

Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 3

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 carrying 04 marks each.
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 2 marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

Section A

1. π is [1]
 - a) a rational number
 - b) an integer
 - c) an irrational number
 - d) a whole number
2. The linear equation $3x - 5y = 15$ has [1]
 - a) no solution
 - b) infinitely many solutions
 - c) a unique solution
 - d) two solutions
3. Two points having same abscissa but different ordinates lie on [1]
 - a) y-axis
 - b) x-axis
 - c) a line parallel to y-axis
 - d) a line parallel to x-axis
4. To draw a histogram to represent the following frequency distribution : [1]

Class interval	5-10	10-15	15-25	25-45	45-75
Frequency	6	12	10	8	15

The adjusted frequency for the class 25-45 is

 - a) 6
 - b) 5
 - c) 2
 - d) 3
5. The graph of the linear equation $2x + 3y = 6$ is a line which meets the x-axis at the point [1]
 - a) (0,3)
 - b) (3,0)

c) (2, 0)

d) (0, 2)

6. Euclid stated that all right angles are equal to each other in the form of [1]

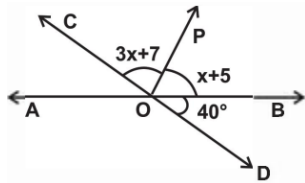
a) A postulate

b) A proof

c) An axiom

d) A definition

7. In the figure AB & CD are two straight lines intersecting at O, OP is a ray. What is the measure of $\angle AOD$. [1]



a) 128°

b) 40°

c) 140°

d) 100°

8. The diagonals AC and BD of a rectangle ABCD intersect each other at P. If $\angle ABD = 50^\circ$, then $\angle DPC =$ [1]

a) 70°

b) 80°

c) 90°

d) 100°

9. Zero of the zero polynomial is - [1]

a) every real number

b) 1

c) not defined

d) 0

10. Express y in terms of x in the equation $5x - 2y = 7$. [1]

a) $y = \frac{5x-7}{2}$

b) $y = \frac{7-5x}{2}$

c) $y = \frac{7x+5}{2}$

d) $y = \frac{5x+7}{2}$

11. ABCD is a Rhombus such that $\angle ACB = 40^\circ$, then $\angle ADB$ is [1]

a) 100°

b) 40°

c) 60°

d) 50°

12. Diagonals of a quadrilateral ABCD bisect each other. If $\angle A = 45^\circ$, then $\angle B =$ [1]

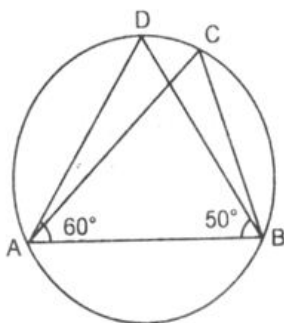
a) 125°

b) 115°

c) 120°

d) 135°

13. In the figure, if $\angle DAB = 60^\circ$, $\angle ABD = 50^\circ$, then $\angle ACB$ is equal to : [1]



a) 80°

b) 60°

c) 50°

d) 70°

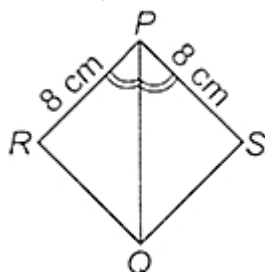
14. The simplest form of $0.\overline{57}$ is [1]

- a) $\frac{26}{45}$ b) $\frac{57}{99}$
c) $\frac{57}{100}$ d) $\frac{57}{90}$

15. Which of the following point does not lie on the line $y = 2x + 3$? [1]

- a) (-5, -7) b) (-1, 1)
c) (3, 9) d) (3, 7)

16. The congruence rule, by which the two triangles in the given figure are congruent is _____. [1]



- a) ASA b) SAS
c) SSS d) RHS

17. In a histogram, which of the following is proportional to the frequency of the corresponding class? [1]

- a) Width of the rectangle b) Length of the rectangle
c) Perimeter of the rectangle d) Area of the rectangle

18. The curved surface area of a cylinder and a cone is equal. If their base radius is same, then the ratio of the slant height of the cone to the height of the cylinder is [1]

- a) 1 : 1 b) 2 : 3
c) 1 : 2 d) 2 : 1

19. **Assertion (A):** The sides of a triangle are 3 cm, 4 cm and 5 cm. Its area is 6 cm^2 . [1]

Reason (R): If $2s = (a + b + c)$, where a, b, c are the sides of a triangle, then area = $\sqrt{(s - a)(s - b)(s - c)}$.

- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false. d) A is false but R is true.

20. **Assertion (A):** The point (1, 1) is the solution of $x + y = 2$. [1]

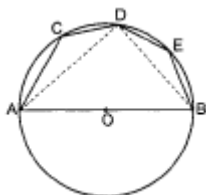
Reason (R): Every point which satisfy the linear equation is a solution of the equation.

- a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false. d) A is false but R is true.

