

Class IX Session 2025-26

Subject - Mathematics

Sample Question Paper - 8

Time Allowed: 3 hours

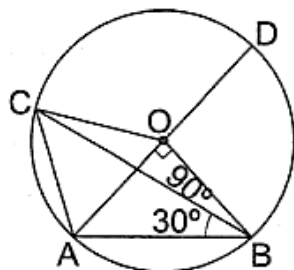
Maximum Marks: 80

General Instructions:

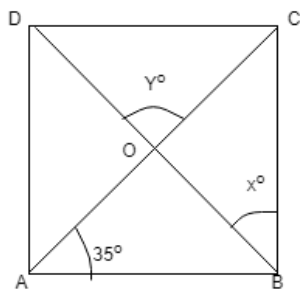
1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment 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. The coordinates of a point A on y-axis, at a distance of 4 units from x-axis and below it, are [1]
a) (0, 4) b) (-4, 0)
c) (0, -4) d) (4, 0)
2. The base of a triangle is 12cm and height is 8cm then area of triangle is [1]
a) 48 cm² b) 24 cm²
c) 56 cm² d) 96 cm²
3. In the given figure, $\angle AOB = 90^\circ$ and $\angle ABC = 30^\circ$. Then, $\angle CAO = ?$ [1]



- a) 90° b) 30°
c) 45° d) 60°
4. In the figure, ABCD is a Rectangle. Find the values of x and y? [1]



a) $x = 50^\circ$ and $y = 100^\circ$

b) $x = 55^\circ$ and $y = 110^\circ$

c) $x = 100^\circ$ and $y = 100^\circ$

d) $x = 60^\circ$ and $y = 120^\circ$

5. If a is rational and $\sqrt{b}$ is irrational, then $a + \sqrt{b}$ is:

[1]

a) a rational number

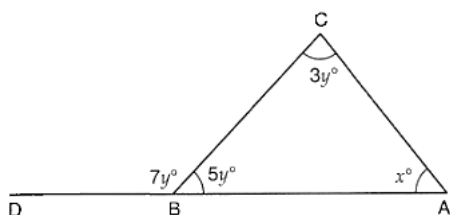
b) a natural number

c) an irrational number

d) an integer

6. In figure, what is the value of x ?

[1]



a) 60

b) 45

c) 35

d) 50

7. If a linear equation has solutions $(1, 2)$, $(-1, -16)$ and $(0, -7)$, then it is of the form

[1]

a) $x - 9y = 7$

b) $9x - y + 7 = 0$

c) $y = 9x - 7$

d) $x = 9y - 7$

8. If $x - \frac{1}{x} = \frac{15}{4}$, then $x + \frac{1}{x} =$

[1]

a) 4

b) $\frac{17}{4}$

c) $\frac{1}{4}$

d) $\frac{13}{4}$

9. Every rational number is

[1]

a) a whole number

b) a real number

c) a natural number

d) an integer

10. In which of the following figures are the diagonals equal?

[1]

a) Parallelogram

b) Rhombus

c) Trapezium

d) Rectangle

11. The value of $(32)^{\frac{1}{5}} + (-7)^0 + (64)^{\frac{1}{2}}$ is

[1]

a) 0

b) 10

c) 1

d) 11

12. The point on the graph of the linear equation $2x + 5y = 19$, whose ordinate is $1\frac{1}{2}$ times its abscissa is

[1]

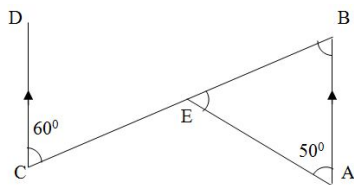
a) $(2, 3)$

b) $(-4, -6)$

c) (4, 6)

d) (-2, -3)

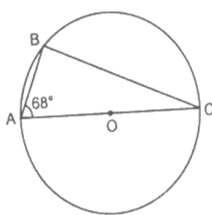
13. In the given figure, $AB \parallel CD$. If $\angle EAB = 50^\circ$ and $\angle ECD = 60^\circ$, then $\angle AEB = ?$ [1]

a) 55° b) 70° c) 50° d) 60°

14. The simplest rationalising factor of $\sqrt{3} + \sqrt{5}$, is [1]

a) $\sqrt{3} + \sqrt{5}$ b) $3 - \sqrt{5}$ c) $\sqrt{3} - 5$ d) $\sqrt{3} - \sqrt{5}$

15. In the given figure, O is the centre of circle, $\angle BAO = 68^\circ$, AC is diameter of circle, then measure of $\angle BCO$ is [1]
:

a) 33° b) 44° c) 22° d) 68°

16. The point whose abscissa and ordinate have different signs will lie in [1]

a) II and IV quadrant

b) II and III quadrants

c) I and III quadrants

d) I and II quadrants

17. Express y in terms of x in the equation $5y - 3x - 10 = 0$. [1]

a) $y = \frac{3x+10}{5}$ b) $y = \frac{3-10x}{5}$ c) $y = \frac{3x-10}{5}$ d) $y = \frac{3+10x}{5}$

18. If $x + \frac{1}{x} = 5$, then $x^2 + \frac{1}{x^2} =$ [1]

a) 27

b) 10

c) 23

d) 25

19. **Assertion (A):** Two opposite angles of a parallelogram are $(3x - 2)^\circ$ and $(50 - x)^\circ$. The measure of one of the angle is 37° . [1]

Reason (R): Opposite angles of a parallelogram are equal.

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

b) Both A and R are true but R is not the

explanation of A.

correct explanation of A.

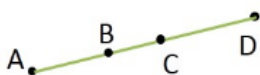
c) A is true but R is false.

d) A is false but R is true.

