

**Class IX Session 2023-24**  
**Subject - Mathematics**  
**Sample Question Paper - 6**

**Time Allowed: 3 hours**

**Maximum Marks: 80**

**General Instructions:**

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

**Section A**

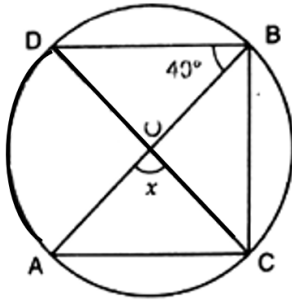
1. Value of  $\sqrt[4]{(81)^{-2}}$  is [1]
  - a)  $\frac{1}{9}$
  - b)  $\frac{1}{81}$
  - c) 9
  - d)  $\frac{1}{3}$
2. For the equation  $5x - 7y = 35$ , if  $y = 5$ , then the value of 'x' is [1]
  - a) 12
  - b) -12
  - c) -14
  - d) 14
3. The co-ordinates of the origin are [1]
  - a) (2, 2)
  - b) (0, 0)
  - c) (0, 2)
  - d) (2, 0)
4. A histogram is a pictorial representation of the grouped data in which class intervals and frequency are respectively taken along [1]
  - a) horizontal axis only
  - b) horizontal axis and vertical axis
  - c) vertical axis and horizontal axis
  - d) vertical axis only
5. Express 'x' in terms of 'y' in the equation  $2x - 3y - 5 = 0$ . [1]
  - a)  $x = \frac{3y-5}{2}$
  - b)  $x = \frac{3y+5}{2}$
  - c)  $x = \frac{5-3y}{2}$
  - d)  $x = \frac{3+5y}{2}$





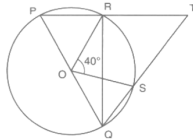
23. A Joker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps. [2]

24. If O is the centre of circle, find the value of x in given figure: [2]



OR

In a given figure, O is the centre of a circle and PQ is a diameter. If  $\angle ROS = 40^\circ$ , find  $\angle RTS$ .



25. Find whether (1, 1) is the solution of the equation  $x - 2y = 4$  or not? [2]

OR

If the length of a rectangle is decreased by 3 units and breadth increased by 4 unit, then the area will increase by 9 sq. units. Represent this situation as a linear equation in two variables.

### Section C

26. Rationalise the denominator:  $\frac{3}{\sqrt{3} + \sqrt{5} - \sqrt{2}}$ . [3]

27. Expand  $\left(\frac{1}{2}a - \frac{1}{3}b + 1\right)^2$  [3]

28. The perimeter of a triangular field is 540 m and its sides are in the ratio 25 : 17 : 12. Find the area of the triangle. [3]

OR

The sides of a triangular field are 41m, 40m and 9m. Find the number of rose beds that can be prepared in the field, if each rose bed on an average needs  $900 \text{ cm}^2$  space.

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]

$$3x + 2y = 6 \text{ and } 5x + 2y = 10$$

30. Show that the line segments joining the mid-points of the opposite sides of a quadrilateral bisect each other. [3]

OR

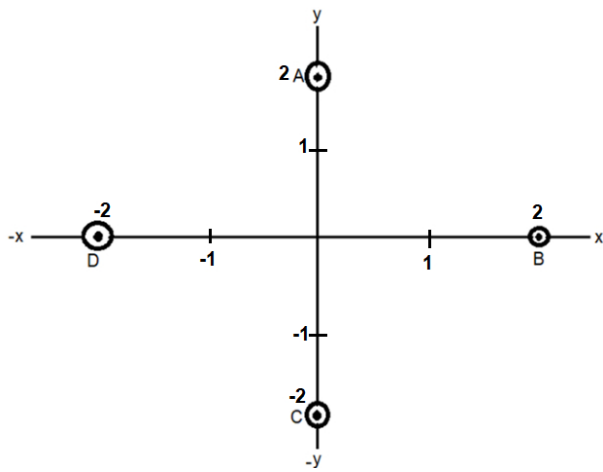
ABC is a triangle right angled at C. A line through the mid-point M of hypotenuse AB and parallel to BC intersects AC at D. Show that

i. D is the mid-point of AC

ii.  $MD \perp AC$

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

31. In fig. write the Co-ordinates of the points and if we join the points write the name of fig. formed. Also write Co-ordinate of intersection point of AC and BD. [3]