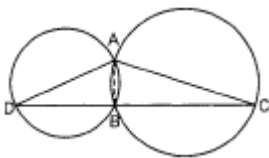
Section B

21. The base of an isosceles triangle measures 24 cm and its area is 192 cm^2 . Find its perimeter. [2]

22. 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 $\angle ACD + \angle BED$. [2]

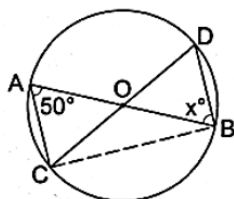


23. The outer diameter of a spherical shell is 10 cm and the inner diameter is 9 cm. Find the volume of the metal contained in the shell. [2]
24. In the given figure, two circles intersect at two points A and B. AD and AC are diameters to the two circles. Prove that B lies on the line segment DC. [2]



OR

If O is the centre of the circle, find the value of x in given figure:



25. Find whether the given equation have $x = 2$, $y = 1$ as a solution: $x + y + 4 = 0$. [2]

OR

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

Section C

26. Give three rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$. [3]
27. Find the value of k, if $x - 1$ is a factor of $p(x)$ in case: $p(x) = 2x^2 + kx + \sqrt{2}$ [3]
28. From a point in the interior of an equilateral triangle, perpendiculars are drawn on the three sides. The lengths of the perpendiculars are 14 cm, 10 cm and 6 cm. Find the area of the triangle. [3]

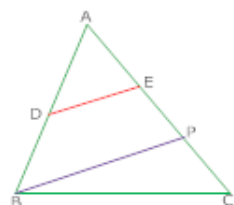
OR

The triangular side walls of a flyover have been used for advertisements. The sides of the walls are 13 m, 14 m and 15 m. The advertisements yield an earning of Rs2000 per m^2 a year. A company hired one of its walls for 6 months. How much rent did it pay?

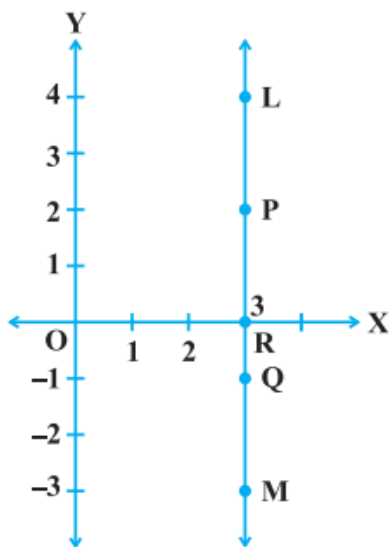
29. Find solutions of the form $x = a$, $y = 0$ and $x = 0$, $y = b$ for the following pairs of equations. Do they have any common such solution? [3]
- $3x + 2y = 6$ and $5x + 2y = 10$
30. Show that the quadrilateral formed by joining the mid-points the sides of a rhombus, taken in order, form a rectangle. [3]

OR

In figure D is mid-points of AB. P is on AC such that $PC = \frac{1}{2} AP$ and $DE \parallel BP$, then show that $AE = \frac{1}{3} AC$.



31. In Figure, LM is a line parallel to the y-axis at a distance of 3 units. [3]



- i. What are the coordinates of the points P, R and Q?
- ii. What is the difference between the abscissa of the points L and M?

Section D

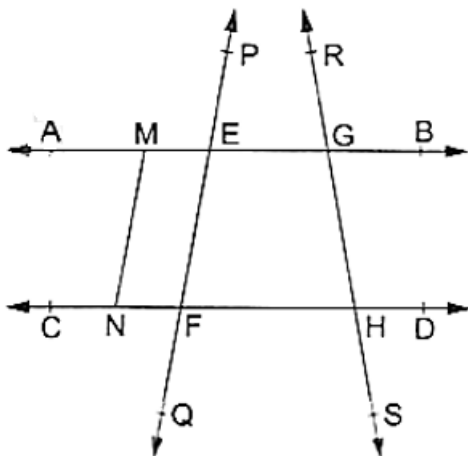
32. Find the values of a and b if $\frac{7+3\sqrt{5}}{3+\sqrt{5}} - \frac{7-3\sqrt{5}}{3-\sqrt{5}} = a + b\sqrt{5}$. [5]

OR

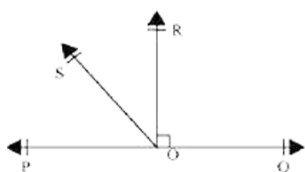
If $p = \frac{3-\sqrt{5}}{3+\sqrt{5}}$ and $q = \frac{3+\sqrt{5}}{3-\sqrt{5}}$, find the value of $p^2 + q^2$.

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

- i. Six points
- ii. Five line segments
- iii. Four rays
- iv. Four lines
- v. Four collinear points

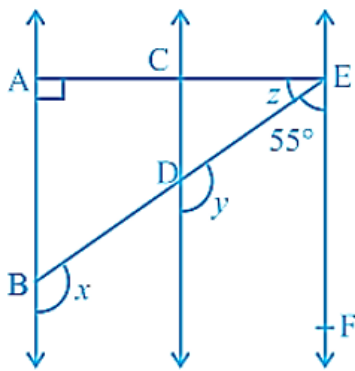


34. In the given figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$. [5]



OR

Fig., $AB \parallel CD$ and $CD \parallel EF$. Also, $EA \perp AB$. If $\angle BEF = 55^\circ$, find the values of x, y and z.



