Class IX Session 2024-25
Subject - Mathematics
Sample Question Paper - 5

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 π =22/7 wherever required if not stated.

Section A

1. The point which lies on y-axis at a distance of 6 units in the positive direction of y-axis is **[1]**

a) (-6, 0) b) (0, -6)

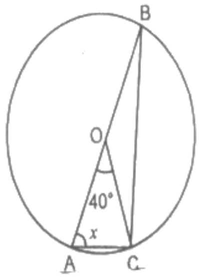
c) (6, 0) d) (0, 6)

2. The perimeter of an equilateral triangle is 60 m. The area is **[1]**

a) $10\sqrt{3}\ m^2$ b) $20\sqrt{3}\ m^2$

c) $15\sqrt{3}\ m^2$ d) $100\ \sqrt{3}\ m^2$

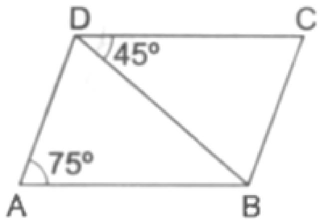
3. In a figure, O is the centre of the circle with AB as diameter. If $\angle AOC = 40^o$, the value of x is equal to **[1]**



a) 80^o b) 50^o

c) 70^o d) 60^o

4. In the given figure, ABCD is a parallelogram in which ∠BDC = 45° and ∠BAD = 75°. Then, ∠CBD = ? **[1]**



a) 60^o

b) 45^o

c) 75^o

d) 55^o

5. The product $\sqrt[3]{2} \cdot \sqrt[4]{2} \cdot \sqrt[12]{32}$ is equal to [1]

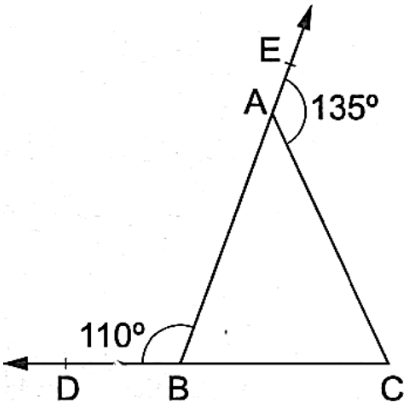
a) $\sqrt[12]{2}$

b) 2

c) $\sqrt{2}$

d) $\sqrt[12]{32}$

6. In the given figure, the sides CB and BA of $\triangle ABC$ have been produced to D and E respectively such that $\angle ABD = 110^\circ$ and $\angle CAE = 135^\circ$. Then, $\angle ACB$ = ? [1]



a) 35^o

b) 45^o

c) 65^o

d) 55^o

7. If x = 3 and y = -2 satisfies 5x - y = k, then the value of k is [1]

a) 3

b) 17

c) 12

d) -2

8. The degree of the zero polynomial is [1]

a) 0

b) any natural number

c) 1

d) not defined

9. The decimal form of $\frac{2}{11}$ is [1]

a) 0.018

b) 0.18

c) $0.\overline{18}$

d) $0.0\overline{18}$

10. If one angle of a parallelogram is 24^o less than twice the smallest angle, then the measure of the largest angle of the parallelogram is [1]

a) 112^o

b) 68^o

c) 176^o

d) 102^o

11. $9^3 + (-3)^3 - 6^3$ = ? [1]

a) 540 b) 486

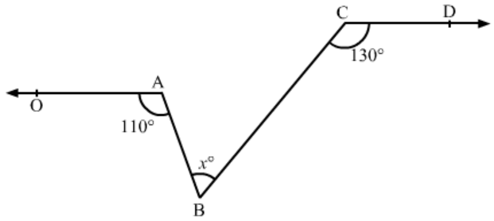
c) 270 d) 432

12. The equation x - 2 = 0 on number line is represented by **[1]**

a) infinitely many lines b) two lines

c) a point d) a line

13. In the given figure, ∠OAB = 110^o and ∠BCD = 130^o then ∠ABC is equal to **[1]**



a) 50^o b) 60^o

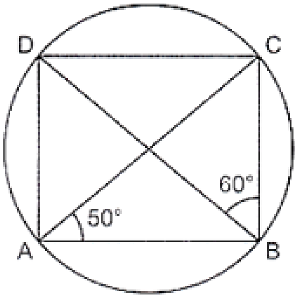
c) 40^o d) 70^o

14. If $\frac{5-\sqrt{3}}{2+\sqrt{3}} = x + y\sqrt{3}$, then **[1]**

a) x = -13, y = - 7 b) x = 13, y = -7

c) x = -13, y = 7 d) x = 13, y = 7

15. In Fig. ABCD is a cyclic quadrilateral. If $\angle BAC = 50^\circ$ and $\angle DBC = 60^\circ$ then find $\angle BCD$. **[1]**



a) 50° b) 60°

c) 70^o d) 55°

16. Which of the following points lies on the line y = 2x + 3? **[1]**

a) (2,8) b) (5,15)

c) (3,9) d) (4,12)

17. How many lines pass through two points? **[1]**

a) many b) three

c) two d) only one

18. Which one of the following is a polynomial? **[1]**

a) $\frac{x-1}{x+1}$ b) $\sqrt{2x} - 1$

c) $x^2 + \frac{3x^{\frac{3}{2}}}{\sqrt{x}}$ d) $\frac{x^2}{2} - \frac{2}{x^2}$

19. **Assertion (A):** In ΔABC, median AD is produced to X such that AD = DX. Then ABXC is a parallelogram. **[1]**

Reason (R): Diagonals AX and BC bisect each other at right angles.