**Section D**

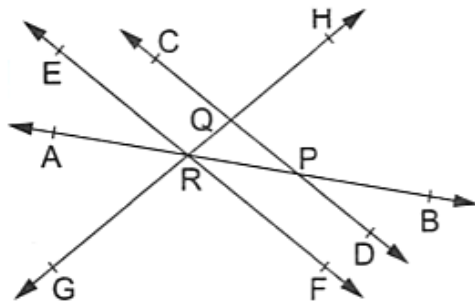
32. If  $\frac{9^n \times 3^2 \times (3^{-n/2})^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$ , prove that  $m - n = 1$ . [5]

OR

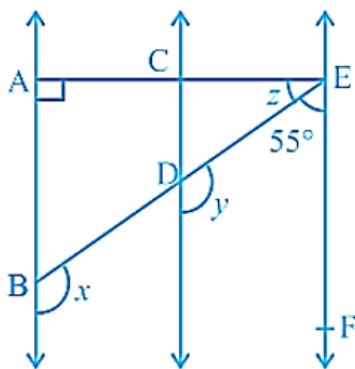
Simplify:  $\frac{7\sqrt{3}}{\sqrt{10+\sqrt{3}}} - \frac{2\sqrt{5}}{\sqrt{6+\sqrt{5}}} - \frac{3\sqrt{2}}{\sqrt{15+3\sqrt{2}}}$ .

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

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

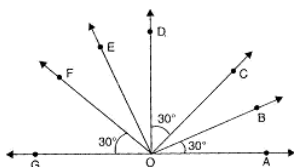


34. Fig.,  $AB \parallel CD$  and  $CD \parallel EF$ . Also,  $EA \perp AB$ . If  $\angle BEF = 55^\circ$ , find the values of  $x$ ,  $y$  and  $z$ . [5]



OR

In figure,  $\angle AOF$  and  $\angle FOG$  form a linear pair,  $\angle EOB = \angle FOC = 90^\circ$  and  $\angle DOC = \angle FOG = \angle AOB = 30^\circ$ . Find the measures of  $\angle FOE$ ,  $\angle COB$  and  $\angle DOE$ .



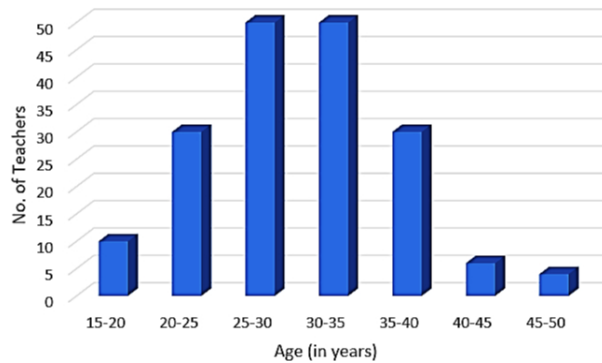
35. Divide  $p(x)$  by  $g(x)$ , where  $p(x) = x + 3x^2 - 1$  and  $g(x) = 1 + x$  [5]

**Section E**

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



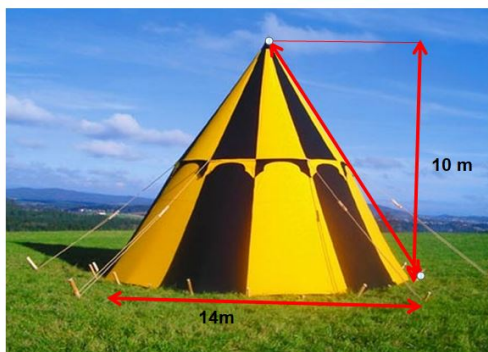
- (i) What is the total no of teachers?
- (ii) Find the class mark of class 15 - 20, 25 - 30 and 45 - 50?
- (iii) What is the no of teachers of age range 25 - 40 years?

**OR**

Which classes are having same no. of teachers?

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

Once four friends Rahul, Arun, Ajay and Vijay went for a picnic at a hill station. Due to peak season, they did not get a proper hotel in the city. The weather was fine so they decided to make a conical tent at a park. They were carrying  $300 \text{ m}^2$  cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.



- (i) How much Cloth was used for the floor?
- (ii) What was the volume of the tent?
- (iii) What was the area of the floor?

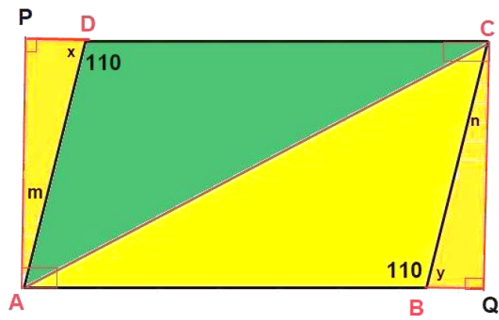
**OR**

What was the total surface area of the tent?

