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 π =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]**

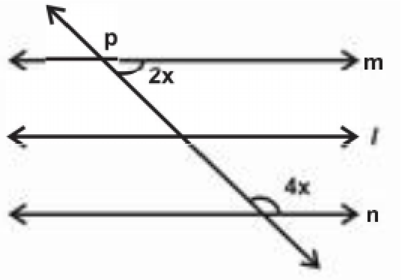
   a) $x = \frac{3y-5}{2}$ b) $x = \frac{3y+5}{2}$

   c) $x = \frac{5-3y}{2}$ d) $x = \frac{3+5y}{2}$

6. The edges of a surface are **[1]**

a) Curves
b) None of these
c) Points
d) Lines

7. In the figure, $l||m$ & $l||n$ then x is- **[1]**



a) 45°
b) 90^o
c) 60°
d) 30°

8. ABCD is a Trapezium in which AB|| DC and $\angle A = \angle B$ = 45^o. Find angles C and D of the Trapezium **[1]**

a) 150^o, 150^o
b) 120^o, 120^o
c) 200^o, 50^o
d) 135^o, 135^o

9. The factors of $x^3 - 1 + y^3 + 3xy$ are **[1]**

a) $3(x + y - 1)(x^2 + y^2 - 1)$
b) $(x - 1 + y)(x^2 - 1 - y^2 + x + y + xy)$
c) $(x + y + 1)(x^2 + y^2 + 1 - xy - x - y)$
d) $(x - 1 + y)(x^2 + 1 + y^2 + x + y - xy)$

10. If we multiply both sides of a linear equation with a non-zero number, then the solution of the linear equation: **[1]**

a) Remains the same
b) Changes in case of multiplication only
c) Changes in case of division only
d) Changes

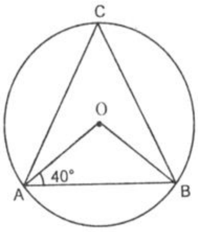
11. If one angle of a parallelogram is 24^o less than twice the smallest angle, then the measure of the largest angle of the parallelogram is **[1]**

a) 112^o
b) 68^o
c) 176^o
d) 102^o

12. If bisector of $\angle A$ and $\angle B$ of a quadrilateral ABCD intersect each other at p , $\angle B$ and $\angle C$ at Q , $\angle C$ and $\angle D$ at R and, $\angle D$ and $\angle A$ at S then PQRS is a **[1]**

a) Rectangle
b) Parallelogram
c) Rhombus
d) Quadrilateral whose opposite angles are supplementary

13. In the figure, O is the center of the circle. If $\angle OAB = 40^o$, then $\angle ACB$ is equal to : **[1]**



a) 40^o

b) 70^o

c) 60^o

d) 50^o

14. If a = -2, b = -1, then $a^b - b^a$ is equal to **[1]**

a) -1

b) 0.5

c) -2

d) -1.5

15. The graph of the linear equation y = x passes through the point **[1]**

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

b) $\left(0, \frac{3}{2}\right)$

c) $\left(\frac{-1}{2}, \frac{1}{2}\right)$

d) (1 ,1)

16. If the bisector of the angle A of a △ABC is perpendicular to the base BC of the triangle then the triangle ABC is: **[1]**

a) Isosceles

b) Obtuse Angled

c) Equilateral

d) Scalene

17. In a bar graph if 1 cm represents 30 km, then the length of bar needed to represent 75 km is **[1]**

a) 3.5 cm

b) 2.5 cm

c) 2 cm

d) 3 cm

18. The diameters of two cones are equal. If their slant heights are in the ratio 5 : 4, the ratio of their curved surface areas, is **[1]**

a) 5 : 4

b) 4 : 5

c) 16 : 25

d) 25 : 16

19. **Assertion (A):** The height of the triangle is 18 cm and its area is 72 cm^2. Its base is 8 cm. **[1]**
Reason (R): Area of a triangle = $\frac{1}{2} \times$ base $\times$ height

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):** A linear equation 2x + 3y = 5 has a unique solution. **[1]**
Reason (R): A linear equation in two variables has infinitely many solutions.

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

b) Both A and R are true but R is not the correct explanation of A.

