine the position of any point in the Cartesian plane?

ii. What is the name of each part of the plane formed by these two lines?

iii. Write the name of the point where these two lines intersect.

Section D

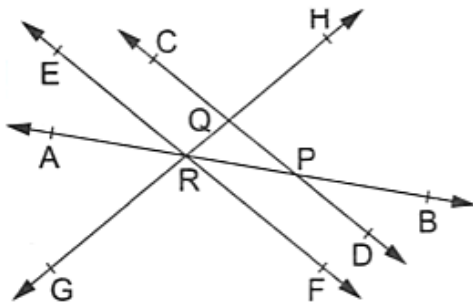
32. Find the values of a and b if $\frac{7+3\sqrt{5}}{3+\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$. [5]

OR

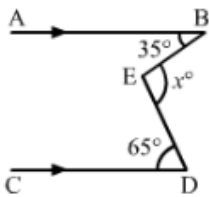
If $a = \frac{\sqrt{2}+1}{\sqrt{2}-1}$ and $b = \frac{\sqrt{2}-1}{\sqrt{2}+1}$, then find the value of $a^2 + b^2 - 4ab$.

33. In the adjoining figure, name: [5]

- i. Two pairs of intersecting lines and their corresponding points of intersection
- ii. Three concurrent lines and their points of intersection
- iii. Three rays
- iv. Two line segments

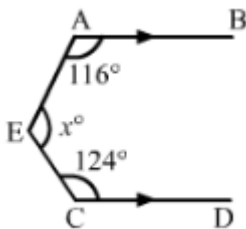


34. In each of the figures given below, $AB \parallel CD$. Find the value of x° in each case. [5]



OR

In each of the figures given below, $AB \parallel CD$. Find the value of x° in each other case.



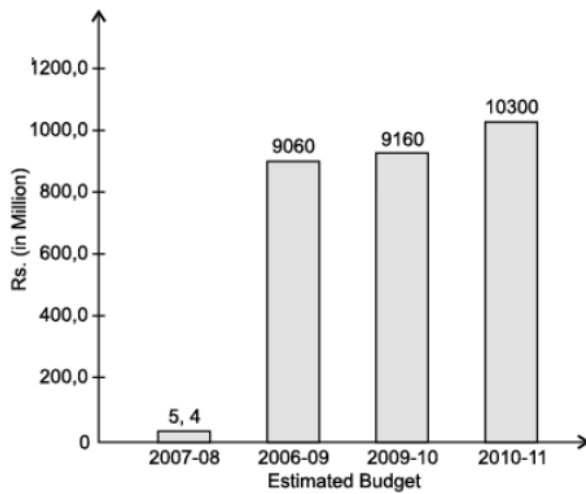
35. What must be added to $x^4 + 2x^3 - 2x^2 + x - 1$ so that the result is exactly divisible by $x^2 + 2x - 3$ [5]

Section E

36. **Read the text carefully and answer the questions:** [4]

Ladli Scheme was launched by the Delhi Government in the year 2008. This scheme helps to make women strong and will empower a girl child. This scheme was started in 2008.

The expenses for the scheme are plotted in the following bar chart.



- (i) What are the total expenses from 2009 to 2011?
- (ii) What is the percentage of no of expenses in 2009-10 over the expenses in 2010-11?
- (iii) What is the percentage of minimum expenses over the maximum expenses in the period 2007-2011?

OR

What is the difference of expenses in 2010-11 and the expenses in 2006-09?

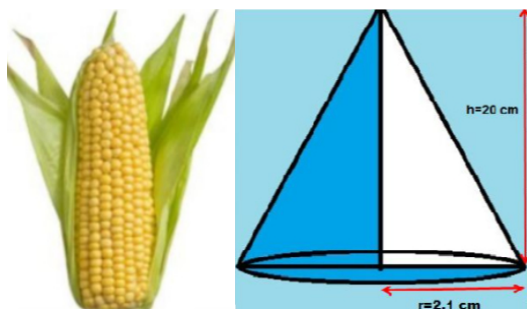
37. **Read the text carefully and answer the questions:**

[4]

Once upon a time in Ghaziabad was a corn cob seller. During the lockdown period in the year 2020, his business was almost lost.

So, he started selling corn grains online through Amazon and Flipcart. Just to understand how many grains he will have from one corn cob, he started counting them.

Being a student of mathematics let's calculate it mathematically. Let's assume that one corn cob (see Fig.), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length as 20 cm.



- (i) Find the curved surface area of the corn cub.
- (ii) What is the volume of the corn cub?
- (iii) If each 1 cm^2 of the surface of the cob carries an average of four grains, find how many grains you would find on the entire cob?