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):** Three rational numbers between $\frac{2}{5}$ and $\frac{3}{5}$ are $\frac{9}{20}, \frac{10}{20}$ and $\frac{11}{20}$ **[1]**

Reason (B): A rational number between two rational numbers p and q is $\frac{1}{2}(p+q)$

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.

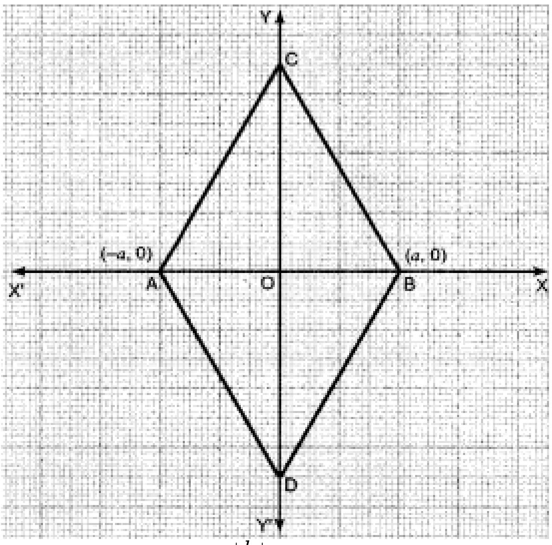
d) A is false but R is true.

Section B

21. If a point O lies between two points P and R such that PO = OR then prove that $\boldsymbol{PO} = \frac{1}{2}\boldsymbol{PR}$. **[2]**

22. Why is Axiom 5, in the list of Euclid's axioms, considered a **universal truth**? **[2]**

23. In Fig., if ABC and ABD are equilateral triangles then find the coordinates of C and D. **[2]**



24. Prove that: $\frac{a+b+c}{a^{-1}b^{-1}+b^{-1}c^{-1}+c^{-1}a^{-1}}$ = abc **[2]**

OR

Express $0.35\overline{7}$ in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

25. If the volume of a right circular cone of height 9 cm is 48π cm^3, find the diameter of its base. **[2]**

OR

A team of 10 interns and 1 professor from zoological department visited a forest, where they set up a conical tent for their accommodation. There they perform activities like planting saplings, yoga, cleaning lakes, testing the water for contaminants and pollutant levels and desilt the lake bed and also using the silt to strengthen bunds.

Find the radius and height of the tent if the base area of tent is 154 cm^2 and curved surface area of the tent is 396 cm^2.

Section C

26. Represent $\sqrt{4.5}$ on the number line. **[3]**

27. Draw a histogram for the daily earnings of 30 drug stores in the following table: **[3]**

Daily earnings (in ₹):	450 - 500	500 - 550	550 - 600	600 - 650	650 - 700
Number of Stores:	16	10	7	3	1

28. ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC **[3]**

intersects AC at D. Show that

i. D is the mid-point of AC

ii. MD $\perp$ AC

iii. CM = MA = $\frac{1}{2}$AB

29. Write linear equation 3x + 2y =18 in the form of ax + by + c = 0. Also write the values of a, b and c. Are (4, 3) and (1, 2) solution of this equation? **[3]**

30. Following are the marks of a group of 92 students in a test of reading ability : **[3]**

Marks	50-52	47-49	44-46	41-43	38-40	35-37	32-34	Total
Number of students	4	10	15	18	20	12	13	92

Construct a frequency polygon for the above data.

OR

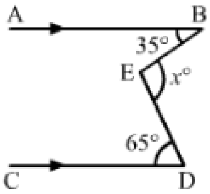
Draw a frequency polygon for the following distribution:

Marks obtained	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of students	7	10	6	8	12	3	2	2

31. The polynomials $ax^3 + 3x^2 - 3$ and $2x^3 - 5x + a$ when divided by (x - 4) leave the remainders R_1 and R_2 respectively. Find the values of a if $R_1 + R_2 = 0$ **[3]**

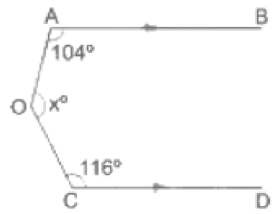
Section D

32. In each of the figures given below, AB || CD. Find the value of x° in each case. **[5]**



OR

In the given figure, AB || CD and $\angle AOC = x^\circ$. If $\angle OAB = 104^\circ$ and $\angle OCD = 116^\circ$, find the value of x.



33. An iron pillar consists of a cylindrical portion 2.8 m high and 20 cm in diameter and a cone 42 cm high is surmounting it. Find the weight of the pillar, given that 1 cm^3 of iron weighs 7.5 g. **[5]**

34. Find the percentage increase in the area of a triangle if its each side is doubled. **[5]**

OR

The sides of a triangle are in the ratio 5 : 12 : 13 and its perimeter is 150 m. Find the area of the triangle.