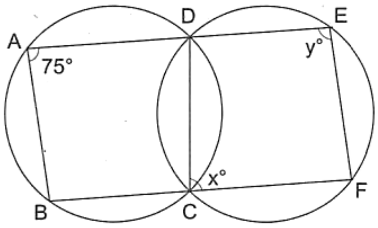
c) A is true but R is false.

d) A is false but R is true.

Section B

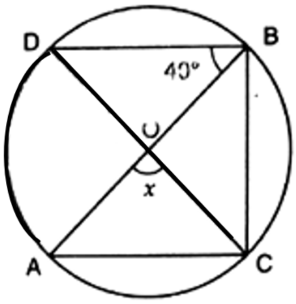
21. The perimeter of an equilateral triangle is 60 cm. Find its area. **[2]**

22. In the given figure, ∠BAD = 75°, ∠DCF = x° and ∠DEF = y°. Find the values of x and y. **[2]**



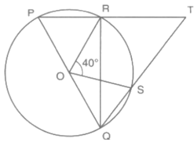
23. A Joker's cap is in the form of a right circular cone of base radius 7 cm and height 24 cm. Find the area of the sheet required to make 10 such caps. **[2]**

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 $\angle ROS = 40°$, 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 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 and 5x + 2y = 10

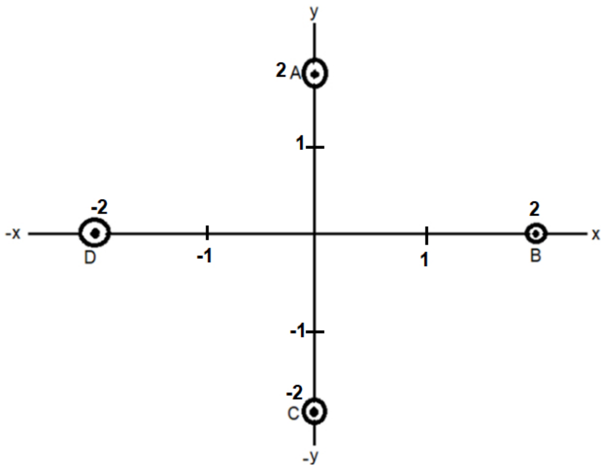
30. Show that the line segments joining the mid-points of the opposite sides of a quadrilateral bisect each other. **[3]**

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

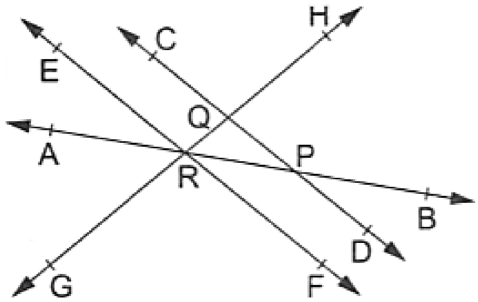
32. If $\frac{9^n \times 3^2 \times \left(3^{-n/2}\right)^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, prove that m - n = 1. **[5]**

OR

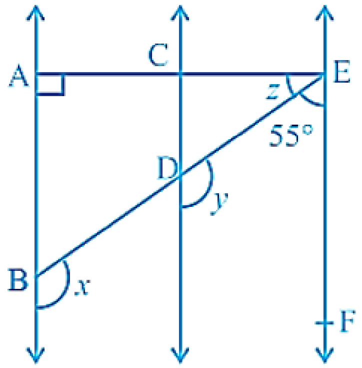
Simplify: $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$.

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

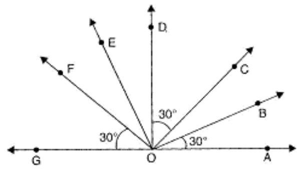


34. Fig., AB || CD and CD || EF. Also, EA ⊥ AB. If ∠BEF = 55°, find the values of x, y and z. **[5]**



OR

In figure, ∠AOF and ∠FOG form a linear pair, ∠EOB = ∠FOC = 90^{o} and ∠DOC = ∠FOG = ∠AOB = 30^{o}. Find the measures of FOE, COB and DOE.