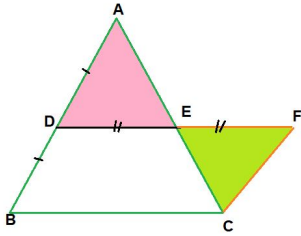
OR

How many such cubs can be stored in a carton of size $20 \text{ cm} \times 25 \text{ cm} \times 20 \text{ cm}$.

38. **Read the text carefully and answer the questions:**

[4]

Hareh and Deep were trying to prove a theorem. For this they did the following



- i. Draw a triangle ABC
- ii. D and E are found as the mid points of AB and AC
- iii. DE was joined and DE was extended to F so $DE = EF$
- iv. FC was joined.
 - (i) $\triangle ADE$ and $\triangle EFC$ are congruent by which criteria?
 - (ii) Show that $CF \parallel AB$.
 - (iii) Show that $CF = BD$.

OR

Show that $DF = BC$ and $DF \parallel BC$.

Solution

Section A

1. (d) $\frac{1}{6}$
Explanation: $(1296)^{\frac{-1}{4}} = (6^4)^{\frac{-1}{4}}$
 $= (6)^{-1} = \frac{1}{6}$
2. (a) Parallel to x-axis at a distance 6 units from the origin
Explanation: As $y = a$ is an equation of a line parallel to x-axis at a distance of a units from the origin.
3. (a) $(-, +)$
Explanation: Abscissa means just the horizontal axis i.e. x axis. Ordinate means just the vertical axis i.e. y axis. x-coordinate and y-coordinate make a point. The signs of abscissa and ordinate of a point in quadrant II are $(-, +)$.
4. (d) frequency of the corresponding class interval
Explanation: A histogram is a display of statistical information that uses rectangles to show the frequency of data items in successive numerical intervals of equal size. In the most common form of histogram, the independent variable is plotted along the horizontal axis and the dependent variable is plotted along the vertical axis.
5. (b) 4
Explanation: $(2, 0)$ is a solution of the linear equation $2x + 3y = k$
 $\Rightarrow 4 = k$
6. (a) equal
Explanation: According to an Euclidian axiom, The things which are double of the same things are equal to one another. Example : if $2x = 2y$, then $x = y$.
7. (c) 20°
Explanation: Since, POQ is a line segment.
 $\therefore \angle POQ = 180^\circ$
 $\Rightarrow \angle POA + \angle AOB + \angle BOQ = 180^\circ$
 $\Rightarrow 40^\circ + 4x + 3x = 180^\circ$
[Putting $\angle POA = 40^\circ$, $\angle AOB = 4x$ and $\angle BOQ = 3x$]
 $\Rightarrow 7x = 180^\circ - 40^\circ$
 $\Rightarrow 7x = 140^\circ$
 $\Rightarrow x = \frac{140^\circ}{7}$
 $\therefore x = 20^\circ$
8. (a) Parallelogram
Explanation: Two diagonals of quadrilateral form four triangles. Out of these four triangles two triangles of opposite to each other are congruent by SAS. By using CPCT property we can prove that both pair of opposite sides in a quadrilateral are parallel. A quadrilateral with both pair of opposite sides parallel is called parallelogram.
9. (b) 0
Explanation: $10x - 4x^2 - 3$
 $p(x) = -4x^2 + 10x - 3$
 $\Rightarrow p(0) + p(1) = [-4(0)^2 + 10(0) - 3] + [-4(1)^2 + 10(1) - 3]$

$$\Rightarrow p(0) + p(1) = [0 + 0 - 3] + [-4 + 10 - 3]$$

$$\Rightarrow p(0) + p(1) = [-3] + [3]$$

$$\Rightarrow p(0) + p(1) = 0$$

10.

(d) $x - 2y = 0$

Explanation: Let the cost of the notebook is ₹ x and pen is ₹ y and we have given that the cost of a notebook is twice the cost of a pen.

So we have

$$x = 2y$$

$$\text{or } x - 2y = 0$$

11.

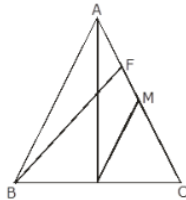
(d) 3.5 cm

Explanation:

Given,

In $\triangle ABC$

E is mid point of median AD



$$AC = 10.5 \text{ cm}$$

Draw $DM \parallel EF$

$\because E$ is mid point of AD so F is mid point of AM

$$AF = FM \dots(i)$$

In $\triangle BFC$

$$EF \parallel DM$$

So, $FM = MC \dots(ii)$

From (i) & (ii)

$$AF = MC \dots(iii)$$

$$AC = AF + MC + FM$$

$$\Rightarrow AC = AF + AF + AF \text{ From (i) (ii) \& (iii)}$$

$$AC = 3AF$$

$$AF = \frac{1}{3} AC$$

$$AF = \frac{1}{3} \times 10.5 = 3.5 \text{ cm}$$

12.