Section B

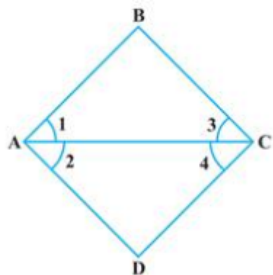
21. In fig., if $AC = BD$, then prove that $AB = CD$

[2]



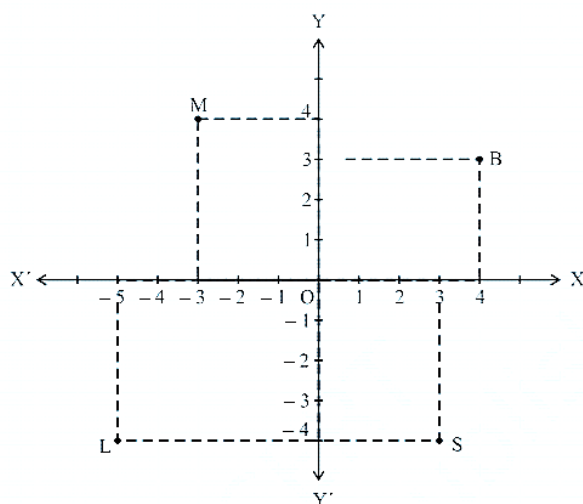
22. In the given figure, we have $\angle 1 = \angle 3$ and $\angle 2 = \angle 4$. Show that $\angle A = \angle C$.

[2]



23. See Fig. and complete the statement: The abscissa and the ordinate of the point B are _____ and _____, respectively. Hence, the coordinates of B are (_____, _____).

[2]



24. If $x = \frac{1}{3-\sqrt{8}}$ find the value of $x^3 - 2x^2 - 7x + 5$.

[2]

OR

Express the decimal $0.\overline{235}$ in the form $\frac{p}{q}$, where p, q are integers and $q \neq 0$.

25. The surface area of a cuboid is 758 cm^2 . Its length and breadth are 14 cm and 11 cm respectively. Find its height.

[2]

OR

A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 12 cm. Find the volume of the solid so obtained.

Section C

26. Rationalise the denominator: $\frac{1}{\sqrt{7}+\sqrt{6}-\sqrt{13}}$

[3]

27. If $\triangle ABC$ is an isosceles triangle such that $AB = AC$ and AD is an altitude from A on BC. Prove that

[3]

i. $\angle B = \angle C$

ii. AD bisects BC

iii. AD bisects $\angle A$.

28. P, Q, R and S are respectively the mid-points of the sides AB, BC, CD and DA of a quadrilateral ABCD such that $AC \perp BD$. Prove that PQRS is a rectangle.

[3]

29. Draw the graph of the following equation and check whether :

[3]

i. $x = 2, y = 5$

ii. $x = -1, y = 3$ are the solutions : $5x + 3y = 4$

30. ABC is an isosceles triangle in which $AC = BC$. AD and BE are respectively two altitudes to sides BC and AC. [3]
Prove that $AE = BD$.

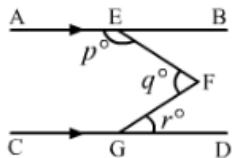
OR

ABCD is a square. X and Y are points on sides AD and BC respectively such that $AY = BX$. Prove that $BY = AX$ and $\angle BAY = \angle ABX$.

31. Factorise: $x^3 + x^2 - 4x - 4$ [3]

Section D

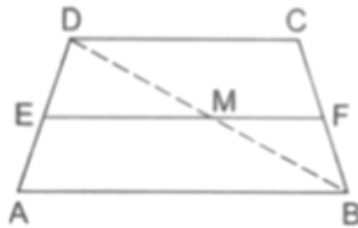
32. In the given figure, $AB \parallel CD$. Prove that $p + q - r = 180$. [5]



OR

If two parallel lines are intersected by a transversal, then prove that the bisectors of the interior angles form a rectangle.

33. In Fig., ABCD is a trapezium in which side AB is parallel to side DC and E is the mid-point of side AD. If F is a point on the side BC such that the segment EF is parallel to side DC. Prove that F is the mid-point of BC and $EF = \frac{1}{2} (AB + DC)$. [5]



34. Find the area of the given trapezium PQRS in which $RQ \parallel SP$ and $PQ \perp SP$ such that $RQ = 7$ m, $RS = 13$ m and $SP = 12$ m. [5]

OR

Find the area of the quadrilateral ABCD in which $AB = 9$ m, $BC = 40$ m, $\angle ABC = 90^\circ$, $CD = 15$ m and $AD = 28$ m.

35. Verify that $x^3 + y^3 + z^3 - 3xyz$ [5]
 $= \frac{1}{2}(x + y + z) \left[(x - y)^2 + (y - z)^2 + (z - x)^2 \right]$

Section E

36. Basant Kumar is a farmer. He has an agricultural field in the form of a rectangle of length 20 m and width 14 m. [4]
He planned to prepare compost manure in his field. For this purpose, a pit 6 m long, 3 m wide and 2.5 m deep is dug in a corner of the field and the earth taken out of the pit is spread uniformly over the remaining area of the field.



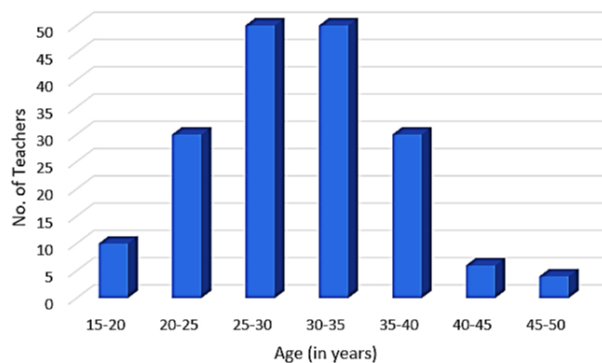
- i. Find the area of the remaining part of the field.
- ii. Find the extent to which the level of the field has been raised.