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

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

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



- (i) Show that  $\triangle APD$  and  $\triangle BQC$  are congruent.
- (ii) PD is equal to which side?
- (iii) Show that  $\triangle ABC$  and  $\triangle CDA$  are congruent.

**OR**

What is the value of  $\angle m$ ?

# Solution

## Section A

1. (a)  $\frac{1}{9}$

**Explanation:**  $\sqrt[4]{(81)^{-2}}$

$$= \sqrt[4]{\frac{1}{(81)^2}}$$

$$= \sqrt[4]{\frac{1}{(9^2)^2}}$$

$$= \sqrt[4]{\frac{1}{9^4}}$$

$$= \left(\frac{1}{9}\right)^{4 \times \frac{1}{4}}$$

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

2.

(d) 14

**Explanation:** For the equation  $5x - 7y = 35$ , if  $y = 5$ ,

$$5x - 7y = 35$$

$$y = 5$$

$$5x - 7.5 = 35$$

$$5x - 35 = 35$$

$$5x = 35 + 35$$

$$5x = 70$$

$$x = \frac{70}{5} = 14$$

$$x = 14$$

3.

(b) (0, 0)

**Explanation:** In co-ordinate, there are two Axis one is x-axis and other is y-axis, the point of intersection of both x-axis and y-axis is origin.

Coordinate of origin is always (0, 0).

4.

(b) horizontal axis and vertical axis

**Explanation:** In a histogram the class limits are marked on the horizontal axis and the frequency is marked on the vertical axis. Thus, a rectangle is constructed on each class interval.

5.

(b)  $x = \frac{3y+5}{2}$

$$2x - 3y - 5 = 0$$

**Explanation:**  $2x = 3y + 5$

$$x = \frac{3y + 5}{2}$$

6.

(d) Lines

**Explanation:** Edge is a line or border at which a surface terminates.

7.

(d)  $30^\circ$

**Explanation:**  $30^\circ$

Since lines m and n are parallel, we have

$$2x + 4x = 180$$



$$6x = 180$$

$$x = 30$$

8.

(d)  $135^\circ, 135^\circ$

**Explanation:** AB is parallel to DC.

angle A + angle D =  $180^\circ$  (co-interior angle)

$$\text{angle D} = 180^\circ - 45^\circ = 135^\circ$$

Similarly by following same argument, angle C =  $135^\circ$

9.

(d)  $(x - 1 + y)(x^2 + 1 + y^2 + x + y - xy)$

**Explanation:** The given expression to be factorized is  $x^3 - 1 + y^3 + 3xy$

This can be written in the form

$$x^3 - 1 + y^3 + 3xy = (x)^2 + (-1)^3 + (y)^3 - 3(x)(-1)(y)$$

$$\text{Recall the formula } a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

Using the above formula, we have,

$$x^3 - 1 + y^3 + 3xy$$

$$= (x + (-1) + y) \{ (x)^2 + (-1)^2 + (y)^2 - (x)(-1) - (-1)(y) - (y)(x) \}$$

$$= (x - 1 + y)(x^2 + 1 + y^2 + x + y - xy)$$

10. (a) Remains the same

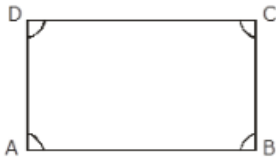
**Explanation:** If for any c, where c is any natural number

Like addition and subtraction we can multiply and divide both sides of an equation by a number, c, without changing the equation, where c is any natural number.

11. (a)  $112^\circ$

**Explanation:**

Let angles of parallelogram are  $\angle A, \angle B, \angle C, \angle D$



Let smallest angle =  $\angle A$

Let largest angle =  $\angle B$

$$= \angle B = 2\angle A - 24^\circ \dots(i)$$

$$\angle A + \angle B = 180^\circ \text{ [adjacent angle of parallelogram]}$$

$$\text{So, } \angle A + 2\angle A - 24^\circ = 180^\circ$$

$$= 3\angle A = 180^\circ + 24^\circ = 204^\circ$$

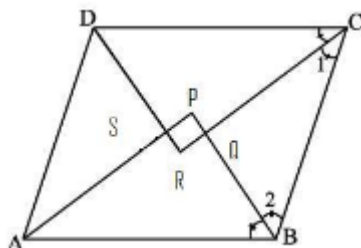
$$= \angle A = \frac{204^\circ}{3} = 68^\circ$$