(d) A Parallelogram

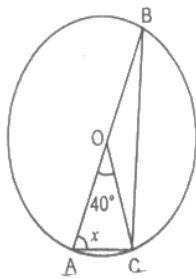
Explanation: By mid point theorem, DE is parallel to BC . In triangle BOA , DP parallel to OA and OA is parallel to QE in triangle AOC (mid point theorem) because D and P are mid points in triangle BOA and E and Q are mid points in triangle AOC .

So, DP is parallel to EQ . In quadrilateral $DPQE$, both pair of opposite sides are parallel. So, it become parallelogram.

13.

(c) 70°

Explanation:



OA = OC (radii)

So, $\angle OAC = \angle OCA = x$

Again, In $\triangle OAC$

$$\angle OAC + \angle OCA + \angle AOC = 180^\circ$$

$$x + x + \angle AOC = 180^\circ$$

$$x + x + 40^\circ = 180^\circ$$

$$2x = 140^\circ$$

$$x = 70^\circ$$

14.

(c) 2

Explanation: 1.9999 can be written as 2,
2 is taken as approx value .

15. (a) $y = kx$

Explanation: let force applied be y and acceleration produced be x
The force applied on a body is directly proportional to the acceleration produced on it.

$$y \propto x$$

$$y = kx$$

where k is proportionality constant

16.

(d) 4 : 3 : 2

Explanation:

$$3A = 4B = 6C$$

$$3A = 4B \Rightarrow A/B = 4/3$$

This means, A:B=4:3

$$4B = 6C \Rightarrow B/C = 6/4 = 3/2$$

$$\Rightarrow B:C = 3:2$$

The value of B in 4:3 is equal to the value of B in 3:2

Hence A : B : C = 4 : 3 : 2

17.

(c) 2

Explanation: Adjusted frequency = $\left(\frac{\text{frequency of the class}}{\text{width of the class}} \right) \times 5$

Therefore, Adjusted frequency of 25 - 45 = $\frac{8}{20} \times 5 = 2$

18. (a) 704 cm²

Explanation: Given $r = 7$ cm, $h = 24$ cm

So, slant height, $l = \sqrt{r^2 + h^2}$

$$= \sqrt{7^2 + 24^2}$$

$$= \sqrt{49 + 576}$$

$$= \sqrt{625}$$

$$= 25 \text{ cm}$$

So, surface area of hollow cone = curved surface area + area of base

$$\begin{aligned}
 &= \pi r l + \pi r^2 \\
 &= \pi r(1 + r) \\
 &= \frac{22}{7} \times 7(25 + 7) \\
 &= 22 \times 32 \\
 &= 704 \text{ cm}^2
 \end{aligned}$$

19.

(c) A is true but R is false.

Explanation: $s = \frac{a+b+c}{2}$

$$s = \frac{3+4+5}{2} = 6 \text{ cm}$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{(6)(6-3)(6-4)(6-5)}$$

$$= \sqrt{(6)(3)(2)(1)} = 6 \text{ cm}^2$$

20.

(c) A is true but R is false.

Explanation: Every linear equation has degree 1.

$2x + 5 = 0$ and $3x + y = 5$ are linear equations. So, both have degree 1.

Section B

21. Computation of area: Clearly, the park is triangular with sides

$$a = BC = 120 \text{ m}, b = CA = 80 \text{ m} \text{ and } c = AB = 50 \text{ m}$$

If s denotes the semi-perimeter of the park, then

$$2s = a + b + c \Rightarrow 2s = 120 + 80 + 50 \Rightarrow s = 125$$

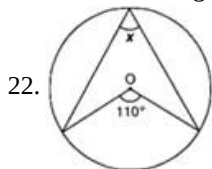
$$\therefore s - a = 125 - 120 = 5, s - b = 125 - 80 = 45 \text{ and } s - c = 125 - 50 = 75$$

$$\text{Hence, Area of the park} = \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{125 \times 5 \times 45 \times 75} \text{ m}^2 = 375\sqrt{15} \text{ m}^2$$

Length of the wire needed for fencing = perimeter of the park - width of the gate

$$= 250\text{m} - 3\text{m} = 247 \text{ m}$$

$$\text{Cost of fencing} = \text{Rs.}(20 \times 247) = \text{Rs.}4940$$



$$x = \frac{1}{2} \times 110^\circ = 55^\circ$$

[\therefore Angle subtended by an arc of a circle at the centre is double the angle subtended by it at any point of the remaining part of the circle.]

23. Inner radius of the bowl, $r = \frac{10.5}{2} = 5.25 \text{ cm}$

$$\text{Therefore, Inner curved surface area of the bowl} = 2\pi r^2 = 2 \times \frac{22}{7} \times (5.25)^2 = 173.25 \text{ cm}^2$$

$$\text{Rate of tin-plating} = 32 \text{ per } 100 \text{ cm}^2$$

Therefore, Cost of tin-plating the bowl on the inside

$$= \text{Inner curved surface area of the bowl} \times \text{Rate of tin-plating}$$

$$= 173.25 \times \frac{32}{100}$$

$$= 55.44$$

Therefore, the cost of tin-plating the bowl on the inside is 55.44.