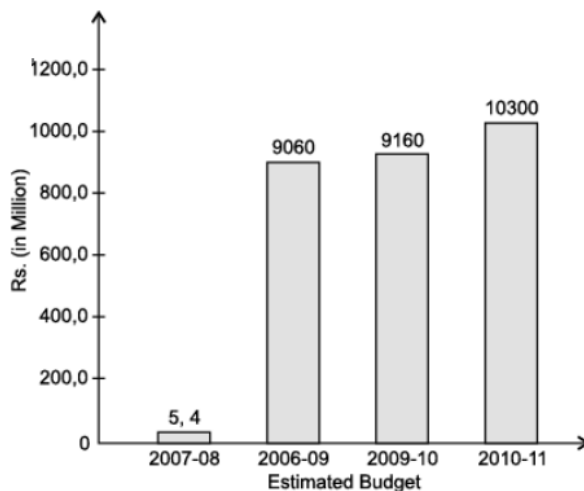
35. Find the values of a and b so that the polynomial $(x^4 + ax^3 - 7x^2 - 8x + b)$ is exactly divisible by $(x + 2)$ as well as $(x + 3)$. [5]

Section E

36. Read the following text carefully and answer the questions that follow: [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.



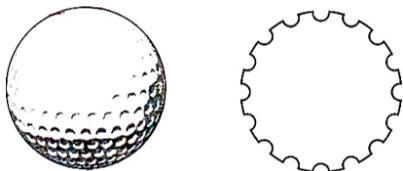
- What are the total expenses from 2009 to 2011? (1)
- What is the percentage of no of expenses in 2009-10 over the expenses in 2010-11? (1)
- What is the percentage of minimum expenses over the maximum expenses in the period 2007-2011? (2)

OR

What is the difference of expenses in 2010-11 and the expenses in 2006-09? (2)

37. Read the following text carefully and answer the questions that follow: [4]

A golf ball is spherical with about 300 - 500 dimples that help increase its velocity while in play. Golf balls are traditionally white but available in colours also. In the given figure, a golf ball has diameter 4.2 cm and the surface has 315 dimples (hemi-spherical) of radius 2 mm.



- i. Find the surface area of one such dimple. (1)
- ii. Find the volume of the material dug out to make one dimple. (1)
- iii. Find the total surface area exposed to the surroundings. (2)

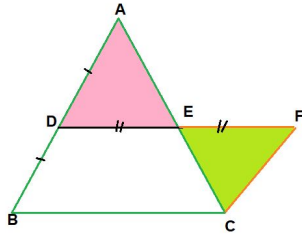
OR

Find the volume of the golf ball. (2)

38. **Read the following text carefully and answer the questions that follow:**

[4]

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.

Questions:

- i. $\triangle ADE$ and $\triangle EFC$ are congruent by which criteria? (1)
- ii. Show that $CF \parallel AB$. (1)
- iii. Show that $CF = BD$. (2)

OR

Show that $DF = BC$ and $DF \parallel BC$. (2)

Solution

Section A

1.

(c) an irrational number

Explanation: $\pi = 3.14159265359\dots$, which is non-terminating non-recurring.

Hence, it is an irrational number.

2.

(b) infinitely many solutions

Explanation:

Given linear equation: $3x - 5y = 15$ Or, $x = \frac{5y+15}{3}$

When $y = 0$, $x = \frac{15}{3} = 5$

When $y = 3$, $x = \frac{30}{3} = 10$

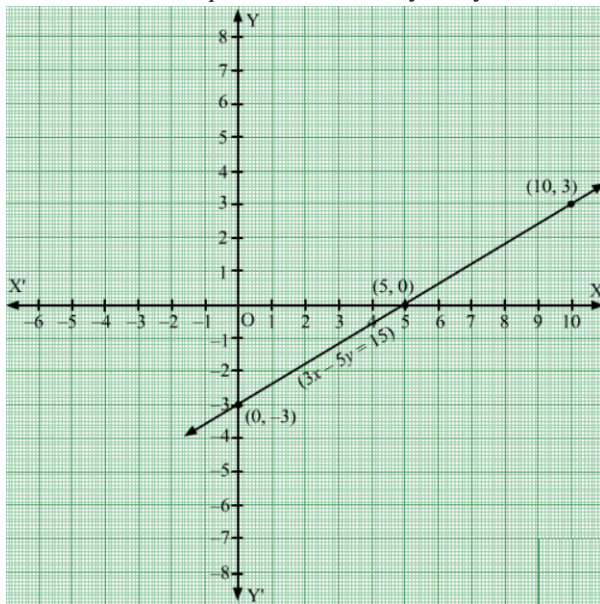
When $y = -3$, $x = \frac{0}{3} = 0$

xx	5	10	0
yy	0	3	-3

Plot the points A(5,0) , B(10,3) and C(0,-3). Join the points and extend them in both the directions.