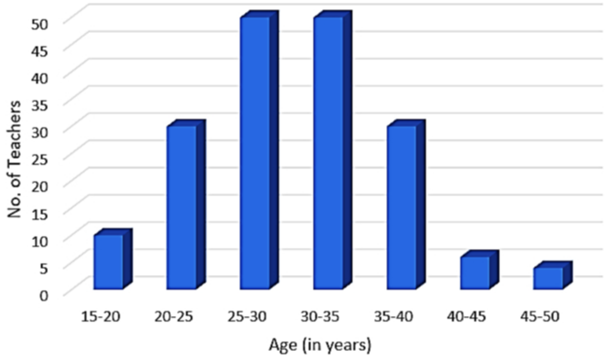
35. Divide p(x) by g(x), where $p(x) = x + 3x^2 - 1$ and $g(x) = 1 + x$ **[5]**

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 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?

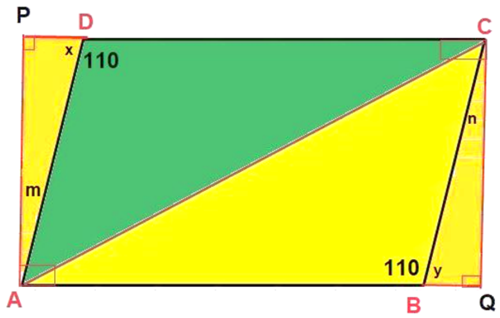
OR

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||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.

(ii) PD is equal to which side?

(iii) Show that ΔABC and ΔCDA are congruent.

OR

What is the value of ∠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) $x = \frac{3y+5}{2}$

Explanation:
$$2x - 3y - 5 = 0$$
$$2x = 3y + 5$$
$$x = \frac{3y+5}{2}$$

6.

(d) Lines

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

7.

(d) 30°

Explanation: 30°

Since lines m and n are parallel, we have

2x + 4x = 180

$6x = 180$

$x = 30$

8.

(d) 135^o, 135^o

Explanation: AB is parallel to DC.

angle A + angle D = 180^o (co-interior angle)

angle D = $180^o - 45^o = 135^o$

Similarly by following same argument, angle C = 135^o

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

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

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

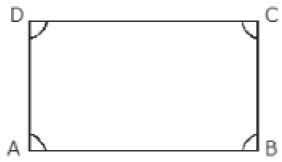
Explanation: If for any c. where c is any natural number

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^o

Explanation:

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



Let smallest angle = $\angle A$

Let largest angle = $\angle B$

$= \angle B = 2\angle A - 24^o$ ...(i)

$\angle A + \angle B = 180^o$ [adjacent angle of parallelogram]

So, $\angle A + 2\angle A - 24^o = 180^o$

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

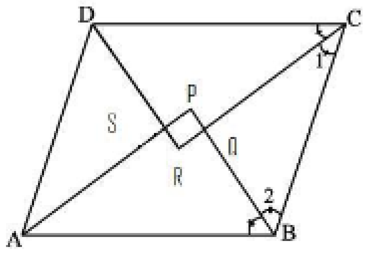
$= \angle A = \frac{204^o}{3} = 68^o$

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

12. **(a)** Rectangle

Explanation:

Let's assume our quadrilateral ABCD as a parallelogram :

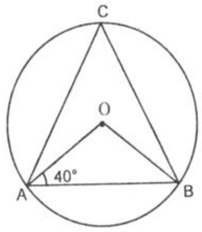


we know

$\angle$DCB + $\angle$ABC = 180° (Co-interior angles of parallelogram are supplementary)
$\Rightarrow \frac{1}{2}\angle DCB + \frac{1}{2}\angle ABC = 90°$ (Both sides divide by 2)
$\Rightarrow \angle 1 + \angle 2 = 90°$... (1)
In, ΔCQB we know
$\Rightarrow \angle 1 + \angle 2 + \angle CQB = 180°$ ... (2)
From eq(1) and eq(2), We get
$\Rightarrow \angle CQB = 180° - 90°$
$\Rightarrow \angle CQB = 90°$
$\Rightarrow \angle PQR = 90°$ (because $\angle CQB = \angle PQR$, vertically opposite angles)
Similarly, it can be shown
$\angle QPS = \angle PSR = \angle SRQ = 90°$
So, quadrilateral PQRS is a rectangle.

13.