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

[4]

A teacher is a person whose professional activity involves planning, organizing, and conducting group activities to develop student's knowledge, skills, and attitudes as stipulated by educational programs. Teachers may work with students as a whole class, in small groups or one-to-one, inside or outside regular classrooms. In this indicator, teachers are compared by their average age and work experience measured in years.

For the same in 2015, the following distribution of ages (in years) of primary school teachers in a district was collected to evaluate the teacher on the above-mentioned criterion.



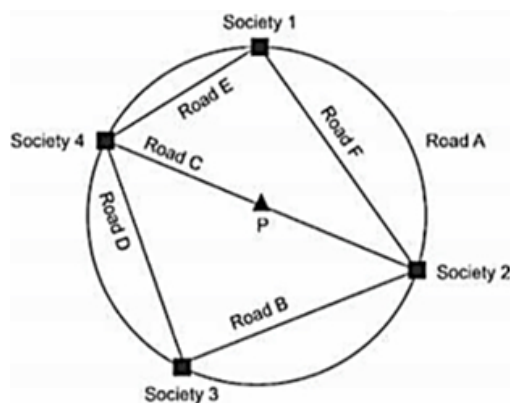
- i. What is the total no of teachers? (1)
- ii. Find the class mark of class 15 - 20, 25 - 30 and 45 - 50? (1)
- iii. What is the no of teachers of age range 25 - 40 years? (2)

OR

Which classes are having same no. of teachers? (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°

b. 90°

c. 180°

d. 360°

ii. Krish says, The distance to go from society 4 to society 2 using Road D will be longer than 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 support your answer.

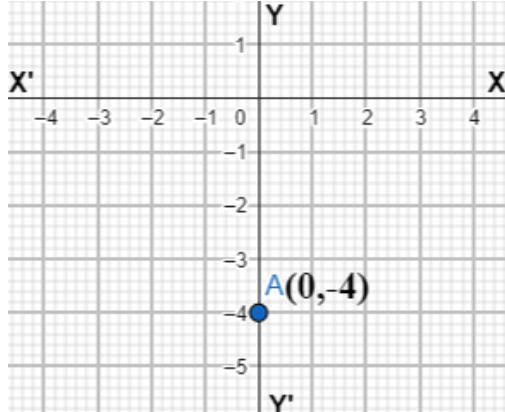
Solution

Section A

1.

(c) (0, -4)

Explanation:



$\therefore$ Coordinate of A(0, -4)

2. (a) 48 cm^2

Explanation:

$$\begin{aligned} \text{Area of triangle} &= \frac{1}{2} \times \text{base} \times \text{height} \\ &= \frac{1}{2} \times 12 \times 8 = 48 \end{aligned}$$

3.

(d) 60°

Explanation:

We have:

$$\angle AOB = 2\angle ACB$$

$$\Rightarrow \angle ACB = \frac{1}{2}\angle AOB = \left(\frac{1}{2} \times 90^\circ\right) = 45^\circ \Rightarrow \angle ACB = 45^\circ$$

$$\angle COA = 2\angle CBA = (2 \times 30^\circ) = 60^\circ$$

$$\therefore \angle COD = 180^\circ - \angle COA = (180^\circ - 60^\circ) = 120^\circ$$

$$\Rightarrow \angle CAO = \frac{1}{2}\angle COD = \left(\frac{1}{2} \times 120^\circ\right) = 60^\circ \Rightarrow \angle CAO = 60^\circ$$

4.

(b) $x = 55^\circ$ and $y = 110^\circ$

Explanation:

ABCD is a rectangle

The diagonals of a rectangle are congruent and bisect each other. Therefore, in $\triangle AOB$, we have:

$$OA = OB$$

$$\angle OAB = \angle OBA = 35^\circ$$

$$x = 90^\circ - 35^\circ = 55^\circ \text{ and } \angle AOB = 180^\circ - (35^\circ + 35^\circ) = 110^\circ$$

$$y = \angle AOB = 110^\circ \text{ [Vertically opposite angles]}$$

Hence, $x = 55^\circ$ and $y = 110^\circ$

5.

(c) an irrational number

Explanation:

Let a be rational and $\sqrt{b}$ is irrational.

If possible let $a + \sqrt{b}$ be rational.

Then $a + \sqrt{b}$ is rational and a is rational.

$\Rightarrow [(a + \sqrt{b}) - a]$ is rational [Difference of two rationals is rational]

$\Rightarrow \sqrt{b}$ is rational.

This contradicts the fact that $\sqrt{b}$ is irrational.

The contradiction arises by assuming that $a + \sqrt{b}$ is rational.

Therefore, $a + \sqrt{b}$ is irrational.

6. (a) 60

Explanation:

In $\triangle ABC$,

$$\angle BCA + \angle CAB + \angle ABC = 180^\circ$$

$$\Rightarrow 3y^\circ + x^\circ + 5y^\circ = 180^\circ$$

$$\Rightarrow 8y^\circ + x^\circ = 180^\circ \dots(i)$$

$$\text{Also, } 5y^\circ = 180^\circ - 7y^\circ$$

$$\Rightarrow 12y^\circ = 180^\circ$$

$$\Rightarrow y^\circ = 15^\circ$$

$$\text{From (i), } x^\circ = 180^\circ - 8y^\circ$$

$$\Rightarrow x^\circ = 180^\circ - 8 \times 15^\circ$$

$$\Rightarrow x^\circ = 60^\circ$$

7.

$$(c) y = 9x - 7$$

Explanation:

Since all the given co-ordinate (1, 2), (-1, -16) and (0, -7) satisfy the given line $y = 9x - 7$

For point (1, 2)

$$y = 9x - 7$$

$$2 = 9(1) - 7$$

$$2 = 9 - 7$$

$$2 = 2$$

Hence (2, 1) is a solution.