We get infinite points that satisfy the given equation.

Hence, the linear equation has infinitely many solutions.



3.

(c) a line parallel to y-axis

Explanation: Two points having same abscissa but different ordinate always make a line which is parallel to the y-axis as abscissa is fixed and the only ordinate keeps changing.

4.

(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 = $\frac{8}{20} \times 5 = 2$

5.

(b) (3,0)

Explanation: $2x + 3y = 6$ meets the X-axis.

Put $y = 0$,

$$2x + 3(0) = 6$$

$$x = 3$$

Therefore, graph of the given line meets X-axis at (3, 0).

6. (a) A postulate

Explanation: Euclid's fourth postulate states that all right angles are equal to one another.

7.

(c) 140°

Explanation: 140°

From the figure it follows that

$$(3x + 7) + (x + 5) + 40 = 180$$

$$\Rightarrow 4x + 52 = 180$$

$$\Rightarrow 4x = 180 - 52 = 128$$

$$\Rightarrow x = 32$$

Now,

$$\angle AOD = \angle COP + \angle POB$$

$$\Rightarrow \angle AOD = (3x + 7) + (x + 5)$$

$$\Rightarrow \angle AOD = 4x + 12$$

$$\Rightarrow \angle AOD = 4 \times 32 + 12$$

$$\Rightarrow \angle AOD = 128 + 12$$

$$\Rightarrow \angle AOD = 140$$

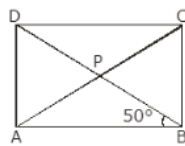
8.

(b) 80°

Explanation:

Given,

ABCD is a rectangle



Diagonals AC & BD intersect each other at P

$$\angle ABD = 50^\circ$$

\therefore diagonals of rectangle bisect each other and are equal in length

$$\Rightarrow \angle ABD = \angle PDC \text{ [alternate angles]}$$

$$\Rightarrow \angle PDC = \angle PCD = 50^\circ$$

In $\triangle DPC$

$$\Rightarrow \angle DPC + \angle PCD + \angle PDC = 180^\circ$$

$$\Rightarrow \angle DPC + 50^\circ + 50^\circ = 180^\circ$$

$$\Rightarrow \angle DPC = 180^\circ - 100^\circ = 80^\circ$$

9. (a) every real number

Explanation: Zero of the zero polynomial is any real number.

e.g., Let us consider zero polynomial be $0(x - k)$, where k is a real number.

For determining the zero, put $x - k = 0 \Rightarrow x = k$ Hence, zero of the zero polynomial be any real number.

10. (a) $y = \frac{5x-7}{2}$

Explanation: $5x - 2y = 7$

$$-2y = 7 - 5x$$

$$2y = 5x - 7$$

$$y = \frac{5x-7}{2}$$

11.

(d) 50°

Explanation: In Rhombus, diagonals bisect each other right angle. By using angle sum property in any of the four triangles formed by intersection of diagonals, we get $\angle CBD = 50$ and $\angle CBD = \angle ADC$ (alternate angles).

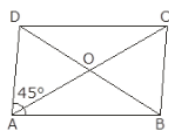
So, $\angle ADC = 50$

12.

(d) 135°

Explanation:

Given,



ABCD is a quadrilateral

$\angle A = 45^\circ$,

\therefore diagonals of quadrilateral bisect each other hence ABCD is a parallelogram,

$\Rightarrow \angle A + \angle B = 180^\circ$

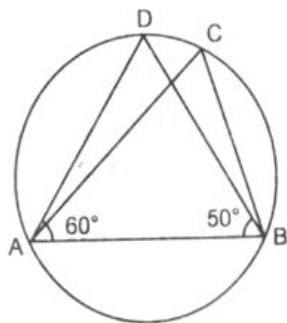
$\Rightarrow 45^\circ + \angle B = 180^\circ$

$\Rightarrow \angle B = 180^\circ - 45^\circ = 135^\circ$

13.

(d) 70°

Explanation:



In, $\triangle ABD$

$\angle D = 180^\circ - \angle A - \angle B$

$= 180^\circ - 110^\circ = 70^\circ$

Since angles made by same chord at any point of circumference are equal so, $\angle ACB = \angle ADB = 70^\circ$

14. (a) $\frac{26}{45}$

Explanation: $0.\overline{57} = \frac{57-5}{90}$

$= \frac{52}{90} = \frac{26}{45}$

15.

(d) (3, 7)

Explanation: Let us put $x = 3$ in the give equation,

Then, $y = 2(3) + 3$

$y = 6 + 3 = 9$

So, the point will be (3, 9)

For $x = 3$, $y = 9$. But in the given option, $y = 7$

So, the given point (3, 7) will not lie on the line $y = 2x + 3$.

16.

(b) SAS

Explanation: In $\triangle PQR$ and $\triangle PQS$

$PR = PS = 8$ cm

$\angle RPQ = \angle SPQ$ (Given)

$$PQ = PQ \text{ (Common)}$$

$$\therefore \triangle PQR \cong \triangle PQS \text{ (By SAS congruency)}$$

17.