35. Find the integral roots of the polynomial $f(x) = x^3 + 6x^2 + 11x + 6$. **[5]**

Section E

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

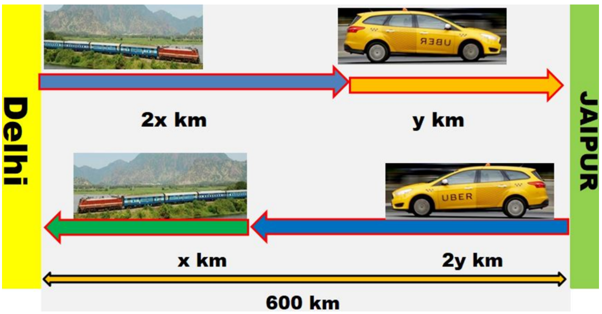
Ajay lives in Delhi, The city of Ajay's father in laws residence is at Jaipur is 600 km from Delhi. Ajay used to travel this 600 km partly by train and partly by car.

He used to buy cheap items from Delhi and sale at Jaipur and also buying cheap items from Jaipur and sale at

Delhi.

Once From **Delhi to Jaipur** in forward journey he covered 2x km by train and the rest y km by taxi.

But, while returning he did not get a reservation from Jaipur in the train. So first 2y km he had to travel by taxi and the rest x km by Train. From Delhi to Jaipur he took 8 hrs but in returning it took 10 hrs.



i. Write the above information in terms of equation. (1)

ii. Find the value of x and y? (1)

iii. Find the speed of Taxi? (2)

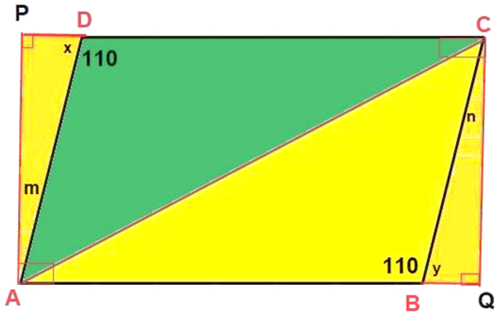
OR

Find the speed of Train? (2)

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

In the middle of the city, there was a park ABCD in the form of a parallelogram form so that AB = CD, AB||CD and AD = BC, AD || BC.

Municipality converted this park into a rectangular form by adding land in the form of ΔAPD and Δ BCQ. Both the triangular shape of land were covered by planting flower plants.



i. Show that ΔAPD and ΔBQC are congruent. (1)

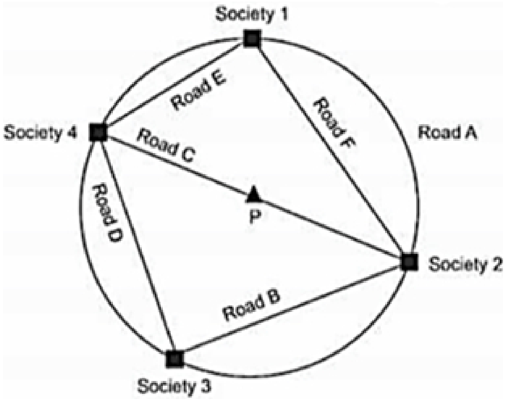
ii. PD is equal to which side? (1)

iii. Show that ΔABC and ΔCDA are congruent. (2)

OR

What is the value of $\angle$m? (2)

38. Two new roads, Road E and Road F were constructed between society 4 and 1 and society 1 and 2. **[4]**



i. What would be the measure of the sum of angles formed by the straight roads at Society 1 and society 3?

a. 60^o

b. 90^o

c. 180^o

d. 360^o

ii. Krish says, The distance to go from society 4 to society 2 using Road D will be longer that the distance using Road E. Is Krish correct? Justify your answer with examples.

iii. Road G, perpendicular to Road F was constructed to connect the park and Road F. Which of the following is true for Road G and Road F?

a. Road G and road F are of same length.

b. Road F divides Road G into two equal parts.

c. Road G divides Road F into two equal parts.

d. The length of road G is one-fourth of the length of Road F.

iv. Priya said, Minor arc corresponding to Road B is congruent to minor arc corresponding to Road D. Do you agree with Priya? Give reason to supportyour answer.

Solution

Section A

1.

(d) (0, 6)

Explanation: Since it lies on the y-axis so it's abscissa x will be zero.

Thus, the point will be (0, 6).

2.

(d) 100 $\sqrt{3}\ m^2$

Explanation: Perimeter of equilateral triangle = 60 m

$\Rightarrow$ 3 $\times$ side = 60 m

$\Rightarrow$ side = 20 m

Area of equilateral triangle = $\frac{\sqrt{3}}{4}(\text{Side})^2$

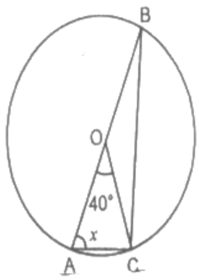
= $\frac{\sqrt{3}}{4}20 \times 20$

= $100\sqrt{3}$ sq.m

3.

(c) 70^o

Explanation:



OA = OC (radii)

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

Again, In $\triangle$OAC

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

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

x + x + 40^o = 180^o

2x = 140^o

x = 70^o

4. **(a)** 60^o

Explanation: As per the question

$\angle$BAD = $\angle$BCD = 75^o (opposite angles of parallelogram)

Now, in $\triangle$BCD,

$\angle$BCD + $\angle$CBD + $\angle$BCD = 180^o

45^o + $\angle$CBD + 75^o = 180^o

$\angle$CBD = 60^o

5.