(d) 50^o
Explanation:



In $\triangle$AOB,
$\angle A = \angle B = 40^o$
And $\angle A + \angle B + \angle O = 180^o$
$\Rightarrow \angle O = 100^o$
So, $\angle ACB = \frac{100^0}{2} = 50^0$

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 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
Curved Surface Area $= \pi rl$
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

$\frac{C.S.A_1}{C.S.A_2} = \frac{\pi r_1 l_1}{\pi r_2 l_2}$

$= \frac{\pi r(5k)}{\pi r(4k)}$

$= \frac{5}{4}$

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

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

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

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

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

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

Hence, the area of the given triangle is 173.2 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.

i.e., ∠BAD = ∠DCF = 75°

⇒ ∠DCF = x° = 75° ==> x° = 75°

Again, the sum of the opposite angles in a cyclic quadrilateral is 180°.

Thus, ∠DCF + ∠DEF = 180°

⇒ 75° + y° = 180°

⇒ y° = (180° - 75°) = 105° ==> y° = 105°

Hence, x° = 75° and y° = 105°

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

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

= $\sqrt{49 + 576}$

= $\sqrt{625}$

= 25 cm

Area of sheet required to make a cap = CSA of cone = πrl πrl

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

$= 550\ cm^2$ =550 cm^2

∴ Area of sheet required to make 10 caps =10 × 550 = 5500 cm^2

24. We have, ∠DBO = 40^o

∠DBC = 90^o (Angle in semi-circle)

Therefore, ∠DBO + ∠OBC = 90^o

40^o + ∠OBC = 90^o

∠OBC = 50^o

By degree measure theorem,

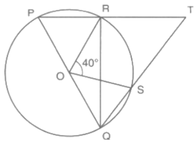
$\angle AOC = 2\ \angle OBC$

$x = 2 \times 50^o$

$x = 100^o$

OR

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



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

In right angled triangle RQT we have

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

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

$=> \ \angle QTR = 180^o - 20^o - 90^o$

$\Rightarrow \angle QTR = 70^o$

$\angle QTR \ = \ \angle RTS = 70^o$ [Same angles]

Hence, $\angle RTS = 70^o$

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

x – 2y = 1 – 2(1) = 1 – 2 = –1, which is not 4.

∴ (1, 1) is not a solution of given equation.

OR

Let the length be x and breadth be y.

$\therefore$ 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

26. $\frac{3}{\sqrt{3}+\sqrt{5}-\sqrt{2}}$

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

$= \frac{3(\sqrt{3}+\sqrt{5}+\sqrt{2})}{(\sqrt{3}+\sqrt{5})^2-\sqrt{2}^2}$ [$a^2 - b^2 = (a + b)(a - b)$]

$= \frac{3\sqrt{3}+3\sqrt{5}+3\sqrt{2}}{(3+5+2\sqrt{15})-2}$

$= \frac{3\sqrt{3}+3\sqrt{5}+3\sqrt{2}}{8+2\sqrt{15}-2}$

$= \frac{3\sqrt{3}+3\sqrt{5}+3\sqrt{2}}{6+2\sqrt{15}}$

$= \frac{3\sqrt{3}+3\sqrt{5}+3\sqrt{2}}{6+2\sqrt{15}} \times \frac{6-2\sqrt{15}}{6-2\sqrt{15}}$

$= \frac{18\sqrt{3}-6\sqrt{45}+18\sqrt{5}-6\sqrt{75}+18\sqrt{2}-6\sqrt{30}}{6^2-(2\sqrt{15})^2}$ [$\because a^2 - b^2 = (a + b)(a - b)$]

$= \frac{18\sqrt{3}-6\sqrt{9\times5}+18\sqrt{5}-6\sqrt{25\times3}+18\sqrt{2}-6\sqrt{30}}{36-60}$

$= \frac{18\sqrt{3}-18\sqrt{5}+18\sqrt{5}-30\sqrt{3}+18\sqrt{2}-6\sqrt{30}}{-24}$

$= \frac{-12\sqrt{3}+18\sqrt{2}-6\sqrt{30}}{-24}$

$= \frac{-6(2\sqrt{3}-3\sqrt{2}+\sqrt{30})}{-24}$

$= \frac{2\sqrt{3}-3\sqrt{2}+\sqrt{30}}{4}$

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

Using identity $(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yx + 2zx$

$\left(\frac{1}{2}a-\frac{1}{3}b+1\right)^2=\left(\frac{1}{2}a\right)^2+\left(\frac{-1}{3}b\right)^2+(1)^2+2\times\frac{1}{2}a\times\frac{-1}{3}b+2\times\frac{-1}{3}b\times1+2\times1\times\frac{1}{2}a$

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

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 m

54x = 540 m

x = 10 m

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

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

By Heron's formula:

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

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

= $\sqrt{270\times150\times100\times20}$

= 9000 m^2

So, area of the triangle is 9000 m^2.