(b) Length of the rectangle

Explanation: In Histogram each rectangle is drawn, where width equivalent to class interval and height equivalent to the frequency of the class.

18.

(d) 2 : 1

Explanation: CSA of cone = CSA of cylinder

$$\pi r l = 2\pi r h$$

$$l = 2h$$

$$l : h = 2 : 1$$

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

Explanation: Putting (1, 1) in the given equation, we have

$$\text{L.H.S} = 1 + 1 = 2 = \text{R.H.S}$$

$$\text{L.H.S} = \text{R.H.S}$$

Hence (1, 1) satisfy the $x + y = 2$. So it is the solution of $x + y = 2$.

Section B

21. Let $\triangle ABC$ be an isosceles triangle and let $AL \perp BC$

$$\therefore \frac{1}{2} \times BC \times AL = 192 \text{ cm}^2$$

$$\Rightarrow \frac{1}{2} \times 24 \text{ cm} \times h = 192 \text{ cm}^2$$

$$\Rightarrow h = \left(\frac{192}{12} \right) \text{ cm} = 16 \text{ cm}$$

$$\text{Now, } BL = \frac{1}{2}(BC) = \left(\frac{1}{2} \times 24 \right) \text{ cm} = 12 \text{ cm and } AL = 16 \text{ cm.}$$

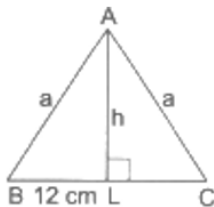
$$\text{In } \triangle ABL \text{ } AB^2 = BL^2 + AL^2$$

$$\Rightarrow a^2 = BL^2 + AL^2$$

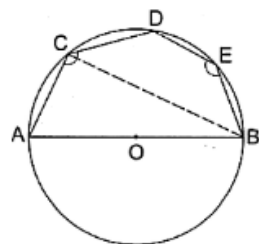
$$\therefore a = \sqrt{BL^2 + AL^2} = \sqrt{(12)^2 + (16)^2} \text{ cm} = \sqrt{144 + 256} \text{ cm}$$

$$\Rightarrow a = \sqrt{400} \text{ cm} = 20 \text{ cm}$$

$$\text{Hence, perimeter} = (20 + 20 + 24) \text{ cm} = 64 \text{ cm.}$$



22.



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

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

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

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

23. Outer diameter = 10 cm

$$\therefore \text{Outer radius (R)} = \frac{10}{2} \text{ cm} = 5 \text{ cm}$$

As Inner diameter = 9 cm

$$\therefore \text{Inner radius (r)} = \frac{9}{2} \text{ cm}$$

$$\text{Volume of the metal contained in the shell} = \frac{4}{3}\pi R^3 - \frac{4}{3}\pi r^3$$

$$\frac{4}{3}\pi(R^3 - r^3) = \frac{4}{3} \times \frac{22}{7} \times [(5)^3 - (\frac{9}{2})^3]$$

$$= \frac{4}{3} \times \frac{22}{7} \times (125 - \frac{729}{8})$$

$$= \frac{4}{3} \times \frac{22}{7} \times \frac{271}{8} = \frac{2981}{21} \text{ cm}^3$$

24. In the given diagram join AB. Also $\angle ABD = 90^\circ$ (because angle in a semicircle is always 90°)

Similarly, we have $\angle ABC = 90^\circ$

$$\text{So, } \angle ABD + \angle ABC = 90^\circ + 90^\circ = 180^\circ$$

Therefore, DBC is a line i.e., B lies on the line segment DC.

OR

$$\angle ODB = \angle OAC = 50^\circ \text{ [angles in the same segment]}$$

$$OB = OD \Rightarrow \angle OBD = \angle ODB = 50^\circ = x^\circ$$

$$\Rightarrow x^\circ = 50^\circ$$

25. For $x = 2, y = 1$

$$x + y + 4 = 0$$

$$\text{L.H.S.} = x + y + 4$$

$$= 2 + 1 + 4 = 7$$

$$\neq \text{R.H.S}$$

$$\therefore x = 2, y = 1 \text{ is not a solution of } x + y + 4 = 0.$$

OR

$$x - 2y = 4$$

Put $x = \sqrt{2}, y = 4\sqrt{2}$ in given equation, we get

$$\sqrt{2} - 2(4\sqrt{2}) = \sqrt{2} - 8\sqrt{2} = -7\sqrt{2}$$

which is not 4.

$$\therefore (\sqrt{2}, 4\sqrt{2}) \text{ is not a solution of given equation.}$$

Section C

26. Here $a = \frac{1}{3}, b = \frac{1}{2}, n = 3$

$$\therefore \frac{b-a}{n+1} = \frac{\frac{1}{2} - \frac{1}{3}}{3+1} = \frac{\frac{3-2}{6}}{4} = \frac{1}{6} = \frac{1}{24}$$