24. In $\triangle ADB$,

$$\angle ADB = 90^\circ \text{ (Angle in semi-circle) ... (i)}$$

Now, by using angle sum property in $\triangle ABD$, we have

$$\angle ABD + \angle ADB + \angle DAB = 180^\circ$$

$$\Rightarrow \angle ABD + 90^\circ + 55^\circ = 180^\circ \text{ ... [From equation (i) and given } \angle DAB = 55^\circ \text{]}$$

$$\Rightarrow \angle ABD + 180^\circ - 145^\circ$$

$$\Rightarrow \angle ABD = 35^\circ \text{ ... (ii)}$$

Now, $\angle ABD = 90^\circ$... (Angle between tangent and radius)

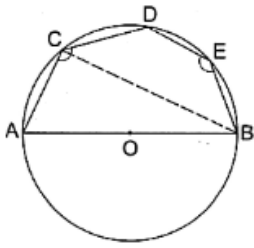
or, $\angle ABD + \angle DBC = 90^\circ$

or, $\angle DBC = 90^\circ - \angle ABD$

or, $\angle DBC = 90^\circ - 35^\circ$... [From equation (ii)]

or, $\angle DBC = 55^\circ$

OR



Join BC,

Then, $\angle ACB = 90^\circ$ (Angle in the semicircle)

Since DCBE is a cyclic quadrilateral.

$\angle BCD + \angle BED = 180^\circ$

Adding $\angle ACB$ both the sides, we get

$\angle BCD + \angle BED + \angle ACB = \angle ACB + 180^\circ$

$(\angle BCD + \angle ACB) + \angle BED = 90^\circ + 180^\circ$

$\angle ACD + \angle BED = 270^\circ$

25. $2x + 3y = 9.3\bar{5}$

We need to express the linear equation $2x + 3y = 9.3\bar{5}$ in the form $ax + by + c = 0$ and indicate the values of a, b and c.

$2x + 3y = 9.3\bar{5}$ can also be written as $2x + 3y - 9.3\bar{5} = 0$.

We need to compare the equation $2x + 3y - 9.3\bar{5} = 0$

with the general equation $ax + by + c = 0$, to get the values of a, b and c.

Therefore, we can conclude that $a = 2, b = 3$ and $c = -9.3\bar{5}$

OR

$x - 2y = 4$

Put $x = 4$ and $y = 0$ in given equation, we get

$x - 2y = 4 - 2(0) = 4$

$\therefore (4, 0)$ is a solution of given equation.

Section C

26. $3^{2x+4} + 1 = 2 \times 3^{x+2}$

$\Rightarrow 3^{2x} \cdot 3^4 + 1 = 2 \cdot 3^x \cdot 3^2$

$\Rightarrow (3^x)^2 \times 81 + 1 = 18 \cdot 3^x$

$\Rightarrow 81(3^x)^2 - 18 \cdot 3^x + 1 = 0$

Let $3^x = a$

Thus, we have $81a^2 - 18a + 1 = 0$

$\Rightarrow 81a^2 - 9a - 9a + 1 = 0$

$\Rightarrow (9a)^2 - 2(9a)(1) + (1)^2 = 0$

$\Rightarrow (9a - 1)^2 = 0$

$\Rightarrow 9a - 1 = 0$

$\Rightarrow 9a = 1$

$\Rightarrow a = \frac{1}{9}$

$\Rightarrow 3^x = \frac{1}{9}$

$\Rightarrow 3^x = \frac{1}{3^2} = 3^{-2}$

$\Rightarrow x = -2$

27. Let $p(x) = 3x^3 - 4x^2 + 7x - 5$

$\therefore p(3) = 3(3)^3 - 4(3)^2 + 7(3) - 5$

$$\begin{aligned}
&= 3(27) - 4(9) + 21 - 5 \\
&= 81 - 36 + 21 - 5 \\
&= 61
\end{aligned}$$

$$\begin{aligned}
\text{Now, } p(-3) &= 3(-3)^3 - 4(-3)^2 + 7(-3) - 5 \\
&= 3(-27) - 4(9) - 21 - 5 \\
&= -81 - 36 - 21 - 5 \\
&= -143
\end{aligned}$$

28. As the sides of the equal to the base of an isosceles triangle is 3 : 2, so let the sides of an isosceles triangle be $3x$, $3x$ and $2x$.