OR

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

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

s = 45m

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

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

$=\sqrt{45\times4\times5\times36}$

=180 m^2

=1800000 cm^2

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

⇒ 3x = 6

⇒ $x=\frac{6}{3}=2$

∴ (2, 0) is a solution.

3x + 2y = 6

put x = 0, we get

3(0) + 2y = 6

⇒ 2y = 6

⇒ $y=\frac{6}{2}=3$

∴ (0, 3) is a solution.

5x+ 2y = 10

Put y = 0, we get

5x + 2(0) = 10

⇒ 5x = 10

⇒ $x=\frac{10}{5}=2$

∴ (2, 0) is a solution.

5x + 2y = 10

Put x = 0, we get

5(0) + 2y = 10

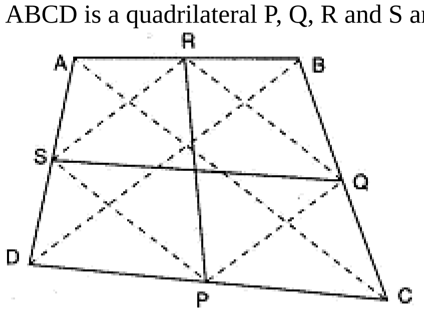
⇒ 2y = 10

⇒ $y=\frac{10}{2}=5$

∴ (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 || AC and RQ = $\frac{1}{2}$ AC

Similarly, we can show that

PS || AC and PS = $\frac{1}{2}$ AC

$\therefore$ RQ || PS and RQ = PS.

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

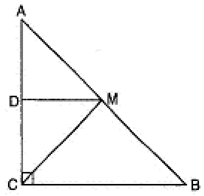
$\therefore$ PQRS is a parallelogram.

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
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

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

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

OR

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

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.
∴ x = y ... (i)
We know that the interior angles on the same side of the transversal are supplementary.
∴ y + 55° = 180°
$\Rightarrow$ y = 180° - 55° = 125°
So, x = y = 125°
Since AB || CD and CD || EF.
∴ AB || EF
$\Rightarrow$ ∠EAB + ∠FEA = 180° [∵ Interior angles on the same side of the transversal EA are supplementary]
$\Rightarrow$ 90° + z + 55° = 180°
$\Rightarrow$ z = 35°

OR

$\angle AOF + \angle FOG = 180^o$ . . . . [Linear pair axiom]

$\Rightarrow \angle AOG = 180^o$

$\Rightarrow \angle AOB + \angle EOB + \angle FOE + \angle FOG = 180^o$

$\Rightarrow 30^o + 90^o + \angle FOE + 30^o = 180^o$

$\Rightarrow \angle FOE + 150^o = 180^o$

$\Rightarrow \angle FOE = 180^o - 150^o = 30^o$

$\angle AOF + \angle FOG = 180^o$ . . . . [Linear pair axiom]

$\Rightarrow \angle AOG = 180^o$

$\Rightarrow \angle AOB + \angle COB + \angle FOC + \angle FOG = 180^o$

$\Rightarrow 30^o + \angle COB + 90^o + 30^o = 180^o$

$\Rightarrow \angle COB + 150^o = 180^o$

$\Rightarrow \angle COB = 180^o - 150^o = 30^o$

$\angle FOC = 90^o$

$\Rightarrow \angle FOE + \angle DOE + \angle DOC = 90^o$

$\Rightarrow 30^o + \angle DOE + 30^o = 90^o$

$\Rightarrow \angle DOE + 60^o = 90^o$

$\Rightarrow \angle DEO = 30^o$

35. We carry out the process of division by means of the following steps:

Step 1 : We write the dividend $x + 3x^2 - 1$ and the divisor $1 + x$ in the standard form, i.e., after arranging the terms in the descending order of their degrees. Therefore, the dividend is $3x^2 + x - 1$ and divisor is $x + 1$.