For point (-1, -16)

$$y = 9x - 7$$

$$-16 = 9(-1) - 7$$

$$-16 = -9 - 7$$

$$-16 = -16$$

Hence (-1, -16) is a solution.

For point (0, -7)

$$y = 9x - 7$$

$$-7 = 9(0) - 7$$

$$-7 = -7$$

Hence (0, -7) is a solution.

8.

$$(b) \frac{17}{4}$$

Explanation:

$$\Rightarrow x - \frac{1}{x} = \frac{15}{4}$$

$$\text{Now, } \left(x - \frac{1}{x}\right)^2 = \left(\frac{15}{4}\right)^2$$

$$\Rightarrow \left(x^2\right) + \left(\frac{1}{x^2}\right) - 2 \times x \times \frac{1}{x} = \frac{225}{16}$$

$$\Rightarrow \left(x^2\right) + \left(\frac{1}{x^2}\right) = \frac{225}{16} + 2$$

$$\Rightarrow \left(x^2\right) + \left(\frac{1}{x^2}\right) = \frac{257}{16}$$

$$\Rightarrow \left(x^2\right) + \left(\frac{1}{x^2}\right) + 2 \times x \times \frac{1}{x} = \frac{257}{16} + 2 \times x \times \frac{1}{x}$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^2 = \frac{257+32}{16} = \frac{289}{16}$$

$$\Rightarrow \left(x + \frac{1}{x}\right) = \sqrt{\frac{289}{16}} = \frac{17}{4}$$

9.

(b) a real number

Explanation:

Every rational number (1, 4.5, 10, 1/2, -27, 75/5, 0) is a real number.

However, not every real number, is a rational number.

Although some numbers that appear to be irrational are actually rational because they can be reduced i.e. $\sqrt{25} = 5$

10.

(d) Rectangle

Explanation:

Rectangle is the correct answer. As we know that from all the quadrilaterals given in other options, diagonals of a rectangle are equal.

11.

(d) 11

Explanation:

$$(32)^{\frac{1}{5}} + (-7)^0 + (64)^{\frac{1}{2}}$$

$$= 2 + 1 + 8$$

$$= 11$$

12. **(a)** (2, 3)

Explanation:

Ordinate means y-coordinate. It means we need to find a point on the given line where y-coordinate = 3/2 (x-coordinate) . Just put $y = \left[\frac{3}{2}\right] \cdot x$ in the given eqn.

$$2x + 5 \cdot \frac{3}{2}x = 19$$

$$2x + \frac{15}{2}x = 19$$

$$\frac{4x+15x}{2} = 19$$

$$\frac{19x}{2} = 19$$

$$x = \frac{19 \times 2}{19}$$

$$y = \frac{3}{2}x$$

$$y = \frac{3}{2} \times 2$$

$$y=3$$

so the co-ordinate are (2,3)

13.

(b) 70°

Explanation:

$\angle BCD = \angle ABE = 60^\circ$ (Vertically opposite angle)

In $\triangle EAB$

$\angle EAB + \angle EBA + \angle AEB = 180^\circ$ (Angle sum property)

$$50^\circ + 60^\circ + \angle AEB = 180^\circ$$

$$\angle AEB = 70^\circ$$

14.

(d) $\sqrt{3} - \sqrt{5}$

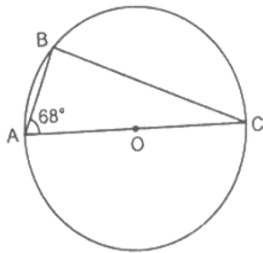
Explanation:

The simplest rationalising factor of $\sqrt{3} + \sqrt{5}$ is $\sqrt{3} - \sqrt{5}$

15.

(c) 22°

Explanation:



$\angle B = 90^\circ$ (Angle in a semicircle)

Now, in $\triangle ABC$

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

$$68^\circ + 90^\circ + \angle C = 180^\circ$$

16. (a) II and IV quadrant

Explanation:

A coordinate is an ordered pair of numbers in which the first number is the abscissa i.e. the measurement along the X axis.

The signs of the coordinates in the first quadrant is (+,+),

the second quadrant is (-,+),

the third quadrant is (-,-),

fourth quadrant is (+,-).

So, the points whose abscissa and ordinate have different signs are 2nd and 4th quadrants.

17. (a) $y = \frac{3x+10}{5}$

Explanation:

$$5y - 3x - 10 = 0$$

$$5y - 3x = 10$$

$$5y = 10 + 3x$$

$$y = \frac{10+3x}{5}$$

18.

(c) 23

Explanation:

$$\text{Using } (a+b)^2 = a^2 + b^2 + 2ab$$

$$\left(x + \frac{1}{x}\right)^2 = x^2 + \left(\frac{1}{x^2}\right) + 2x \cdot \frac{1}{x}$$

$$\Rightarrow (5)^2 = x^2 + \left(\frac{1}{x^2}\right) + 2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 25 - 2$$

$$x^2 + \frac{1}{x^2} = 23$$

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

Explanation:

Since, opposite angles of a parallelogram are equal.

$$\text{Therefore, } 3x - 2 = 50 - x$$

$$x = 13$$

One angle is 37°

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. $AC = BD \dots$ [Given] $\dots$ (1)

$AC = AB + BC \dots$ [Point B lies between A and C] $\dots$ (2)

$$BD = BC + CD \dots [\text{Point C lies between B and D}] \dots (3)$$

Substituting (2) and (3) in (1), we get

$$AB + BC = BC + CD$$

$$\Rightarrow AB = CD \dots [\text{Subtracting equals from equals}]$$

22. We have $\angle 1 = \angle 3 \dots (1)$ [Given]

And $\angle 2 = \angle 4 \dots (2)$ [Given]

Now, by Euclid's axiom 2, we have if equal are added to equals, the whole are equal.