$$\text{Now, perimeter of triangle} = 3x + 3x + 2x = 8x$$

$$\text{Given Perimeter of triangle} = 32 \text{ m}$$

$$\therefore 8x = 32; x = 32 \div 8 = 4$$

So, the sides of the isosceles triangle are $(3 \times 4)\text{cm}$, $(3 \times 4)\text{cm}$, $(2 \times 4)\text{cm}$ i.e., 12 cm, 12 cm and 8cm

$$\begin{aligned}
\therefore s &= \frac{12+12+8}{2} = \frac{32}{2} = 16\text{cm} \\
&= \sqrt{16(16-12)(16-12)(16-8)} \\
&= \sqrt{16 \times 4 \times 4 \times 8} = \sqrt{4 \times 4 \times 4 \times 4 \times 4 \times 2} \\
&= 4 \times 4 \times 2\sqrt{2} = 32\sqrt{2}\text{cm}^2
\end{aligned}$$

OR

$$\text{We have, } 2s = 50 \text{ m} + 65 \text{ m} + 65 \text{ m} = 180 \text{ m}$$

$$S = 180 \div 2 = 90 \text{ m}$$

$$\begin{aligned}
\text{Area of } \Delta &= \sqrt{s(s-a)(s-b)(s-c)} \\
&= \sqrt{90(90-50)(90-65)(90-65)} \\
&= \sqrt{90 \times 40 \times 25 \times 25} = 60 \times 25 \\
&= 1500\text{m}^2.
\end{aligned}$$

$$\text{Cost of laying grass at the rate of Rs7 per m}^2 = \text{Rs}(1500 \times 7) = \text{Rs}10,500.$$

29. i. On x-axis $y = 0$

$$\Rightarrow x + 2 \times 0 = 8 \Rightarrow x = 8$$

Therefore, the required point is (8, 0).

ii. On y-axis $x = 0$

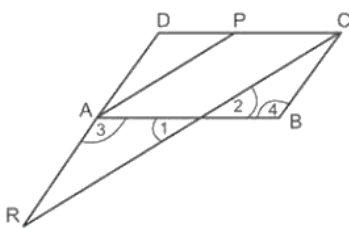
$$\Rightarrow 0 + 2y = 8$$

$$\Rightarrow y = \frac{8}{2} \Rightarrow y = 4$$

Thus, the required point is (0, 4).

30. ABCD is a parallelogram. P is the mid-point of CD. CR which intersects AB at Q is parallel to AP

In $\triangle DCR$, P is the mid-point of CD and $AP \parallel CR$,



\therefore A is the mid-point of DR, i.e., $AD = AR$.

[\therefore The line drawn through the mid-point of one side of a triangle parallel to another side intersects the third side at its mid-point.]

In $\triangle ARQ$ and $\triangle BCQ$, we have

$$AR = BC \text{ [}\therefore AD = AR \text{ [proved above] and } AD = BC\text{]}$$

$$\angle 1 = \angle 2 \text{ [Vertically opposite angles]}$$

$$\angle 3 = \angle 4 \text{ [Alt. } \angle s\text{]}$$

$$\therefore \triangle ARQ \cong \triangle BCQ \text{ [By AAS Congruence rule]}$$

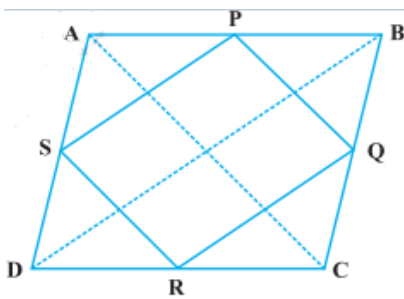
$$CQ = QR \text{ [CPCT]}$$

$$CQ = QR$$

$$\text{Hence, } DA = AR \text{ and } CQ = QR$$

OR

Let ABCD be a rhombus and P, Q, R and S be the mid-points of sides AB, BC, CD and DA, respectively (Fig.). Join AC and BD.



From triangle ABD, we have $SP = \frac{1}{2}BD$ and

$SP \parallel BD$ (Because S and P are mid-points)

Similarly $RQ = \frac{1}{2}BD$ and $RQ \parallel BD$

Therefore, $SP = RQ$ and $SP \parallel RQ$

So, PQRS is a parallelogram ...(1)

Also, $AC \perp BD$ (Diagonals of a rhombus are perpendicular)

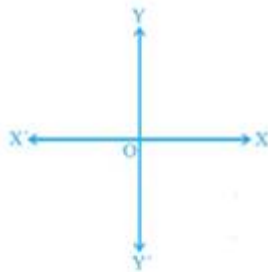
Further $PQ \parallel AC$ (From $\triangle BAC$)

As $SP \parallel BD$, $PQ \parallel AC$ and $AC \perp BD$,

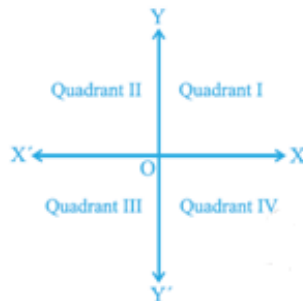
therefore, we have $BD \perp PQ$, i.e. $\angle SPQ = 90^\circ$. ..(2)

Therefore, PQRS is a rectangle. [From (1) and (2)]

31. i. The horizontal line that is drawn to determine the position of any point in the Cartesian plane is called as x-axis. The vertical line that is drawn to determine the position of any point in the Cartesian plane is called as y-axis



- ii. The name of each part of the plane that is formed by x-axis and y-axis is called as quadrant.