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

12. (a) Rectangle

**Explanation:**

Let's assume our quadrilateral ABCD as a parallelogram :



we know

$\angle DCB + \angle ABC = 180^\circ$  ( Co-interior angles of parallelogram are supplementary)

$$\Rightarrow \frac{1}{2}\angle DCB + \frac{1}{2}\angle ABC = 90^\circ \quad (\text{Both sides divide by } 2)$$

$$\Rightarrow \angle 1 + \angle 2 = 90^\circ \dots (1)$$

In,  $\triangle CQB$  we know

$$\Rightarrow \angle 1 + \angle 2 + \angle CQB = 180^\circ \dots (2)$$

From eq(1) and eq(2), We get

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

$$\Rightarrow \angle CQB = 90^\circ$$

$$\Rightarrow \angle PQR = 90^\circ \quad (\text{because } \angle CQB = \angle PQR, \text{ vertically opposite angles})$$

Similarly, it can be shown

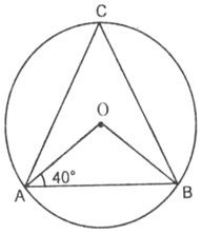
$$\angle QPS = \angle PSR = \angle SRQ = 90^\circ$$

So, quadrilateral PQRS is a rectangle.

13.

(d)  $50^\circ$

**Explanation:**



In  $\triangle AOB$ ,

$$\angle A = \angle B = 40^\circ$$

$$\text{And } \angle A + \angle B + \angle O = 180^\circ$$

$$\Rightarrow \angle O = 100^\circ$$

$$\text{So, } \angle ACB = \frac{100^\circ}{2} = 50^\circ$$

14.

(d) -1.5

**Explanation:**  $a^b - b^a$

$$= (-2)^{-1} - (-1)^{-2}$$

$$= \frac{1}{(-2)} - \frac{1}{(-1)^2}$$

$$= \frac{-1}{2} - 1$$

$$= \frac{-3}{2}$$

$$= -1.5$$

15.

(d) (1, 1)

**Explanation:**  $y = x$ ,  $\Rightarrow$  both the coordinates are the same. Hence (1, 1) is correct option.

16.

(c) Equilateral

**Explanation:** Angle bisector is perpendicular to the opposite side only in equilateral triangle.

17.

(b) 2.5 cm

**Explanation:** 1 cm = 30 km

So for 75 km

$$\frac{75}{30} = 2.5 \text{ cm}$$

18. (a) 5 : 4

**Explanation:** The formula of the curved surface area of a cone with base radius 'r' and slant height 'l' is given as

$$\text{Curved Surface Area} = \pi r l$$

Now there are two cones with base radius and slant heights as  $r_1, l_1$  &  $r_2, l_2$  respectively.

The ratio between slant heights of the two cones is given as 5: 4, we shall use them by introducing a constant 'k'

So, now  $l_1 = 5k$

$$l_2 = 4k$$

since the base diameters of both the cones are equal we get that  $r_1 = r_2 = r$

Using these values we shall evaluate the ratio between the curved surface areas of the two cones

$$\begin{aligned}\frac{C.S.A_1}{C.S.A_2} &= \frac{\pi r_1 l_1}{\pi r_2 l_2} \\ &= \frac{\pi r(5k)}{\pi r(4k)} \\ &= \frac{5}{4}\end{aligned}$$

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

**Explanation:** Assertion: Area of  $\triangle = \frac{1}{2} \times \text{base} \times \text{height}$

$$72 = \frac{1}{2} \times 18 \times b$$

$$b = \frac{72 \times 2}{18} = 8 \text{ cm}$$

- 20.

(d) A is false but R is true.

**Explanation:** A is false but R is true.

### Section B

21. The perimeter of the given equilateral triangle = 60 cm

As every side of the equilateral triangle is equal.

$$\text{Length of each of its sides} = a = \frac{60}{3} \text{ cm} = 20 \text{ cm}$$

$$\text{Area of the triangle} = \left( \frac{\sqrt{3}}{4} \times a^2 \right) \text{ sq units}$$

$$= \left( \frac{\sqrt{3}}{4} \times 20 \times 20 \right) \text{ cm}^2$$

$$= (100 \times \sqrt{3}) \text{ cm}^2$$

$$= (100 \times 1.732) \text{ cm}^2$$

$$= 173.2 \text{ cm}^2$$

Hence, the area of the given triangle is  $173.2 \text{ cm}^2$ .