Adding (1) and (2), we get

$$\angle 1 + \angle 2 = \angle 3 + \angle 4$$

$$\text{Hence, } \angle A = \angle C.$$

23. Since the distance of point B from the y-axis is 4 units. Thus x - coordinate or abscissa of point B is 4. The distance of point B from the x-axis is 3 units. Therefore, y - coordinate or ordinate of point B is 3.

Hence, the coordinates of point B are (4, 3).

24. We have

$$x = \frac{1}{3 - \sqrt{8}}$$

$$= \frac{1}{(3 - \sqrt{8})} \times \frac{(3 + \sqrt{8})}{(3 + \sqrt{8})}$$

$$= \frac{(3 + \sqrt{8})}{(3)^2 - (\sqrt{8})^2}$$

$$= \frac{(3 + \sqrt{8})}{9 - 8}$$

$$= (3 + \sqrt{8})$$

$$\text{hence } x = 3 + \sqrt{8} \Rightarrow x - 3 = \sqrt{8}$$

$$\Rightarrow (x - 3)^2 = (\sqrt{8})^2$$

$$\Rightarrow x^2 + 9 - 6x = 8$$

$$\Rightarrow x^2 - 6x + 1 = 0$$

$$\therefore x^3 - 2x^2 - 7x + 5$$

$$= x(x^2 - 6x + 1) + 4(x^2 - 6x + 1) + 16x + 1$$

$$= x \times 0 + 4 \times 0 + 16(3 + \sqrt{8}) + 1$$

$$= 48 + 16\sqrt{8} + 1$$

$$= 49 + 32\sqrt{2}$$

OR

Let $x = 0.\overline{235}$

i.e. $x = 0.235235\dots\dots\dots (i)$

Multiply both sides by 1000, we get

$$\Rightarrow 1000x = 235.235235\dots\dots\dots (ii)$$

On subtracting (i) from (ii), we get

$$999x = 235$$

$$\Rightarrow x = \frac{235}{999}$$

$$\therefore 0.\overline{235} = \frac{235}{999}$$

25. Surface area of cuboid = 758 cm^2

Length of cuboid = 14 cm

Breadth of cuboid = 11 cm

Let height of cuboid = h cm

Total surface area of cuboid = $2(lb + bh + hl)$

$$\Rightarrow 758 = 2(14 \times 11 + 11h + 14h)$$

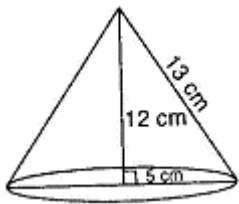
$$\Rightarrow 154 + 25h = \frac{758}{2} = 379$$

$$\Rightarrow 25h = 379 - 154 = 225$$

$$\Rightarrow h = \frac{225}{25} = 9$$

Height of cuboid = 9 meter

OR



The solid obtained will be a right circular cone whose radius of the base is 5 cm. and height is 12 cm

$$\therefore r = 5 \text{ cm}, h = 12 \text{ cm}$$

$$\therefore \text{Volume} = \frac{1}{3} \pi r^2 h$$

$$\frac{1}{3} \times \pi \times (5)^2 \times 12 \text{ cm}^3$$

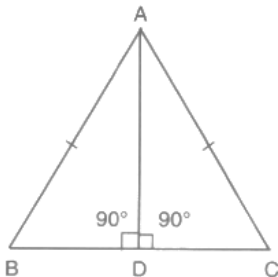
$$= 100\pi \text{ cm}^3$$

The volume of the solid so obtained is $100\pi \text{ cm}^3$

Section C

$$\begin{aligned} 26. & \frac{1}{\sqrt{7} + \sqrt{6} - \sqrt{13}} \\ & \frac{1}{(\sqrt{7} + \sqrt{6}) - \sqrt{13}} \times \frac{(\sqrt{7} + \sqrt{6}) + \sqrt{13}}{(\sqrt{7} + \sqrt{6}) + \sqrt{13}} \\ & = \frac{(\sqrt{7} + \sqrt{6}) + \sqrt{13}}{(\sqrt{7} + \sqrt{6})^2 - \sqrt{13}^2} [\because a^2 - b^2 = (a + b)(a - b)] \\ & = \frac{\sqrt{7} + \sqrt{6} + \sqrt{13}}{\sqrt{7} + \sqrt{6} + \sqrt{13}} \\ & = \frac{(7 + 6 + 2\sqrt{42}) - 13}{\sqrt{7} + \sqrt{6} + \sqrt{13}} \\ & = \frac{13 + 2\sqrt{42} - 13}{\sqrt{7} + \sqrt{6} + \sqrt{13}} \\ & = \frac{2\sqrt{42}}{\sqrt{7} + \sqrt{6} + \sqrt{13}} \\ & = \frac{\sqrt{7} + \sqrt{6} + \sqrt{13}}{2\sqrt{42}} \times \frac{\sqrt{42}}{\sqrt{42}} \\ & = \frac{\sqrt{7 \times 42} + \sqrt{6 \times 42} + \sqrt{13 \times 42}}{2(\sqrt{42})^2} \\ & = \frac{\sqrt{7 \times 7 \times 6} + \sqrt{6 \times 6 \times 7} + \sqrt{546}}{2 \times 42} \\ & = \frac{7\sqrt{6} + 6\sqrt{7} + \sqrt{546}}{84} \end{aligned}$$

27. In right triangles ADB and ADC, we have



According to question Hyp. AB = Hyp. AC [Given]

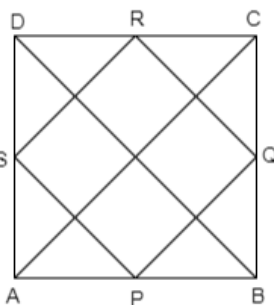
AD = AD [Common side]

So, by RHS criterion of congruence, we have

$$\triangle ABD \cong \triangle ACD$$

$$\Rightarrow \angle B = \angle C, BD = DC \text{ and } \angle BAD = \angle CAD \text{ [c.p.c.t.]}$$

$$\Rightarrow AD \text{ bisect } BC \text{ and } \angle A$$



28.