- iii. The point, where the x-axis and the y-axis intersect is called as origin.

Section D

32. LHS

$$\begin{aligned}
 &= \frac{7+3\sqrt{5}}{3+\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}} \\
 &= \frac{7+3\sqrt{5}}{3+\sqrt{5}} \times \frac{3-\sqrt{5}}{3-\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}} \\
 &= \frac{7 \times 3 - 7\sqrt{5} + 3\sqrt{5} \times 3 - 3\sqrt{5} \times \sqrt{5}}{7 \times 3 + 7\sqrt{5} - 3\sqrt{5} \times 3 - 3\sqrt{5} \times \sqrt{5}} - \frac{7 \times 3 + 7\sqrt{5} - 3\sqrt{5} \times 3 - 3\sqrt{5} \times \sqrt{5}}{3^2 - \sqrt{5}^2} \\
 &= \frac{21 - 7\sqrt{5} + 9\sqrt{5} - 15}{9 - 5} - \frac{21 + 7\sqrt{5} - 9\sqrt{5} - 15}{9 - 5} \\
 &= \frac{6 + 2\sqrt{5}}{4} - \frac{6 - 2\sqrt{5}}{4} \\
 &= \frac{6 + 2\sqrt{5} - 6 + 2\sqrt{5}}{4} \\
 &= \frac{0 + 4\sqrt{5}}{4} \\
 &= 0 + \sqrt{5}
 \end{aligned}$$

We know that,

$$\frac{7+3\sqrt{5}}{3+\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$$

$$0 + \sqrt{5} = a + b\sqrt{5}$$

$$a = 0 \text{ and } b = 1$$

OR

$$\text{Given, } a = \frac{\sqrt{2}+1}{\sqrt{2}-1} \text{ and } b = \frac{\sqrt{2}-1}{\sqrt{2}+1}$$

$$\begin{aligned} \text{Here, } a &= \frac{\sqrt{2}+1}{\sqrt{2}-1} = \frac{\sqrt{2}+1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{(\sqrt{2}+1)^2}{(\sqrt{2})^2-1^2} \\ &= \frac{(\sqrt{2})^2+1+2\sqrt{2}}{2-1} = \frac{2+1+2\sqrt{2}}{1} = 3 + 2\sqrt{2} \end{aligned}$$

$$\therefore a = 3 + 2\sqrt{2} \dots(i)$$

$$\begin{aligned} b &= \frac{\sqrt{2}-1}{\sqrt{2}+1} = \frac{\sqrt{2}-1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \frac{(\sqrt{2}-1)^2}{(\sqrt{2})^2-1} \\ &= \frac{(\sqrt{2})^2+1^2-2\sqrt{2}}{2-1} = \frac{2+1-2\sqrt{2}}{1} = 3 - 2\sqrt{2} \end{aligned}$$

$$\therefore b = 3 - 2\sqrt{2} \dots(ii)$$

From equation (i) and (ii)

$$a + b = 3 + 2\sqrt{2} + 3 - 2\sqrt{2} = 6$$

$$\begin{aligned} ab &= (3 + 2\sqrt{2})(3 - 2\sqrt{2}) = 3^2 - (2\sqrt{2})^2 \\ &= 9 - 4 \times 2 = 9 - 8 = 1 \end{aligned}$$

$$\therefore a^2 + b^2 - 4ab = a^2 + b^2 + 2ab - 6ab$$

$$= (a + b)^2 - 6ab$$

$$= 6^2 - 6$$

$$= 36 - 6 = 30$$

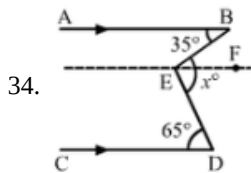
33. i. \overleftrightarrow{EF} , \overleftrightarrow{GH} and their corresponding point of intersection is R.

\overleftrightarrow{AB} , \overleftrightarrow{CD} and their corresponding point of intersection is P.

ii. \overleftrightarrow{AB} , \overleftrightarrow{EF} , \overleftrightarrow{GH} and their point of intersection is R.

iii. Three rays are: \overrightarrow{RB} , \overrightarrow{RH} , \overrightarrow{RG}

iv. Two line segments are: \overline{RQ} , \overline{RP} .