22. We know that if one side of a cyclic quadrilateral is produced, then the exterior angle is equal to the interior opposite angle.

$$\text{i.e., } \angle \text{BAD} = \angle \text{DCF} = 75^\circ$$

$$\Rightarrow \angle \text{DCF} = x^\circ = 75^\circ \Rightarrow x^\circ = 75^\circ$$

Again, the sum of the opposite angles in a cyclic quadrilateral is  $180^\circ$ .

$$\text{Thus, } \angle \text{DCF} + \angle \text{DEF} = 180^\circ$$

$$\Rightarrow 75^\circ + y^\circ = 180^\circ$$

$$\Rightarrow y^\circ = (180^\circ - 75^\circ) = 105^\circ \Rightarrow y^\circ = 105^\circ$$

$$\text{Hence, } x^\circ = 75^\circ \text{ and } y^\circ = 105^\circ$$

23. Radius of cap ( $r$ ) = 7 cm, Height of cap ( $h$ ) = 24 cm

$$\text{Slant height of the cone (l)} = \sqrt{r^2 + h^2} = \sqrt{(7)^2 + (24)^2}$$

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

$$= \sqrt{625}$$

$$= 25 \text{ cm}$$

$$\text{Area of sheet required to make a cap} = \text{CSA of cone} = \pi r l$$

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

$$= 550 \text{ cm}^2 = 550 \text{ cm}^2$$

$$\therefore \text{Area of sheet required to make 10 caps} = 10 \times 550 = 5500 \text{ cm}^2$$

24. We have,  $\angle \text{DBO} = 40^\circ$

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

$$\text{Therefore, } \angle \text{DBO} + \angle \text{OBC} = 90^\circ$$

$$40^\circ + \angle \text{OBC} = 90^\circ$$

$$\angle \text{OBC} = 50^\circ$$

By degree measure theorem,

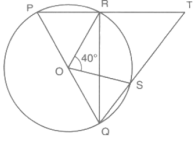
$$\angle AOC = 2 \angle OBC$$

$$x = 2 \times 50^\circ$$

$$x = 100^\circ$$

OR

It is given that O is the center and  $\angle ROS = 40^\circ$



$$\text{We have } \angle RQS = \frac{1}{2} \angle ROS = 20^\circ$$

In right angled triangle RQT we have

$$\angle RQT + \angle QTR + \angle TRQ = 180^\circ$$

$$\Rightarrow 20^\circ + \angle QTR + 90^\circ = 180^\circ$$

$$\Rightarrow \angle QTR = 180^\circ - 20^\circ - 90^\circ$$

$$\Rightarrow \angle QTR = 70^\circ$$

$$\angle QTR = \angle RTS = 70^\circ \text{ [Same angles]}$$

$$\text{Hence, } \angle RTS = 70^\circ$$

25. Put  $x = 1$  and  $y = 1$  in given equation, we get

$$x - 2y = 1 - 2(1) = 1 - 2 = -1, \text{ which is not } 4.$$

$\therefore (1, 1)$  is not a solution of given equation.

OR

Let the length be  $x$  and breadth be  $y$ .

$$\therefore \text{Area of the rectangle} = xy$$

When length is  $x - 3$  and breadth is  $y + 4$ , then the area will increase by 9 sq. units

$$\therefore (x - 3)(y + 4) = xy + 9$$

$$\Rightarrow xy + 4x - 3y - 12 = xy + 9$$

$$\Rightarrow 4x - 3y - 12 = 9$$

$$\Rightarrow 4x - 3y = 21$$

### Section C

$$\begin{aligned} 26. & \frac{3}{\sqrt{3} + \sqrt{5} - \sqrt{2}} \\ &= \frac{3}{(\sqrt{3} + \sqrt{5}) - \sqrt{2}} \times \frac{(\sqrt{3} + \sqrt{5}) + \sqrt{2}}{(\sqrt{3} + \sqrt{5}) + \sqrt{2}} \\ &= \frac{3(\sqrt{3} + \sqrt{5} + \sqrt{2})}{(\sqrt{3} + \sqrt{5})^2 - \sqrt{2}^2} \text{ [ } a^2 - b^2 = (a + b)(a - b) \text{]} \\ &= \frac{3\sqrt{3} + 3\sqrt{5} + 3\sqrt{2}}{(3 + 5 + 2\sqrt{15}) - 2} \\ &= \frac{3\sqrt{3} + 3\sqrt{5} + 3\sqrt{2}}{8 + 2\sqrt{15} - 2} \\ &= \frac{3\sqrt{3} + 3\sqrt{5} + 3\sqrt{2}}{6 + 2\sqrt{15}} \\ &= \frac{3\sqrt{3} + 3\sqrt{5} + 3\sqrt{2}}{6 + 2\sqrt{15}} \times \frac{6 - 2\sqrt{15}}{6 - 2\sqrt{15}} \\ &= \frac{18\sqrt{3} - 6\sqrt{45} + 18\sqrt{5} - 6\sqrt{75} + 18\sqrt{2} - 6\sqrt{30}}{6^2 - (2\sqrt{15})^2} \text{ [ } \therefore a^2 - b^2 = (a + b)(a - b) \text{]} \\ &= \frac{18\sqrt{3} - 6\sqrt{9 \times 5} + 18\sqrt{5} - 6\sqrt{25 \times 3} + 18\sqrt{2} - 6\sqrt{30}}{36 - 60} \\ &= \frac{18\sqrt{3} - 18\sqrt{5} + 18\sqrt{5} - 30\sqrt{3} + 18\sqrt{2} - 6\sqrt{30}}{-24} \\ &= \frac{-12\sqrt{3} + 18\sqrt{2} - 6\sqrt{30}}{-24} \\ &= \frac{-6(2\sqrt{3} - 3\sqrt{2} + \sqrt{30})}{-24} \\ &= \frac{2\sqrt{3} - 3\sqrt{2} + \sqrt{30}}{4} \end{aligned}$$