\therefore Three rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$ are

$$\frac{1}{3} + \frac{1}{24}, \frac{1}{3} + 2\left(\frac{1}{24}\right), \frac{1}{3} + 3\left(\frac{1}{24}\right)$$

$$\frac{1}{3} + \frac{1}{24}, \frac{1}{3} + \frac{1}{12}, \frac{1}{3} + \frac{1}{8}$$

$$\frac{3}{8}, \frac{5}{12}, \frac{11}{24}$$

27. $p(x) = 2x^2 + kx + \sqrt{2}$

We know that according to the factor theorem

$$p(a) = 0, \text{ if } x - a \text{ is a factor of } p(x)$$

We conclude that if $(x - 1)$ is a factor of $p(x) = 2x^2 + kx + \sqrt{2}$ then $p(1) = 0$

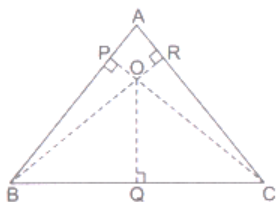
$$p(1) = 2(1)^2 + k(1) + \sqrt{2} = 0, \text{ or}$$

$$2 + k + \sqrt{2} = 0$$

$$k = -(2 + \sqrt{2}).$$

Therefore, we can conclude that the value of k is $-(2 + \sqrt{2})$

28. Let ABC be an equilateral triangle, O be the interior point and OQ, OR and OC are the perpendicular drawn from points O. Let the sides of an equilateral triangle be a m.



$$\text{Area of } \triangle AOB = \frac{1}{2} \times AB \times OP$$

$$[\because \text{Area of a triangle} = \frac{1}{2} \times (\text{base} \times \text{height})]$$

$$= \frac{1}{2} \times a \times 14 = 7a \text{ cm}^2 \dots(1)$$

$$\text{Area of } \triangle OBC = \frac{1}{2} \times BC \times OQ = \frac{1}{2} \times a \times 10$$

$$= 5a \text{ cm}^2 \dots(2)$$

$$\text{Area of } \triangle OAC = \frac{1}{2} \times AC \times OR = \frac{1}{2} \times a \times 6$$

$$= 3a \text{ cm}^2 \dots(3)$$

$$\therefore \text{Area of an equilateral } \triangle ABC$$

$$= \text{Area of } (\triangle OAB + \triangle OBC + \triangle OAC)$$

$$= (7a + 5a + 3a) \text{ cm}^2$$

$$= 15a \text{ cm}^2 \dots(4)$$

$$\text{We have, semi-perimeter } s = \frac{a+a+a}{2}$$

$$\Rightarrow s = \frac{3a}{2} \text{ cm}$$

$$\therefore \text{Area of an equilateral } \triangle ABC = \sqrt{s(s-a)(s-b)(s-c)} \quad [\text{By Heron's formula}]$$

$$= \sqrt{\frac{3a}{2} \left(\frac{3a}{2} - a \right) \left(\frac{3a}{2} - a \right) \left(\frac{3a}{2} - a \right)}$$

$$= \sqrt{\frac{3a}{2} \times \frac{a}{2} \times \frac{a}{2} \times \frac{a}{2}}$$

$$= \frac{\sqrt{3}}{4} a^2 \dots(5)$$

From equations (4) and (5), we get

$$\frac{\sqrt{3}}{4} a^2 = 15a$$

$$\Rightarrow a = \frac{15 \times 4}{\sqrt{3}} = \frac{60}{\sqrt{3}}$$

$$\Rightarrow a = \frac{60}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{3}} = 20\sqrt{3} \text{ cm}$$

On putting $a = 20\sqrt{3}$ in equation (5), we get

$$\text{Area of } \triangle ABC = \frac{\sqrt{3}}{4} (20\sqrt{3})^2 = \frac{\sqrt{3}}{4} \times 400 \times 3 = 300\sqrt{3} \text{ cm}^2$$

Hence, the area of an equilateral triangle is $300\sqrt{3} \text{ cm}^2$.

OR

The sides of triangular side walls of flyover which have been used for advertisements are 13 m, 14 m, 15 m.

$$s = \frac{13+14+15}{2} = \frac{42}{2} = 21 \text{ m}$$

$$= \sqrt{21(21-13)(21-14)(21-15)}$$

$$= \sqrt{21 \times 8 \times 7 \times 6}$$

$$= \sqrt{7 \times 3 \times 2 \times 2 \times 2 \times 7 \times 3 \times 2}$$

$$= 7 \times 3 \times 2 \times 2 = 84 \text{ m}^2$$

It is given that the advertisement yield an earning of Rs. 2,000 per m^2 a year.

$$\therefore \text{Rent for } 1 \text{ m}^2 \text{ for 1 year} = \text{Rs. } 2000$$

$$\text{So, rent for } 1 \text{ m}^2 \text{ for 6 months or } \frac{1}{2} \text{ year} = \text{Rs. } \left(\frac{1}{2} \times 2000 \right) = \text{Rs. } 1,000.$$

$$\therefore \text{Rent for } 84 \text{ m}^2 \text{ for 6 months} = \text{Rs. } (1000 \times 84) = \text{Rs. } 84,000.$$

$$29. 3x + 2y = 6$$

Put $y = 0$, we get

$$3x + 2(0) = 6$$

$$\Rightarrow 3x = 6$$

$$\Rightarrow x = \frac{6}{3} = 2$$

$\therefore (2, 0)$ is a solution.