(b) 2

Explanation: $\sqrt[3]{2} \cdot \sqrt[4]{2} \cdot \sqrt[12]{32}$

= $\sqrt[3]{2} \cdot \sqrt[4]{2} \cdot \sqrt[12]{(2)^5}$

= $(2)^{\frac{1}{3}} \cdot (2)^{\frac{1}{4}} \cdot (2)^{\frac{5}{12}}$

$= (2)^{\frac{1}{3}+\frac{1}{4}+\frac{5}{12}}$

$= (2)^{\frac{4+3+5}{12}}$

$= (2)^{\frac{12}{12}}$

= 2

6.

(c) 65°

Explanation: We can find ∠ CBA as follows:

Given that ∠ EBA = 110°

∠ CBA = 180 - 110 ...(linear pair)

= 70°

Given ∠ CAD = 135°

So, ∠ CAB = 180 - 135 ...(linear pair)

= 45°

So, ∠ ACB = 180 - (70 + 45) ...(angle sum property of triangle)

= 65°

7.

(b) 17

Explanation: If x = 3 and y = -2 satisfies 5x - y = k

Then

5x - y = k

5 × 3 - (-2) = k

15 + 2 = k

k = 17

8.

(d) not defined

Explanation: The general form of a polynomial is $a_n x^n$, where n is a natural number.

For zero polynomial $a_n = 0$.

Since the largest value of n for which a_n is non-zero is negative infinity (all the integers are bigger than negative infinity).

Therefore, the degree of zero polynomials is not defined.

9.

(c) $0.\overline{18}$

Explanation: When we divide 2 by 11

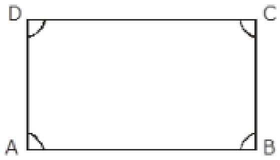
We have value = 0.181818..

Which is $0.\overline{18}$

10. **(a)** 112°

Explanation:

Let angles of parallelogram are ∠A, ∠B, ∠C, ∠D



Let smallest angle = ∠A

Let largest angle = ∠B

= ∠B = 2∠A – 24° ...(i)

∠ A + ∠B = 180° [adjacent angle of parallelogram]

So, ∠A + 2∠A -24° = 180°

= 3∠A = 180° + 24° = 204°

= $\angle A = \frac{204^o}{3} = 68^o$

= $\angle B = 2 \times 68^o - 24^o = 112^o$

11.

(b) 486

Explanation: $9^3 + (-3)^3 - 6^3$

= 729 - 27 - 216

=729 - 243

=486

12.

(c) a point

Explanation: x – 2 = 0

x = 2 is a point on the number line

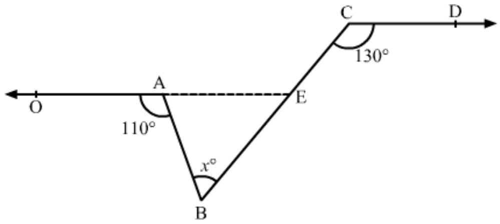
13.

(b) 60^o

Explanation:

In the given figure, OA||CD.

Construction: Extend OA such that it intersects BC at E.



Now, OE||CD and BC is a transversal.

$\therefore \angle AEC = \angle BCD = 130^o$ (Pair of corresponding angles)

Also, $\angle OAB + \angle BAE = 180^o$ (Linear pair)

$\therefore 110^o + \angle BAE = 180^o$

$\Rightarrow \angle BAE = 180^o - 110^o = 70^o$

In $\triangle ABE$

$\angle AEC = \angle BAE + \angle ABE$ ... (In a triangle, exterior angle is equal to the sum of two opposite interior angles)

$\therefore 130^o = 70^o + x^o$

$\Rightarrow x^o = 130^o - 70^o = 60^o$

Thus, the measure of angle $\angle ABC$ is 60^o

14.

(b) x = 13, y = -7

Explanation: $x + y\sqrt{3} = \frac{5-\sqrt{3}}{2+\sqrt{3}}$

$= \frac{5-\sqrt{3}}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$

$= \frac{(5-\sqrt{3})(2-\sqrt{3})}{(2)^2-(\sqrt{3})^2}$

$= \frac{5(2-\sqrt{3})-\sqrt{3}(2-\sqrt{3})}{4-3}$

$= \frac{10-5\sqrt{3}-2\sqrt{3}+3}{1}$

$= 13 - 7\sqrt{3}$

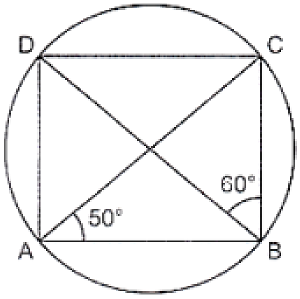
Hence, $x+y\sqrt{3} = 13-7\sqrt{3}$

$\Rightarrow$ x = 13, y = -7

15.

(c) 70^o

Explanation: Here $\angle BDC = \angle BAC = 50^\circ$ (angles in same segment are equal)



In ΔBCD, we have

$\angle BCD = 180^\circ - (\angle BDC + \angle DBC)$

$= 180^\circ - (50^\circ + 60^\circ)$

= 70^o

16.

(c) (3,9)

Explanation: Here, y = 2x + 3

So, for x = 3, we have

y = 2 $\times$3 + 3

= 6 + 3

= 9

So, (3, 9) lies on the given line

17.

(d) only one

Explanation: only one because if a line is passing through two points then that two points are solution of a single linear equation

so only one line passes over two given points.

18.