$$27. \left( \frac{1}{2}a - \frac{1}{3}b + 1 \right)^2$$

$$\text{Using identity } (x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yx + 2zx$$

$$\left(\frac{1}{2}a - \frac{1}{3}b + 1\right)^2 = \left(\frac{1}{2}a\right)^2 + \left(\frac{-1}{3}b\right)^2 + (1)^2 + 2 \times \frac{1}{2}a \times \frac{-1}{3}b + 2 \times \frac{-1}{3}b \times 1 + 2 \times 1 \times \frac{1}{2}a$$

$$= \frac{a^2}{4} + \frac{b^2}{9} + 1 - \frac{ab}{3} - \frac{2b}{3} + a$$

28. The sides of the triangle field are in the ratio 25:17:12.

Let the sides of triangle be 25x, 17x and 12x.

Perimeter of this triangle = 540 m

$$25x + 17x + 12x = 540 \text{ m}$$

$$54x = 540 \text{ m}$$

$$x = 10 \text{ m}$$

Sides of triangle will be 250 m, 170 m, and 120 m

$$\text{Semi-perimeter (s)} = \frac{\text{Perimeter}}{2} = \frac{540}{2} = 270 \text{ m}$$

By Heron's formula:

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

$$= \sqrt{270(270-120)(270-170)(270-250)}$$

$$= \sqrt{270 \times 150 \times 100 \times 20}$$

$$= 9000 \text{ m}^2$$

So, area of the triangle is 9000 m<sup>2</sup>.

OR

Let a = 41m, b = 40m, c = 9m.

$$s = \frac{a+b+c}{2} = \frac{41+40+9}{2} = \frac{90}{2}$$

$$s = 45\text{m}$$

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

$$= \sqrt{45(45-41)(45-40)(45-9)}$$

$$= \sqrt{45 \times 4 \times 5 \times 36}$$

$$= 180 \text{ m}^2$$

$$= 1800000 \text{ cm}^2$$

$$\text{Number of rose beds} = \frac{\text{Total area}}{\text{Area needed for one rose bed}} = \frac{1800000}{900} = 2000$$

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

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

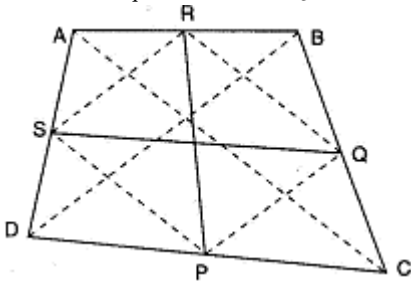
$$\Rightarrow 2y = 10$$

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

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

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

30. ABCD is a quadrilateral P, Q, R and S are the mid-points of the sides DC, CB, BA and AD respectively.



To prove : PR and QS bisect each other.

Construction : Join PQ, QR, RS, SP, AC and BD.

Proof : In  $\triangle ABC$ ,

As R and Q are the mid-points of AB and BC respectively.

$$\therefore RQ \parallel AC \text{ and } RQ = \frac{1}{2} AC$$

Similarly, we can show that

$$PS \parallel AC \text{ and } PS = \frac{1}{2} AC$$

$$\therefore RQ \parallel PS \text{ and } RQ = PS.$$

Thus a pair of opposite sides of a quadrilateral PQRS are parallel and equal.

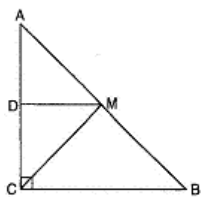
$\therefore$  PQRS is a parallelogram.

Since the diagonals of a parallelogram bisect each other.

$\therefore$  PR and QS bisect each other.