Given, P, Q, R and S are mid-points of the sides AB, BC, CD and DA, respectively.

Also,

AC is perpendicular to BD

$$\therefore \angle COD = \angle AOD = \angle AOB = \angle COB = 90^\circ$$

In $\triangle ADC$, by mid-point theorem,

$SR \parallel AC$ and $SR = \frac{1}{2} AC$

In $\triangle ABC$, by mid-point theorem,

$PQ \parallel AC$ and $PQ = \frac{1}{2} AC$

$\therefore PQ \parallel SR$ and $SR = PQ = \frac{1}{2} AC$

Similarly,

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

Now, in quad EOFR,

$OE \parallel FR$, $OF \parallel ER$

$\angle EOF = \angle ERF = 90^\circ$

Hence, PQRS is a rectangle.

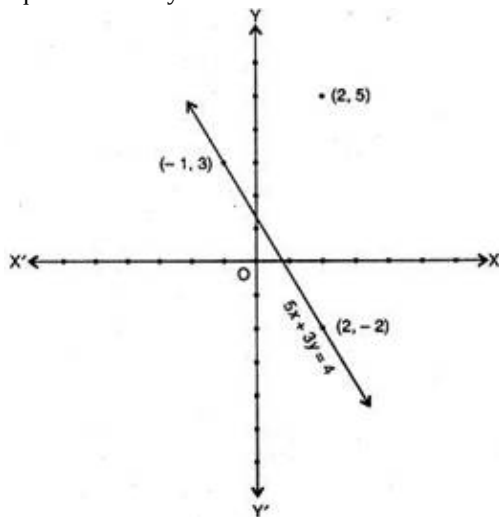
29. $5x + 3y = 4$

$\Rightarrow 3y = 4 - 5x$

$\Rightarrow y = \frac{4-5x}{3}$

x	2	-1
y	-2	3

We plot the points (2, -2) and (-1, 3) on the graph paper and join the same by a ruler to get the line which is the graph of the equation $5x + 3y = 4$



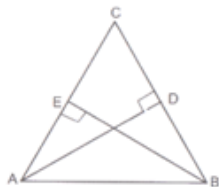
i. $\therefore$ The point (2, 5) does not lie on the graph

$\therefore x = 2$, $y = 5$ is not a solution.

ii. $\therefore$ The point (-1, 3) lies on the graph

$\therefore x = -1$, $y = 3$ is a solution.

30. In $\triangle ADC$ and $\triangle BEC$ we have



$AC = BC$ [Given] ... (1)

$\angle ADC = \angle BEC$ [Each = 90°]

$\angle ACD = \angle BCE$ [Common angle]

$\therefore \triangle ADC \cong \triangle BEC$ [By SSS congruence rule]

$\therefore CE = CD$... (2) [CPCT]

Subtracting (2) from (1), we get

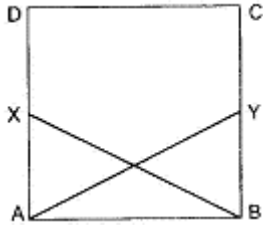
$AC - CE = BC - CD$

$\Rightarrow AE = BD$

Hence, proved.

OR

In right triangles $\triangle BAY$ and $\triangle ABX$,



$AY = BX \dots$ [Given]

side $AB =$ side $AB \dots$ [Common]

$\angle ABY = \angle BAX \dots$ [Each 90°]

$\therefore \triangle BAY \cong \triangle ABX \dots$ [R.H.S. axiom]

$\therefore BY = AX \dots$ [c.p.c.t.]

and $\angle BAY = \angle ABX \dots$ [c.p.c.t.]

31. Let $f(x) = x^3 + x^2 - 4x - 4$ be the given polynomial.

We have, $f(-1) = (-1)^3 + (-1)^2 - 4(-1) - 4 = -1 + 1 + 4 - 4 = 0$

And, $f(2) = (2)^3 + (2)^2 - 4(2) - 4 = 8 + 4 - 8 - 4 = 0$

So, $(x + 1)$ and $(x - 2)$ are factors of $f(x)$.

$\Rightarrow (x + 1)(x - 2)$ is also a factor of $f(x)$.

$\Rightarrow x^2 - x - 2$ is a factor of $f(x)$.

Let us know divide $f(x) = x^3 + x^2 - 4x - 4$ by $x^2 - x - 2$ to get the other factors of $f(x)$.

By long division, we have

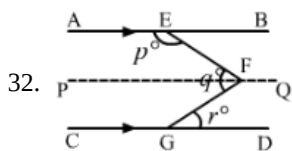
$$\begin{array}{r} x^2 - x - 2 \overline{) x^3 + x^2 - 4x - 4} \quad x + 2 \\ \underline{x^3 - x^2 + 2x} \\ 2x^2 - 2x - 4 \\ \underline{2x^2 - 2x - 4} \\ 0 \end{array}$$

$\therefore x^3 + x^2 - 4x - 4 = (x^2 - x - 2)(x + 2)$

$\Rightarrow x^3 + x^2 - 4x - 4 = (x + 1)(x - 2)(x + 2)$

Hence, $x^3 + x^2 - 4x - 4 = (x - 2)(x + 1)(x + 2)$

Section D



32.