(c) $x^2 + \frac{3x^{\frac{3}{2}}}{\sqrt{x}}$

Explanation: Since the power of the variable of all terms of a polynomial should be a whole number. Then

$x^2 + \frac{3x^{\frac{3}{2}}}{\sqrt{x}}$

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

= $x^2 + 3x^{\frac{2}{2}}$

= $x^2 + 3x$

Here the powers of variable are whole numbers. Therefore the given expression is a polynomial.

19.

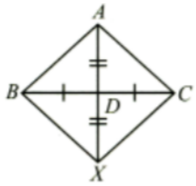
(c) A is true but R is false.

Explanation:

In quadrilateral ABXC, we have

AD = DX [Given]

BD = DC [Given]



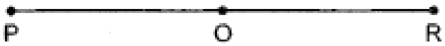
So, diagonals AX and BC bisect each other but not at right angles.

Therefore, ABXC is a parallelogram.

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

Explanation: Both A and R are true and R is the correct explanation of A.

Section B

21. 

Given : In the fig. PR is a line segment such that, PO = OR,

Proof: From Fig. we have

PO + OR = PR ...(i)

PO = OR (Given) ...(ii)

PO + PO = PR [Using (ii) in (i)]

2PO = PR

Therefore $PO = \frac{1}{2}PR$

22. Euclid's Axiom 5 states that "The whole is greater than the part. Since this is true for anything in any part of the world. So, this is a universal truth.

23. Here, AC = $2a$ and AO = a

By Pythagoras theorem

$OC^2 = AC^2 - AO^2 = 4a^2 - a^2 = 3a^2$

OC = $a\sqrt{3}$

Therefore, coordinates of C are (0, $a\sqrt{3}$)

And the coordinates of D are (0, -$a\sqrt{3}$).

24. LHS

$= \frac{a+b+c}{a^{-1}b^{-1}+b^{-1}c^{-1}+c^{-1}a^{-1}}$

$= \frac{a+b+c}{\frac{1}{a}\times\frac{1}{b}+\frac{1}{b}\times\frac{1}{c}+\frac{1}{c}\times\frac{1}{a}}$

$= \frac{a+b+c}{\frac{1}{ab}+\frac{1}{bc}+\frac{1}{ca}}$

$= \frac{\frac{a+b+c}{c+a+b}}{abc}$

$= \frac{abc(a+b+c)}{a+b+c}$

= abc

= RHS

LHS=RHS

Hence Proved

OR

Let x = $0.35\overline{7}$.

Then,$x = 0.35777...$

So, $100x = 35.777...$ ...(i)

$1000x = 357.777...$ ...(ii)

Subtracting (i) from (ii), we get

$1000x - 100x = 357.777... - 35.777...$

$900x = 322$

$\Rightarrow x = \frac{822}{900}$

$\Rightarrow x = \frac{322}{900} = \frac{161}{450}$

25. Let the radius of the base of the right circular cone be r cm.

h = 9 cm, volume = 48π cm^3

$\Rightarrow \frac{1}{3}\pi r^2 h = 48\pi$

$\Rightarrow \frac{1}{3}r^2 h = 48$

$\Rightarrow \frac{1}{3} \times r^2 \times 9 = 48$

$\Rightarrow r^2 = \frac{48\times3}{9}$

$\Rightarrow r^2 = 16 \Rightarrow r = \sqrt{16} = 4$ cm

$\Rightarrow$ 2r = 2(4) = 8 cm.

$\therefore$ the diameter of the base of the right circular cone is 8 cm.

OR

A tent is of conical shape. Thus,

Base area = πr^2 = 154 cm^2

So, radius r = 7 cm

Curved surface area = $\pi r l$ = 396 cm^2

396 = 3.14 $\times$ 7 $\times$ l

$\Rightarrow$ l = 18 cm

Now, height $h = \sqrt{l^2 - r^2}$ = $\sqrt{18^2 - 7^2}$ = 16.5 cm

Section C

26. Consider, AB = 4.5 units.

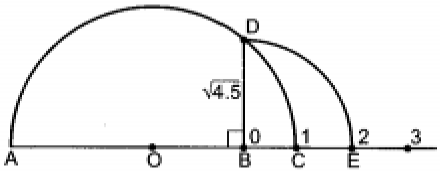
Extend AB upto point C such that BC = 1 unit.

$\therefore$ AC = 4.5 + 1 = 5.5 units.

Now mark O as the midpoint of AC.

With O as centre and radius OC draw a semicircle.

Draw perpendicular BD on AC which intersect the semicircle at D.



This length BD = $\sqrt{4.5}$ units.

To show BD on the number line, consider line ABC as number line with point B as zero.

Therefore, $BC = 1\ unit$.

With B as centre and radius BD draw an arc which intersects number line ABC at E.