OR

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)  $MD \perp AC$

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

Proof :

i. In  $\triangle ACB$ ,

As M is the mid-point of AB and  $MD \parallel BC$

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

ii. As  $MD \parallel BC$  and AC intersects them

$$\angle ADM = \angle ACB \dots [\text{Corresponding angles}]$$

$$\text{But } \angle ACB = 90^\circ \dots [\text{Given}]$$

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

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

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

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

$$AD = CD \dots [\text{As D is the mid-point of AC}]$$

$$\angle ADM = \angle CDM \dots [\text{Each } 90^\circ]$$

$$DM = DM \dots [\text{Common}]$$

$$\therefore \triangle ADM \cong \triangle CDM \dots [\text{By SAS rule}]$$

$$\therefore MA = MC \dots [\text{c.p.c.t.}]$$

But M is the mid-point of AB

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

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

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

31. i. The Co-ordinate of point A is (0, 2), B is (2, 0), C is (0, -2) and D is (-2, 0).  
 ii. If we joined them we get square.  
 iii. Co-ordinate of intersection point of AC and BD is (0, 0).

### Section D

32. We know that

$$\begin{aligned} \frac{9^n \times 3^2 \times \left(3^{-\frac{n}{2}}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} &= \frac{1}{27} \\ \Rightarrow \frac{(3^2)^n \times 3^2 \times \left(3^{-\frac{n}{2}}\right)^{-2} - (3^3)^n}{3^{3m} \times 2^3} &= \frac{1}{3^3} \\ \Rightarrow \frac{(3)^{2n} \times 3^2 \times 3^{\frac{n}{2} \times 2} - (3)^{3n}}{3^{3m} \times 2^3} &= \frac{1}{3^3} \\ \Rightarrow \frac{(3)^{2n+2} \times 3^n - (3)^{3n}}{3^{3m} \times 2^3} &= \frac{1}{3^3} \\ \Rightarrow \frac{(3)^{2n+2+n} - (3)^{3n}}{3^{3m} \times 2^3} &= \frac{1}{3^3} \\ \Rightarrow \frac{(3)^{3n+2} - (3)^{3n}}{3^{3m} \times 2^3} &= \frac{1}{3^3} \\ \Rightarrow 3^3 \times [(3)^{3n+2} - (3)^{3n}] &= 3^{3m} \times 2^3 \\ \Rightarrow 3^{3+3n} \times [(3)^2 - 1] &= 3^{3m} \times 2^3 \\ \Rightarrow 3^{3+3n} \times [8] &= 3^{3m} \times 2^3 \\ \Rightarrow 3^{3+3n} \times 2^3 &= 3^{3m} \times 2^3 \\ \Rightarrow 3^{3+3n} &= 3^{3m} \\ \Rightarrow 3+3n &= 3m \\ \Rightarrow 3m - 3n &= 3 \\ \Rightarrow m - n &= 1 \end{aligned}$$

OR

$$\begin{aligned} \frac{7\sqrt{3}}{\sqrt{10+\sqrt{3}}} - \frac{2\sqrt{5}}{\sqrt{6+\sqrt{5}}} - \frac{3\sqrt{2}}{\sqrt{15+3\sqrt{2}}} \\ = \frac{7\sqrt{3}}{\sqrt{10+\sqrt{3}}} \times \frac{\sqrt{10-\sqrt{3}}}{\sqrt{10-\sqrt{3}}} - \frac{2\sqrt{5}}{\sqrt{6+\sqrt{5}}} \times \frac{\sqrt{6-\sqrt{5}}}{\sqrt{6-\sqrt{5}}} - \frac{3\sqrt{2}}{\sqrt{15+3\sqrt{2}}} \times \frac{\sqrt{15-3\sqrt{2}}}{\sqrt{15-3\sqrt{2}}} \\ = \frac{7\sqrt{3}(\sqrt{10-\sqrt{3}})}{10-3} - \frac{2\sqrt{5}(\sqrt{6-\sqrt{5}})}{6-5} - \frac{3\sqrt{2}(\sqrt{15-3\sqrt{2}})}{15-18} \\ = \sqrt{3}(\sqrt{10} - \sqrt{3}) - 2\sqrt{5}(\sqrt{6} - \sqrt{5}) + \sqrt{2}(\sqrt{15} - 3\sqrt{2}) \\ = \sqrt{30} - 3 - 2\sqrt{30} + 10 + \sqrt{30} - 6 \\ = 2\sqrt{30} - 9 - 2\sqrt{30} + 10 = 1 \end{aligned}$$

33. i.  $\overleftrightarrow{EF}$ ,  $\overleftrightarrow{GH}$  and their corresponding point of intersection is R.  
 $\overleftrightarrow{AB}$ ,  $\overleftrightarrow{CD}$  and their corresponding point of intersection is P.  
 ii.  $\overleftrightarrow{AB}$ ,  $\overleftrightarrow{EF}$ ,  $\overleftrightarrow{GH}$  and their point of intersection is R.  
 iii. Three rays are:  $\overrightarrow{RB}$ ,  $\overrightarrow{RH}$ ,  $\overrightarrow{RG}$   
 iv. Two line segments are:  $\overline{RQ}$ ,  $\overline{RP}$ .