Draw $EF \parallel AB \parallel CD$

Now, $AB \parallel EF$ and BE is the transversal.

Then,

$$\angle ABE = \angle BEF \text{ [Alternate Interior Angles]}$$

$$\Rightarrow \angle BEF = 35^\circ$$

Again, $EF \parallel CD$ and DE is the transversal

Then,

$$\angle DEF = \angle FED$$

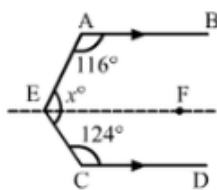
$$\Rightarrow \angle FED = 65^\circ$$

$$\therefore x^\circ = \angle BEF + \angle FED$$

$$x^\circ = 35^\circ + 65^\circ$$

$$x^\circ = 100^\circ$$

OR



Draw $EF \parallel AB \parallel CD$

$$\text{Then, } \angle AEF + \angle CEF = x^\circ$$

Now, $EF \parallel AB$ and AE is the transversal

$$\therefore \angle AEF + \angle BAE = 180^\circ \text{ [Consecutive Interior Angles]}$$

$$\Rightarrow \angle AEF + 116 = 180$$

$$\Rightarrow \angle AEF = 64^\circ$$

Again, $EF \parallel CD$ and CE is the transversal.

$$\angle CEF + \angle ECD = 180^\circ \text{ [Consecutive Interior Angles]}$$

$$\Rightarrow \angle CEF + 124 = 180$$

$$\Rightarrow \angle CEF = 56^\circ$$

Therefore,

$$x^\circ = \angle AEF + \angle CEF$$

$$x^\circ = (64 + 56)^\circ$$

$$x^\circ = 120^\circ$$

35. Let $p(x) = x^4 + 2x^3 - 2x^2 + x - 1$ and $q(x) = x^2 + 2x - 3$. When $p(x)$ is divided by $q(x)$, the remainder is a linear expression in x . Therefore, let $r(x) = ax + b$ be added to $p(x)$ so that $p(x) + r(x)$ is divisible by $q(x)$.

Let

$f(x) = p(x) + r(x)$. Therefore, we have,

$$f(x) = x^4 + 2x^3 - 2x^2 + x - 1 + ax + b$$

$$f(x) = x^4 + 2x^3 - 2x^2 + (a + 1)x + b - 1$$

$$\text{We have, } q(x) = x^2 + 2x - 3 = x^2 + 3x - x - 3 = x(x + 3) - (x + 3) = (x - 1)(x + 3)$$

Clearly, $q(x)$ is divisible by $(x - 1)$ and $(x + 3)$ i.e. $x - 1$ and $x + 3$ are factors of $q(x)$.

$$\text{i.e., } f(1) = 0 \text{ and } f(-3) = 0$$

$$\Rightarrow 1 + 2 - 2 + a + 1 + b - 1 = 0$$

$$\text{and, } (-3)^4 + 2(-3)^3 - 2(-3)^2 + (a + 1)x(-3) + b - 1 = 0$$

$$\Rightarrow a + b + 1 = 0 \text{ and } 81 - 54 - 18 - 3a - 3 + b - 1 = 0$$

$$\Rightarrow a + b + 1 = 0 \text{ and } -3a + b + 5 = 0$$

$$\Rightarrow a + b = -1 \text{ and } 3a - b = 5$$

Therefore, on adding these two equations, we have,

$$\Rightarrow (a + b) + (3a - b) = -1 + 5 \Rightarrow 4a = 4 \Rightarrow a = 1$$

Putting $a = 1$ in $a + b = -1$, we have,

$$1 + b = -1 \Rightarrow b = -2$$

$$\therefore r(x) = ax + b \Rightarrow r(x) = x - 2$$

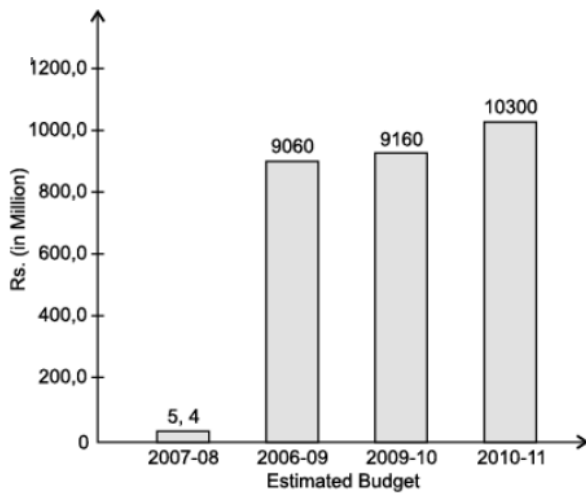
Therefore, $x^4 + 2x^3 - 2x^2 + x - 1$ will be divisible by $x^2 + 2x - 3$, if $x - 2$ is added to it.