Draw $PFQ \parallel AB \parallel CD$

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

Then,

$\angle AEF + \angle EFP = 180^\circ \dots (i)$

[Angles on the same side of a transversal line are supplementary]

Also, $PFQ \parallel CD$.

$\angle PFG = \angle FGD = r^\circ$ [Alternate Angles]

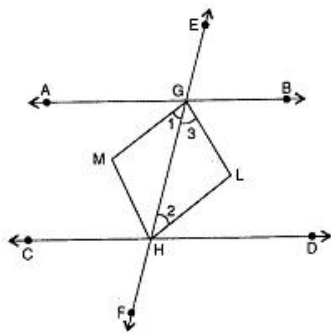
and $\angle EFP = \angle EFG - \angle PFG = q^\circ - r^\circ$

putting the value of $\angle EFP$ in equation (i)

we get,

$p^\circ + q^\circ - r^\circ = 180^\circ$ [$\angle AEF = p^\circ$]

OR



as, $AB \parallel CD$ and EF cuts them

$\therefore \angle AGH = \angle GHD$ (Alternate Angles)

$$\Rightarrow \frac{1}{2} \angle AGH = \frac{1}{2} \angle GHD$$

$$\Rightarrow \angle 1 = \angle 2 \dots\dots (1)$$

But these angles form a pair of equal alternate angles for lines GM and HL and transversal GH .

$$\therefore GM \parallel HL \dots\dots (2)$$

Similarly, we can prove that

$$HM \parallel GL \dots\dots (3)$$

In view of (2) and (3),

$GLHM$ is a parallelogram

$AB \parallel CD$ and EF cuts them

$$\therefore \angle BGH + \angle GHD = 180^\circ$$

(The sum of the interior angles on the same side of a transversal is 180°)

$$\Rightarrow \frac{1}{2} \angle BGH + \frac{1}{2} \angle GHD = 90^\circ$$

$$\Rightarrow \angle 3 + \angle 2 = 90^\circ$$

In $\triangle GHL$,

$$\angle 3 + \angle 2 + \angle GLH = 180^\circ$$

(The sum of the three angles of a triangle is 180°)

$$\Rightarrow 90^\circ + \angle GLH = 180^\circ \dots\dots \text{From (4)}$$

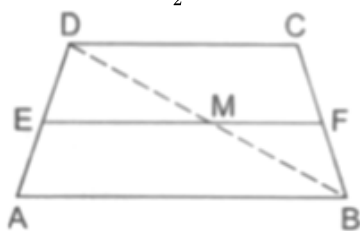
$$\Rightarrow \angle GLH = 180^\circ - 90^\circ = 90^\circ$$

$\Rightarrow$ One angle of parallelogram $GLHM$ is a right angle.

$\Rightarrow$ Parallelogram $GLHM$ is a rectangle.

33. A trapezium $ABCD$ in which $AB \parallel DC$, E is the mid-point of AD and F is a point on BC such that $EF \parallel DC$.

To Prove: $EF = \frac{1}{2} (AB + DC)$



PROOF: In $\triangle ADC$, E is the mid-point of AD and $EM \parallel DC$ (Given)

$\therefore M$ is the mid-point of AC

Since segment joining the mid-points of two sides of a triangle is half of the third side.

$$\therefore EM = \frac{1}{2} DC \dots(i)$$

Now, $ABCD$ is a trapezium in which $AB \parallel DC$

But, $EF \parallel DC$

$$\therefore EF \parallel AB$$

$$\Rightarrow MF \parallel AB$$

In $\triangle ABC$, M is the mid-point of AC (proved above) and $MF \parallel AB$.

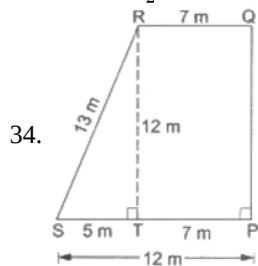
$\therefore F$ is the mid-point of BC

$$\Rightarrow MF = \frac{1}{2} AB [\because \text{Segment joining the mid-points of two sides of a } \triangle \text{ is half of the third sides}] \dots(ii)$$

From (i) and (ii), we have

$$EM + MF = \frac{1}{2} (DC) + \frac{1}{2} (AB)$$

$$\Rightarrow EF = \frac{1}{2} (AB + DC).$$



Draw $RT \perp SP$. Then, $TP = RQ - 7\text{m}$.

$$\therefore ST = SP - TP = (12 - 7)\text{m} = 5\text{m}.$$

From right $\triangle RTS$, we have

$$RT^2 = RS^2 - ST^2 = [(13)^2 - (5)^2]\text{m}^2$$

$$RT^2 = (169 - 25)\text{m}^2 = 144\text{m}^2.$$

$$\therefore RT = \sqrt{144}\text{m} = 12\text{m}$$

Area of trapezium PQRS

$$= \left(\frac{1}{2} \times \text{sum of parallel sides} \times \text{distance between them}\right)$$

$$= \left\{\frac{1}{2} \times (RQ + SP) \times RT\right\} \text{ sq units}$$

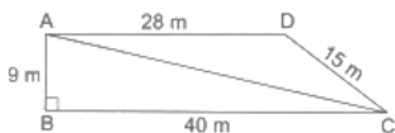
$$= \left\{\frac{1}{2} \times (7 + 12) \times 12\right\} \text{m}^2$$