$$3x + 2y = 6$$

put $x = 0$, we get

$$3(0) + 2y = 6$$

$$\Rightarrow 2y = 6$$

$$\Rightarrow y = \frac{6}{2} = 3$$

$\therefore (0, 3)$ is a solution.

$$5x + 2y = 10$$

Put $y = 0$, we get

$$5x + 2(0) = 10$$

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = \frac{10}{5} = 2$$

$\therefore (2, 0)$ is a solution.

$$5x + 2y = 10$$

Put $x = 0$, we get

$$5(0) + 2y = 10$$

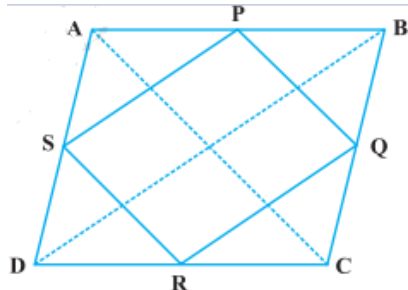
$$\Rightarrow 2y = 10$$

$$\Rightarrow y = \frac{10}{2} = 5$$

$\therefore (0, 5)$ is a solution.

The given equations have a common solution $(2, 0)$.

30. 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)]

OR

In $\triangle ABP$

D is mid points of AB and $DE \parallel BP$

\therefore E is midpoint of AP

$\therefore AE = EP$

Therefore, $AP = 2AE$

Also $PC = \frac{1}{2}AP$

$$2PC = AP$$

$$2PC = 2AE$$

$$\Rightarrow PC = AE$$

$$\therefore AE = PE = PC$$

$$\therefore AC = AE + EP + PC$$

$$AC = AE + AE + AE$$

$$\Rightarrow AE = \frac{1}{3}AC$$

Hence Proved.

31. Given LM is a line parallel to the Y-axis and its perpendicular distance from Y-axis is 3 units.

i. Coordinate of point P = (3,2)

Coordinate of point Q = (3,-1)

Coordinate of point R = (3, 0) [since its lies on X-axis, so its y coordinate is zero].

ii. Abscissa of point L = 3, abscissa of point M=3

∴ Difference between the abscissa of the points L and M = 3 – 3 = 0

Section D

32. LHS

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

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

$$\begin{aligned}
 p &= \frac{3-\sqrt{5}}{3+\sqrt{5}} \\
 &= \frac{3-\sqrt{5}}{3+\sqrt{5}} \times \frac{3-\sqrt{5}}{3-\sqrt{5}} \\
 &= \frac{(3-\sqrt{5})^2}{3^2 - \sqrt{5}^2} \\
 &= \frac{9+5-6\sqrt{5}}{9-5} \\
 &= \frac{14-6\sqrt{5}}{4} \\
 &= \frac{7-3\sqrt{5}}{2} \\
 q &= \frac{3+\sqrt{5}}{3-\sqrt{5}} \\
 &= \frac{3+\sqrt{5}}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}} \\
 &= \frac{(3+\sqrt{5})^2}{3^2 - \sqrt{5}^2} \\
 &= \frac{9+5+6\sqrt{5}}{9-5} \\
 &= \frac{14+6\sqrt{5}}{4} \\
 &= \frac{7+3\sqrt{5}}{2} \\
 p^2 + q^2 &= \left(\frac{7-3\sqrt{5}}{2}\right)^2 + \left(\frac{7+3\sqrt{5}}{2}\right)^2 \\
 &= \frac{49+45-42\sqrt{5}}{4} + \frac{49+45+42\sqrt{5}}{4} \\
 &= \frac{94-42\sqrt{5}}{4} + \frac{94+42\sqrt{5}}{4} \\
 &= \frac{47-21\sqrt{5}}{2} + \frac{47+21\sqrt{5}}{2} \\
 &= \frac{47-21\sqrt{5}+47+21\sqrt{5}}{2} \\
 &= \frac{94}{2} \\
 &= 47
 \end{aligned}$$

- 33.
- Six points: A,B,C,D,E,F
 - Five line segments: \overline{EG} , \overline{FH} , \overline{EF} , \overline{GH} , \overline{MN}
 - Four rays: \overrightarrow{EP} , \overrightarrow{GR} , \overrightarrow{GB} , \overrightarrow{HD}

- Four lines: $\overleftrightarrow{AB}, \overleftrightarrow{CD}, \overleftrightarrow{PQ}, \overleftrightarrow{RS}$
- Four collinear points: M, E, G, B

34. To Prove: $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$

Given: OR is perpendicular to PQ, or $\angle QOR = 90^\circ$

From the given figure, we can conclude that $\angle POR$ and $\angle QOR$ form a linear pair.