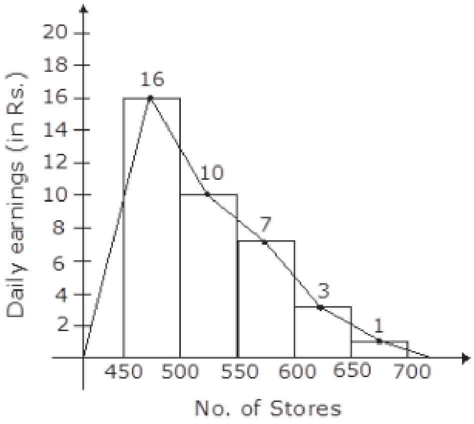
So, point E represents $\sqrt{4.5}$

AB = 4.5 units

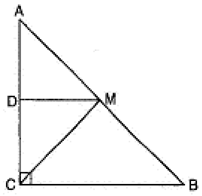
BC = 1 unit

$BD = BE = \sqrt{4.5}\ units$

27. A histogram for the daily earnings of 30 drug stores



28. Given: ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallels to BC intersects AC at D.



To Prove:

i. D is the mid-point of AC (ii) MD $\perp$ AC

ii. CM = MA = $\frac{1}{2}$AB

Proof :

i. In ACB,

As M is the mid-point of AB and MD || BC

$\therefore$ D is the mid-point of AC . . . [By converse of mid-point theorem]

ii. As MD || BC and AC intersects them

$\angle ADM = \angle ACB$ . . . [Corresponding angles]

But $\angle ACB = 90^o$ . . .[Given]

$\therefore \angle ADM = 90^o \Rightarrow MD \perp AC$

iii. Now $\angle ADM + \angle CDM = 180^o$ . . .[Linear pair axiom]

$\angle ADM = \angle CDM = 90^o$

In $\triangle ADM$ and $\triangle CDM$

AD = CD . . . [As D is the mid-point of AC]

$\angle ADM = \angle CDM$ . . .[Each 90^o]

DM = DM . . .[Common]

$\therefore \triangle ADM \cong \triangle CDM$ . . .[By SAS rule]

$\therefore$ MA = MC . . .[c.p.c.t.]

But M is the mid-point of AB

$\therefore MA = MB = \frac{1}{2}AB$

$\therefore MA = MC = \frac{1}{2}AB$

$\therefore CM = MA = \frac{1}{2}AB$

29. We have the equation as 3x + 2y = 18

In standard form

3x + 2y - 18 = 0

Or 3x + 2y + (-18) =0

But standard linear equation is

ax + by + c = 0

On comparison we get, a = 3, b = 2, c = -18

If (4, 3) lie on the line, i.e., solution of the equation LHS = RHS

$\therefore$ 3(4) + 2(3) = 18

12 + 6 = 18

18 = 18

As LHS = RHS, Hence (4, 3) is the solution of given equation.

Again for (1,2)

3x + 2y = 18

$\therefore$ 3(1)+2(2)=18

3 + 4 = 18

7 = 18

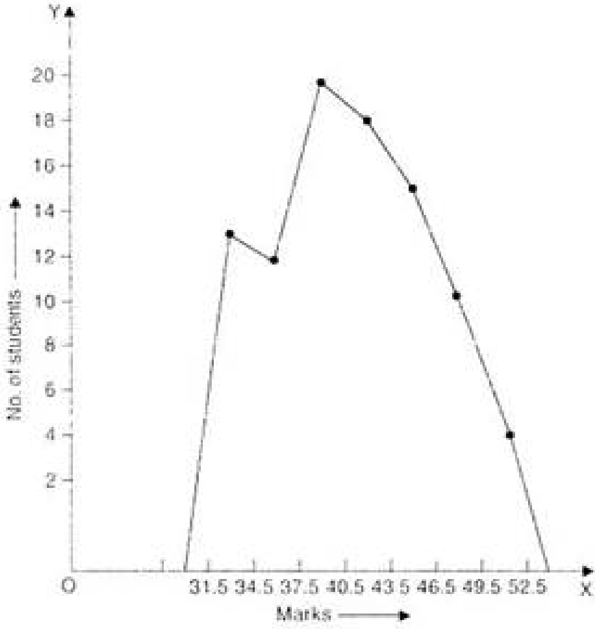
LHS $\neq$ RHS

Hence (1, 2) is not the solution of given equation.

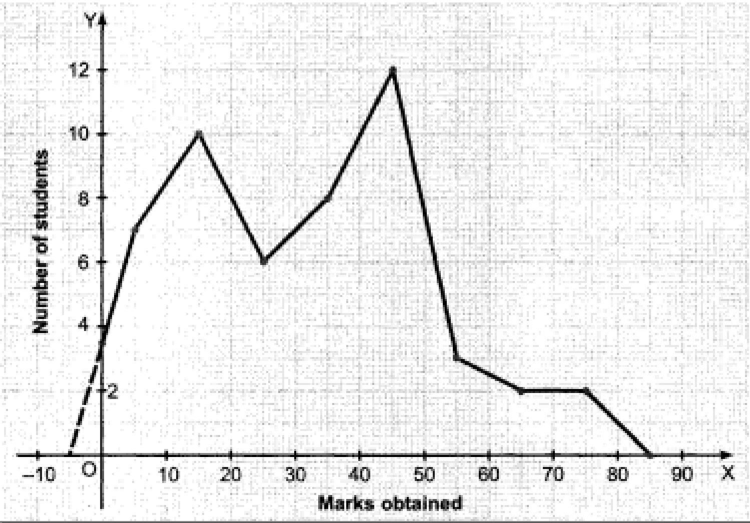
Therefore (4,3) is the point where the equation of the line 3x + 2y = 18 passes through where as the line for the equation 3x + 2y =18 does not pass through the point (1,2).