Step 2 : We divide the first term of the dividend by the first term of the divisor, i.e., we divide $3x^2$ by x, and get 3x. This gives us the first term of the quotient. $\frac{3x^2}{x} = 3x$ = first term of quotient

Step 3 : We multiply the divisor by the first term of the quotient, and subtract this product from the dividend, i.e., we multiply x + 1 by 3x and subtract the product $3x^2 + 3x$ from the dividend $3x^2 + x - 1$. This gives us the remainder as $-2x - 1$.

$$\begin{array}{r|l} & 3x \\ \hline x+1 & 3x^2 + x - 1 \\ & 3x^2 + 3x \\ & - \quad - \\ \hline & -2x - 1 \end{array}$$

Step 4 : We treat the remainder $-2x - 1$ as the new dividend. The divisor remains the same. We repeat Step 2 to get the next term of the quotient, i.e., we divide the first term $-2x$ of the (new) dividend by the first term x of the divisor and obtain -2. Therefore, -2 is the second term in the quotient. $\frac{-2x}{x} = -2$ = second term of quotient | New Quotient = 3x - 2

Step 5 : We multiply the divisor by the second term of the quotient and subtract the product from the dividend. That is, we multiply x + 1 by -2 and subtract the product $-2x - 2$ from the dividend $-2x - 1$. This gives us 1 as the remainder.

$$\begin{array}{l|l} (x+1)(-2) & -2x - 1 \\ = -2x - 2 & -2x - 2 \\ & + \quad + \\ \hline & +1 \end{array}$$

This process continues till the remainder is 0 or the degree of the new dividend is less than the degree of the divisor. At this stage, this new dividend becomes the remainder and the sum of the quotients gives us the whole quotient.

Step 6 : Since the degree of the new dividend 1 is less than degree of divisor, therefore the quotient is full $3x - 2$ and the remainder is 1. Let us look at what we have done in the process above as a whole:

$$
\begin{array}{r|l}
 & \quad 3x - 2 \\
\hline
x + 1 & 3x^2 + x - 1 \\
 & 3x^2 + 3x \\
 & - \quad\;\; - \\
\hline
 & \quad\;\; -2x - 1 \\
 & \quad\;\; -2x - 2 \\
 & \quad\;\; + \quad\;\; + \\
\hline
 & \qquad\qquad 1
\end{array}
$$

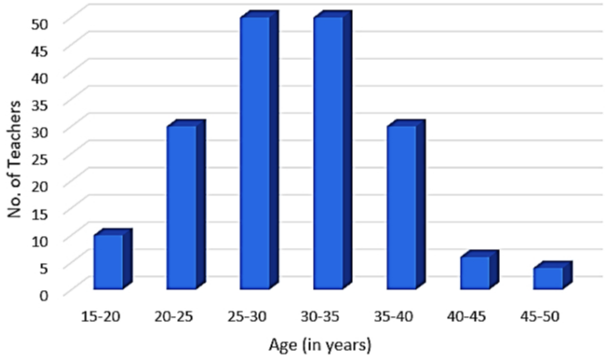
Notice that $3x^2 + x - 1 = (x + 1)(3x - 2) + 1$

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 =

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

Class Mark of class 25 - 30 =

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

Class Mark of class 45 - 50 =

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

(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 m² 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 cm

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

Curved surface of tent = $\pi rl=\frac{22}{7}\times 7\times 12.2$ = 268.4 m^2

Thus the length of the cloth used in the tent = 268.4 m^2

The remaining cloth = 300 - 268.4 = 31.6 m^2

Hence the cloth used for the floor = 31.6 m^2

(ii) Height of the tent h = 10 m

Radius r = 7 cm

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^3

(iii) Radius of the floor = 7 m

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

= 154 m^2

OR

Radius of the floor r = 7 m

Latent height of the tent l = 12.2 m

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

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

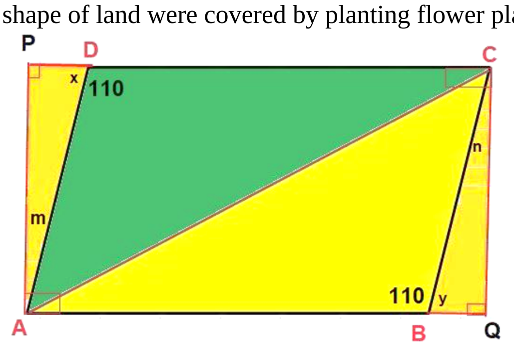
= 22 $\times$ 19.2

= 422.4 m^2

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||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) 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 $\triangle$)

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

$\angle ADP = m = 20^o$