$$= (19 \times 6)\text{m}^2$$

$$\text{Area of trapezium PQRS} = 114\text{m}^2$$

Hence, the area of the trapezium PQRS is 114m^2

OR



Area of right $\triangle ABC$

$$= \left(\frac{1}{2} \times \text{base} \times \text{height}\right)$$

$$= \left(\frac{1}{2} \times 40 \times 9\right)\text{m}^2 = 180\text{m}^2$$

Also, from right $\triangle ABC$, we get

$$AC^2 = AB^2 + BC^2 \text{ [using pythagoras theorem]}$$

$$\Rightarrow AC^2 = [(9)^2 + (40)^2]\text{m}^2$$

$$\Rightarrow AC^2 = (81 + 1600)\text{m}^2 = 1681\text{m}^2$$

$$\Rightarrow AC = \sqrt{1681}\text{m} = 41\text{m}$$

In $\triangle ACD$, we have $AC = 41\text{m}$, $CD = 15\text{m}$ and $AD = 28\text{m}$.

Let $a = 41\text{m}$, $b = 15\text{m}$ and $c = 28\text{m}$. Then,

$$s = \frac{1}{2} (41 + 15 + 28)\text{m} = \left(\frac{1}{2} \times 84\right)\text{m} = 42\text{m}$$

$$\therefore (s - a) = (42 - 41)\text{m} = 1\text{m}, (s - b) = (42 - 15)\text{m} = 27\text{m}$$

$$\text{and } (s - c) = (42 - 28)\text{m} = 14\text{m}$$

$$\therefore \text{area of } \triangle ACD = \sqrt{s(s - a)(s - b)(s - c)}$$

$$= \sqrt{42 \times 1 \times 27 \times 14}\text{m}^2$$

$$= (14 \times 9)\text{m}^2$$

$$= 126\text{m}^2$$

Area of the quadrilaterals ABCD = area ($\triangle ABC$) + area ($\triangle ACD$)

$$= (180 + 126)\text{m}^2 = 306\text{m}^2$$

35. LHS is $x^3 + y^3 + z^3 - 3xyz$

and RHS is $\frac{1}{2}(x + y + z) \left[(x - y)^2 + (y - z)^2 + (z - x)^2 \right]$.

We know that $x^3 + y^3 + z^3 - 3xyz = (x + y + z) (x^2 + y^2 + z^2 - xy - yz - zx)$ (i)

And also, we know that $(x - y)^2 = x^2 - 2xy + y^2$ (ii)

$$\begin{aligned} \text{R.H.S.} &= \frac{1}{2}(x+y+z) \left[(x-y)^2 + (y-z)^2 + (z-x)^2 \right] \\ &= \frac{1}{2}(x+y+z) \left[(x^2 - 2xy + y^2) + (y^2 - 2yz + z^2) + (z^2 - 2zx + x^2) \right] \quad [\text{From eq.(i) and (ii)}] \\ &= \frac{1}{2}(x+y+z) (2x^2 + 2y^2 + 2z^2 - 2xy - 2yz - 2zx) \\ &= (x+y+z) (x^2 + y^2 + z^2 - xy - yz - zx). \end{aligned}$$

Therefore, we can conclude that the desired result is verified

Section E

36. Let ABCD be the field and let $AB_1C_1D_1$ be the part of the field where a pit is to be dug.

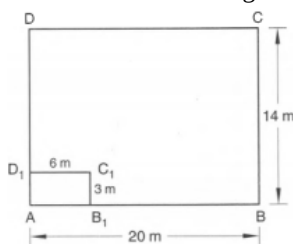
$$\text{Volume of the earth dug out} = (6 \times 3 \times 2.5) \text{ m}^3 = 45 \text{ m}^3 \dots(i)$$

Area of the remaining part of the field = Area of the field - Area of pit

$$= (20 \times 14 - 6 \times 3) \text{ m}^2 = 262 \text{ m}^2$$

The earth taken out of the pit is spread uniformly over the remaining area of the field. Let h metres be the level raised over the field uniformly. Clearly, the earth taken out forms a cuboid of base area 262 m^2 and height h .

$$\text{Volume of the earth dug out} = (262 \times h) \text{ m}^3 \dots\dots(ii)$$



From (i) and (ii), we have

$$262h = 45 \Rightarrow h = \frac{45}{262} = 0.1718 \text{ m} = 17.18 \text{ cm}$$

Hence, the level is raised by 17.18 cm

37. i. No of teachers in the age-group 15-20 years = 10

No of teachers in the age-group 20-25 years = 30

No of teachers in the age-group 25-30 years = 50

No of teachers in the age-group 30-35 years = 50

No of teachers in the age-group 35-40 years = 30

No of teachers in the age-group 40-45 years = 5

No of teachers in the age-group 45-50 years = 2

Thus the total no of teachers

$$= 10 + 30 + 50 + 50 + 30 + 5 + 2$$

$$= 177$$

- ii. Class Mark of class 15 - 20 =

$$= \frac{15 + 20}{2} = 17.5$$

Class Mark of class 25 - 30 =

$$= \frac{25 + 30}{2} = 27.5$$

Class Mark of class 45 - 50 =

$$= \frac{45 + 50}{2} = 47.5$$

- iii. No of teachers in the age-group 25 - 30 years = 50

No of teachers in the age-group 30 - 35 years = 50

No of teachers in the age-group 35 - 40 years = 30

Thus the no of teachers in the age range 25 - 40 years

$$= 50 + 50 + 30 = 130$$

OR

From the observation of the bar chart we find that :

No of teachers in the age-group 25-30 years = 50

No of teachers in the age-group 30-35 years = 50

Thus the no of teacher in the class 25-30 and 30-35 is equal.

38. i. (c) 180°

- 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.