Section E

36. Read the text carefully and answer the questions:

Ladli Scheme was launched by the Delhi Government in the year 2008. This scheme helps to make women strong and will empower a girl child. This scheme was started in 2008.

The expenses for the scheme are plotted in the following bar chart.



- (i) Expenses in 2009-10 = 9160 Million
 Expenses in 2010-11 = 10300 Million
 Total expenses from 2009 to 2011
 = 9160 + 10300
 = 19460 Million

- (ii) Expenses in 2009-10 = 9160 Million
 Expenses in 2010-11 = 10300 Million
 Thus percentage of no of expenses in 2009-10 over the expenses in 2010-11
 = $\frac{9160}{10300} \times 100$
 = 88.93%

- (iii) The minimum expenses (in 2007-08) = 5.4 Million
 The maximum expenses (in 2010-11) = 10300 Million
 Thus percentage of no of minimum expenses over the maximum expenses
 = $\frac{5.4}{10300} \times 100$
 = 0.052%

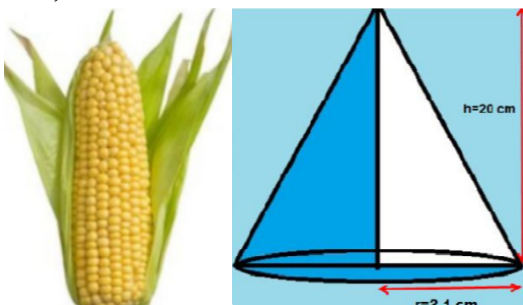
OR

The expenses in 2010-11 = 10300 Million
 The expenses in 2006-09 = 9060 Million
 The difference = 10300 - 9060 Million
 = 1240 Million

37. Read the text carefully and answer the questions:

Once upon a time in Ghaziabad was a corn cob seller. During the lockdown period in the year 2020, his business was almost lost. So, he started selling corn grains online through Amazon and Flipcart. Just to understand how many grains he will have from one corn cob, he started counting them.

Being a student of mathematics let's calculate it mathematically. Let's assume that one corn cob (see Fig.), shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length as 20 cm.



- (i) First we will find the curved surface area of the corn cob.

We have, $r = 2.1$ and $h = 20$

Let l be the slant height of the conical corn cob. Then,

$$l = \sqrt{r^2 + h^2} = \sqrt{(2.1)^2 + (20)^2} = \sqrt{4.41 + 400} = \sqrt{404.41} = 20.11 \text{ cm}$$

\therefore Curved surface area of the corn cub = $\pi r l$

$$= \frac{22}{7} \times 2.1 \times 20.11 \text{ cm}^2$$

$$= 132.726 \text{ cm}^2 = 132.73 \text{ cm}^2$$

- (ii) The volume of the corn cub

$$= \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 2.1 \times 2.1 \times 20$$

$$= 92.4 \text{ cm}^3$$

- (iii) Now

Total number of grains on the corn cob = Curved surface area of the corn cob \times Number of grains of corn on 1 cm^2

Hence, Total number of grains on the corn cob = $132.73 \times 4 = 530.92$

So, there would be approximately 531 grains of corn on the cob.

OR

Volume of a corn cub = 92.4 cm^3

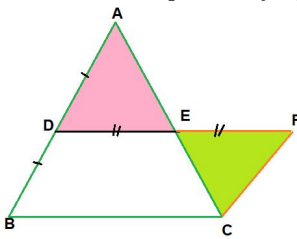
Volume of the carton = $20 \times 25 \times 20 = 10,000 \text{ cm}^3$

Thus no. of cubs which can be stored in the carton

$$\frac{10000}{92.4} \approx 108 \text{ cubs}$$

38. Read the text carefully and answer the questions:

Haresh and Deep were trying to prove a theorem. For this they did the following



- i. Draw a triangle ABC

- ii. D and E are found as the mid points of AB and AC

- iii. DE was joined and DE was extended to F so $DE = EF$

- iv. FC was joined.

- (i) $\triangle ADE$ and $\triangle CFE$

$DE = EF$ (By construction)

$\angle AED = \angle CEF$ (Vertically opposite angles)

$AE = EC$ (By construction)

By SAS criteria $\triangle ADE \cong \triangle CFE$

- (ii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal

$\angle EFC = \angle EDA$

alternate interior angles are equal

$\Rightarrow AD \parallel FC$

$\Rightarrow CF \parallel AB$

- (iii) $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal.

$CF = AD$

We know that D is mid point AB

$\Rightarrow AD = BD$

$\Rightarrow CF = BD$

OR

$DE = \frac{BC}{2}$ {line drawn from mid points of 2 sides of \triangle is parallel and half of third side}

$DE \parallel BC$ and $DF \parallel BC$

$$DF = DE + EF$$

$$\Rightarrow DF = 2DE(BE = EF)$$

$$\Rightarrow DF = BC$$