We know that sum of the angles of a linear pair is 180° .

$$\therefore \angle POR + \angle QOR = 180^\circ$$

$$\text{or } \angle POR = 90^\circ$$

From the figure, we can conclude that

$$\angle POR = \angle POS + \angle ROS$$

$$\Rightarrow \angle POS + \angle ROS = 90^\circ$$

$$\Rightarrow \angle ROS = 90^\circ - \angle POS \dots (i)$$

Again,

$$\angle QOS + \angle POS = 180^\circ$$

$$\Rightarrow \frac{1}{2}(\angle QOS + \angle POS) = 90^\circ \dots (ii)$$

Substitute (ii) in (i), to get

$$\angle ROS = \frac{1}{2}(\angle QOS + \angle POS) - \angle POS$$

$$= \frac{1}{2}(\angle QOS - \angle POS).$$

Therefore, the desired result is proved.

OR

Since corresponding angles are equal.

$$\therefore x = y \dots (i)$$

We know that the interior angles on the same side of the transversal are supplementary.

$$\therefore y + 55^\circ = 180^\circ$$

$$\Rightarrow y = 180^\circ - 55^\circ = 125^\circ$$

$$\text{So, } x = y = 125^\circ$$

Since $AB \parallel CD$ and $CD \parallel EF$.

$$\therefore AB \parallel EF$$

$$\Rightarrow \angle EAB + \angle FEA = 180^\circ [\because \text{Interior angles on the same side of the transversal EA are supplementary}]$$

$$\Rightarrow 90^\circ + z + 55^\circ = 180^\circ$$

$$\Rightarrow z = 35^\circ$$

35. The given polynomial is,

$$f(x) = x^4 + ax^3 - 7x^2 - 8x + b$$

$$\text{Now, } x + 2 = 0 \Rightarrow x = -2$$

By the factor theorem, we can say: $f(x)$ will be exactly divisible by $(x + 2)$ if $f(-2) = 0$

Therefore, we have:

$$f(-2) = [(-2)^4 + a \times (-2)^3 - 7 \times (-2)^2 - 8 \times (-2) + b]$$

$$= (16 - 8a - 28 + 16 + b)$$

$$= (4 - 8a + b)$$

$$\therefore f(-2) = 0 \Rightarrow 8a - b = 4 \dots (i)$$

$$\text{Also, } x + 3 = 0 \Rightarrow x = -3$$

By the factor theorem, we can say: $f(x)$ will be exactly divisible by $(x + 3)$ if $f(-3) = 0$

Therefore, we have:

$$f(-3) = [(-3)^4 + a \times (-3)^3 - 7 \times (-3)^2 - 8 \times (-3) + b]$$

$$= (81 - 27a - 63 + 24 + b)$$

$$= (42 - 27a + b)$$

$$\therefore f(-3) = 0 \Rightarrow 27a - b = 42 \dots (ii)$$

Subtracting (i) from (ii), we have:

$$\Rightarrow 19a = 38$$

$$\Rightarrow a = 2$$

Putting the value of a, we get the value of b, i.e., 12

$\therefore a = 2$ and $b = 12$

Section E

36. i. Expenses in 2009-10 = 9160 Million

Expenses in 2010-11 = 10300 Million

Total expenses from 2009 to 2011

$$= 9160 + 10300$$

$$= 19460 \text{ Million}$$

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

$$= 1240 \text{ Million}$$

37. i. Diameter of golf ball = 4.2 cm

Radius of golf ball, $R = 2.1$ cm

Radius of dimple, $r = 2\text{mm} = 0.2$ cm

Surface area of each dimple = $2\pi r^2$

$$2 \times \frac{22}{7} \times (0.2)^2 = 0.08 \text{ cm}^2$$

ii. Diameter of golf ball = 4.2 cm

Radius of golf ball, $R = 2.1$ cm

Radius of dimple, $r = 2\text{mm} = 0.2\text{cm}$

Volume of the material dug out to make one dimple

= Volume of 1 dimple

$$= \frac{2}{3} \pi r^3$$

$$= \frac{0.016\pi}{3} \text{ cm}^3$$

iii. Diameter of golf ball = 4.2 cm

Radius of golf ball, $R = 2.1$ cm

Radius of dimple, $r = 2\text{mm} = 0.2\text{cm}$

The total surface area exposed to the surroundings

= surface area of golf ball – surface area of 315 dimples

$$= 4\pi R^2 - 315 \times 0.08\pi$$

$$= 70.56\pi - 25.2\pi \text{ cm}^2$$

$$= 45.36\pi \text{ cm}^2$$

OR

Diameter of golf ball = 4.2 cm

Radius of golf ball, $R = 2.1$ cm

Radius of dimple, $r = 2\text{mm} = 0.2\text{cm}$

volume of the golf ball = volume of sphere – volume of 315 dimples

$$= \frac{4}{3} \pi R^3 - 315 \times \frac{2}{3} \pi r^3$$

$$= \frac{4}{3} \pi (74.088 - 10.08)$$

$$= 97.344 \pi \text{ cm}^3$$

38. 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 $DF \parallel BC$

$DF = DE + EF$

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

$\Rightarrow DF = BC$