34. 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  $CD \parallel EF$ .

$$\therefore AB \parallel EF$$

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

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

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

OR





$$\begin{array}{r}
 3x - 2 \\
 x + 1 \overline{) 3x^2 + x - 1} \\
 \underline{3x^2 + 3x} \phantom{- 1} \\
 -2x - 1 \\
 \underline{-2x - 2} \\
 + \phantom{-} + \\
 \hline
 1
 \end{array}$$

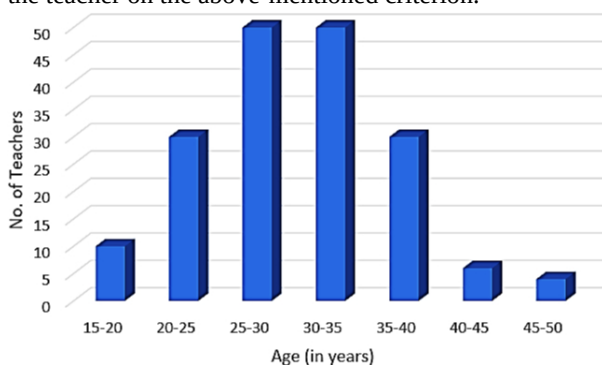
Notice that  $3x^2 + x - 1 = (x + 1)(3x - 2) + 1$

### Section E

#### 36. Read the text carefully and answer the questions:

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) 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 :**

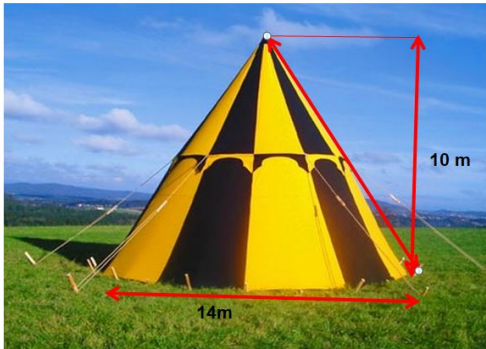
No of teachers in the age-group 25-30 years = 50

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

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

Once four friends Rahul, Arun, Ajay and Vijay went for a picnic at a hill station. Due to peak season, they did not get a proper hotel in the city. The weather was fine so they decided to make a conical tent at a park. They were carrying 300 m<sup>2</sup> cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.



(i) Height of the tent  $h = 10$  m

Radius  $r = 7$  m

Thus Latent height  $l = \sqrt{r^2 + h^2} = \sqrt{7^2 + 10^2} = \sqrt{149} = 12.20$  m

Curved surface of tent =  $\pi r l = \frac{22}{7} \times 7 \times 12.2 = 268.4$  m<sup>2</sup>

Thus the length of the cloth used in the tent = 268.4 m<sup>2</sup>

The remaining cloth =  $300 - 268.4 = 31.6$  m<sup>2</sup>

Hence the cloth used for the floor = 31.6 m<sup>2</sup>

(ii) Height of the tent  $h = 10$  m

Radius  $r = 7$  m

Thus the volume of the tent =  $\frac{1}{3} \pi r^2 h$

=  $\frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 10$

= 513.3 m<sup>3</sup>

(iii) Radius of the floor = 7 m

Area of the floor =  $\pi r^2 = \frac{22}{7} \times 7 \times 7$

= 154 m<sup>2</sup>

OR

Radius of the floor  $r = 7$  m

Latent height of the tent  $l = 12.2$  m

Thus total surface area of the tent =  $\pi r(r + l)$

=  $\frac{22}{7} \times 7(7 + 12.2)$

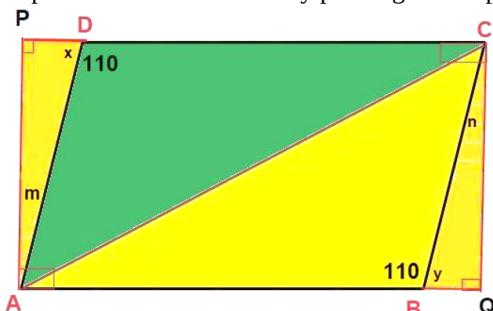
=  $22 \times 19.2$

= 422.4 m<sup>2</sup>

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

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

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



(i) In  $\triangle APD$  and  $\triangle BQC$

$AD = BC$  (given)

$AP = CQ$  (opposite sides of rectangle)

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

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  $\triangle APD$

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

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

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

$\angle ADP = m = 20^\circ$