30. First, we shall make the distribution contineous. Then we have,

Marks	Number of students
31.5-34.5	13
34.5-37.5	12
37.5-40.5	20
40.5-43.5	18
43.5-46.5	15
46.5-49.5	10
49.5-52.5	4



OR



x_i	f_i	(x_i, f_i)
5	7	$(5, 7)$
15	10	$(15, 10)$
25	6	$(25, 6)$
35	8	$(35, 8)$
45	12	$(45, 12)$
55	3	$(55, 3)$
65	2	$(65, 2)$
75	2	$(75, 2)$

31. The given polynomials are,

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

$p(x) = 2x^3 - 5x + a$

Let,

R_1 is the remainder when f(x) is divided by x - 4

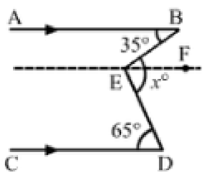
$\Rightarrow R_1 = f(4)$

$\Rightarrow R_1 = a(4)^3 + 3(4)^2 - 3$

$= 64a + 48 - 3$

= 64a + 45 ....(1)
Now, let
R_2 is the remainder when p(x) is divided by x - 4
⇒ R_2 = p(4)
⇒ $R_2 = 2(4)^3 - 5(4) + a$
= 128 - 20 + a
= 108 + a .... (2)
Given, $R_1 + R_2 = 0$
⇒ 64a + 45 + 108 + a = 0
⇒ 65a + 153 = 0
⇒ $a = -\frac{153}{65}$
This is the required value of a.

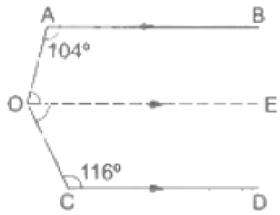
Section D

32. 

Draw EF || AB || CD
Now, AB || EF and BE is the transversal.
Then,
$\angle ABE = \angle BEF$ [Alternate Interior Angles]
$\Rightarrow \angle BEF = 35^\circ$
Again, EF || 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

Through O draw OE || AB || CD
Then, $\angle AOE + \angle COE = x^\circ$
Now, AB || OE and AO is the transversal
$\therefore \angle OAB + \angle AOE = 180^\circ$
$\Rightarrow 104^\circ + \angle AOE = 180^\circ$
$\Rightarrow \angle AOE = (180 - 104)^\circ = 76^\circ$ .....(1)
Again, CD || OE and OC is the transversal
$\therefore \angle COE + \angle OCD = 180^\circ$
$\Rightarrow \angle COE + 116^\circ = 180^\circ$
$\Rightarrow \angle COE = (180^\circ - 116^\circ) = 64^\circ$ ....(2)
$\therefore \angle AOC = \angle AOE + \angle COE$ = $(76^o + 64^o) = 140^o$ [from (1) and (2)]
Hence, $x^\circ = 140^o$



33. We are Given that,
An iron pillar consists of a cylindrical portion and a cone mounted on it.
The height of the cylindrical portion of the pillar, H = 2.8 m = 280 cm.

The height of the conical portion of the pillar, h = 42 cm..

The diameter of the cylindrical portion of the pillar = diameter of the circular base of cone = D = 20 cm.

The radius of the circular base of cylinder/ cone r = $\frac{D}{2}$ = 10 cm.

Now, we have,

Volume of the pillar, (V) = Volume of the cylindrical portion of pillar + volume of the conical portion of the pillar.

$\Rightarrow$ V = $\pi r^2 H + \frac{1}{3}\pi r^2 h$

$\Rightarrow$ V = $\left(\frac{22}{7} \times 10^2 \times 280 + \frac{1}{3} \times \frac{22}{7} \times 10^2 \times 42\right)$ cm^3

$\Rightarrow$ V = (22 $\times$ 100 $\times$ 40 + 22 $\times$ 100 $\times$ 2) cm^3

$\Rightarrow$ V = (88000 + 4400) cm^3

$\Rightarrow$ V = 92400 cm^3

Hence, volume of iron pillar is 92400 cm^3

Given,

Weight of 1 cm^3 iron = 7.5 gm.

Hence, weight of 92400 cm^3 iron = 7.5 $\times$ 92400 gm.

= 693000 gm.

= 693 Kg.

Since, 1Kg = 1000 gm.

Hence, the weight of iron piller is 693 Kg.

34. Let a, b, c be the sides of the old triangle and s be its semi-perimeter. Then,

s = $\frac{1}{2}$(a + b + c)

The sides of the new triangle are 2a, 2b and 2c.

Let s' be its semi-perimeter. Then,

s' = $\frac{1}{2}$(2a + 2b + 2c) = a + b + c = 2s

$\Rightarrow$ s' = 2s

Let Δ and Δ' be the areas of the old and new triangles respectively. Then

$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ ......(1)

and

$\Delta' = \sqrt{s'(s'-2a)(s'-2b)(s'-2c)}$

$\Rightarrow \Delta' = \sqrt{2s(2s-2a)(2s-2b)(2s-2c)}$ [$\because$ s' = 2s]

$\Rightarrow \Delta' = \sqrt{16s(s-a)(s-b)(s-c)}$

$\Rightarrow \Delta' = 4\sqrt{s(s-a)(s-b)(s-c)}$ = 4 Δ [from (1)]

$\therefore$ Increase in the area of the triangle = Δ' - Δ = 4Δ - Δ = 3Δ

Hence, percentage increase in area = $\left(\frac{3\Delta}{\Delta} \times 100\right)$ = 300%

OR

Given that the sides of a triangle are in the ratio 5: 12: 13 and its perimeter is 150 m

Let the sides of the triangle be 5x m, 12x m and 13x m.

We know:

Perimeter = Sum of all sides

or, 150 = 5x + 12x + 13x

or, 30x = 150

or, x = 5

Thus, we obtain the sides of the triangle.

5 $\times$ 5 = 25 m

12 $\times$ 5 = 60 m

13 $\times$ 5 = 65 m

Now,

Let:

a = 25 m, b = 60 m and c = 65 m

$\therefore s = \frac{150}{2} = 75$m

$\Rightarrow$ s = 75 m

By Heron's formula, we have

Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$
$= \sqrt{75(75-25)(75-60)(75-65)}$
$= \sqrt{75 \times 50 \times 15 \times 10}$
$= \sqrt{15 \times 5 \times 5 \times 10 \times 15 \times 10}$
$= 15 \times 5 \times 10$
= 750 m^2

35. Given, that f(x) = $x^3 + 6x^2 + 11x + 6$
Clearly we can say that, the polynomial f(x) with an integer coefficient and the highest degree term coefficient which is known as leading factor is 1.
So, the roots of f(x) are limited to integer factor of 6, they are $\pm 1, \pm 2, \pm 3, \pm 6$
Let x = -1
f(-1) = $(-1)^3 + 6(-1)^2 + 11(-1) + 6$
= -1 + 6 -11 + 6
= 0
Let x = – 2
f(-2) = $(-2)^3 + 6(-2)^2 + 11(-2) + 6$
= – 8 – (6 * 4) - 22 + 6
= – 8 + 24 - 22 + 6
= 0
Let x = – 3
f(-3) = $(-3)^3 + 6(-3)^2 + 11(-3) + 6$
= – 27 – (6 $\times$ 9) - 33 + 6
= – 27 + 54 - 33 + 6
= 0
But from all the given factors only -1, -2, -3 gives the result as zero.Furher,since f(x) is a polynomial of degree 3, therefore,it has almost 3 roots.
Therefore, the integral roots of $x^3 + 6x^2 + 11x + 6$ are -1, -2, -3.

Section E

36. i. Delhi to Jaipur: 2x + y = 600
Jaipur to Delhi: 2y + x = 600
Let S_1 and S_2 be the speeds of Train and Taxi respectively, then
Dehli to Jaipur: $\frac{2x}{S_1} + \frac{y}{S_2} = 8$ ...(i)
Jaipur to Delhi: $\frac{x}{S_1} + \frac{2y}{S_2} = 10$ ...(ii)
ii. 2x + y = 600 ...(1)
x + 2y = 600 ...(2)
Solving (1) and (2) $\times$ 2
2x + y - 2x - 4y = 600 - 1200
$\Rightarrow$ - 3y = - 600
$\Rightarrow$ y = 200
Put y = 200 in (1)
2x + 200 = 600
$\Rightarrow$ x = $\frac{400}{2}$ = 200
iii. We know that speed = $\frac{Distance}{Time} \Rightarrow$ Time = $\frac{Distance}{Speed}$
Let S_1 and S_2 are speeds of train and taxi respectively.
Delhi to Jaipur: $\frac{2x}{S_1} + \frac{y}{S_2}$ = 8 ...(i)
Jaipur to Delhi: $\frac{x}{S_1} + \frac{2y}{S_2}$ = 10 ...(ii)
Solving (i) and (ii) $\times$ 2
$\Rightarrow \frac{2x}{S_1} + \frac{y}{S_2} - \frac{2x}{S_1} - \frac{4y}{S_2}$ = 8 - 20 = -12
$\Rightarrow \frac{-3y}{S_2}$ = -12
We know that y = 200 km

$\Rightarrow S_2 = \frac{3\times200}{12}$ = 50 km/hr

Hence speed of Taxi = 50 km/hr

OR

We know that x = 200 km

Put S_2 = 50 km/hr ...(i)

$\frac{400}{S_1} + \frac{200}{50} = 8$

$\Rightarrow \frac{400}{S_1} = 8 - 4 = 4$

$\Rightarrow S_1 = \frac{400}{4}$ = 100 km/hr

Hence speed of Train = 100 km/hr

37. i. In $\triangle APD$ and $\triangle BQC$

AD = BC (given)

AP = CQ (opposite sides of rectangle)

$\angle APD = \angle BQC = 90^o$

By RHS criteria $\triangle APD \cong \triangle CQB$

ii. $\triangle APD \cong \triangle CQB$

Corresponding part of congruent triangle

side PD = side BQ

iii. In $\triangle ABC$ and $\triangle CDA$

AB = CD (given)

BC = AD (given)

AC = AC (common)

By SSS criteria $\triangle ABC \cong \triangle CDA$

OR

In $\triangle APD$

$\angle APD + \angle PAD + \angle ADP = 180^o$

$\Rightarrow 90^o + (180^o - 110^o) + \angle ADP = 180^o$ (angle sum property of $\triangle$)

$\Rightarrow \angle ADP = m = 180^o - 90^o - 70^o = 20^o$

$\angle ADP = m = 20^o$

38. i. (c) 180^o

ii. Show that in a right triangle the sum of legs is longest for an isosceles right triangle when hypotenuse remains same.

Take for example the length of diameter (hypotenuse) = 5 units.

Road D and Road B are equal hence (Road D = 3.53 units).

Let Road E be = 1, Road F = 4.89 units.

Therefore, length of Road B + Road D is greater than Road E + Road F.

iii. (c) Road G divides Road F into two equal.

iv. Yes, Priya is correct because arc corresponding to two equal roads (chords) are congruent.