Class 09 - Mathematics
Sample Papper - 01 (2023-24)

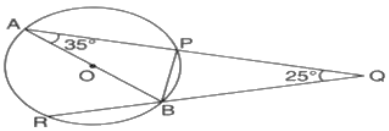
Maximum Marks: 80
Time Allowed: : 3 hours

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.

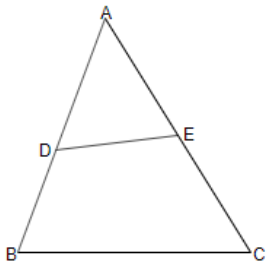
Section A

1. The distance of the point (2,3) from the y-axis
   a) 5 units
   b) 3 units
   c) $\sqrt{13}$ units
   d) 2 units
2. If the area of an equilateral triangle is $36\sqrt{3}\ cm^2$, then the perimeter of the triangle is
   a) 18 cm
   b) $12\sqrt{3}\ cm$
   c) 36 cm
   d) 12 cm
3. In the given figure, AB is a diameter of the circle APBR. APQ and RBQ are straight lines. If $\angle A = 35^o$ and , then the measure of $\angle PBR$ is



   a) 155^o
   b) 135^o
   c) 165^o
   d) 115^o

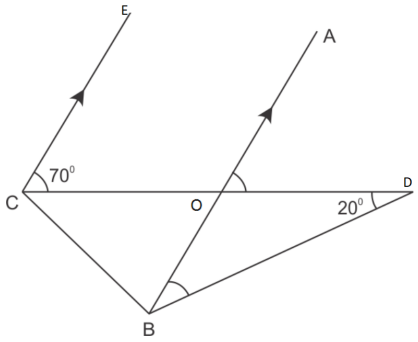
4. In fig D is mid-point of AB and DE ‖ BC then AE is equal to



a) AD
b) DB
c) BC
d) EC

5. The value of $x - y^{x-y}$ when x = 2 and y = -2, is
a) 14
b) -18
c) 18
d) -14

6. In Figure, if EC || AB, ∠ECD = 70° and ∠BDO = 20°, then ∠OBD is

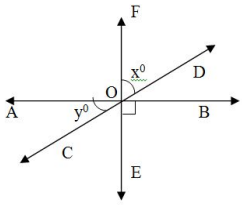


a) 50°
b) 20°
c) 60°
d) 70°

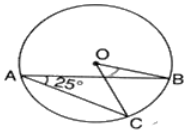
7. Express 'x' in terms of 'y' in the equation 2x – 3y – 5 = 0.
a) $x = \frac{3y-5}{2}$
b) $x = \frac{3y+5}{2}$
c) $x = \frac{5-3y}{2}$
d) $x = \frac{3+5y}{2}$

8. If $x + \frac{1}{x} = 5$, then $x^2 + \frac{1}{x^2} =$
a) 23
b) 27
c) 25
d) 10

9. If $\frac{3-\sqrt{5}}{3+2\sqrt{5}} = a\sqrt{5} - \frac{19}{11}b$, then the value of **b** is
   a) 3
   b) 1
   c) -1
   d) 2
10. In a $\triangle$ABC, P, Q and R are the mid-points of the sides BC, CA and AB respectively. If AC = 21 cm, BC = 29 cm and AB = 30 cm, find the perimeter of the quadrilateral ARPQ?
   a) 20 cm
   b) 80 cm
   c) 51 cm
   d) 52 cm
11. The value of **x** in $3 + 2^x = (64)^{\frac{1}{2}} + (27)^{\frac{1}{3}}$ is
   a) 14
   b) 8
   c) 5
   d) 3
12. The equation x = 7 in two variables can be written as
   a) 1.x + 1.y = 7
   b) 1.x + 0.y = 7
   c) 0.x + 1.y = 7
   d) 0.x + 0.y = 7
13. In the adjoining figure, the three lines AB, CD and EF all pass through the point O. If ∠EOB = 90° and x:y = 2:1 then ∠BOD and ∠COE:-



   a) 60°, 60°
   b) 30°, 60°
   c) 80°, 20°
   d) 45°, 45°
14. Rationalisation of the denominator of $\frac{1}{\sqrt{5}+\sqrt{2}}$ gives
   a) $\sqrt{5} + \sqrt{2}$
   b) $\sqrt{5} - \sqrt{2}$
   c) $\frac{1}{\sqrt{10}}$
   d) $\frac{\sqrt{5}-\sqrt{2}}{3}$
15. In the given figure, if $\angle BAC = 25^o$, then $\angle BOC$ is equal to



   a) 50^o

b) 125^o

c) 25^o

d) 60^o

16. The perpendicular distance of a point Q(4, 7) from y-axis is

a) 4 units

b) 3 units

c) 7 units

d) 11 units

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

a) y = 9x - 7

b) 9x - y + 7 = 0

c) x - 9y = 7

d) x = 9y - 7

18. If x + y + z = 0, then $x^3 + y^3 + z^3$ is

a) 3xyz

b) xyz

c) 2xyz

d) 0

19. **Assertion (A):** A parallelogram consists of two congruent triangles.

Reason (R): Diagonal of a parallelogram divides it into two congruent triangles.

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):** If $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, then $\sqrt{5} = \sqrt{2} + \sqrt{3}$.

Reason (R): Square root of a positive real number always exists.

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

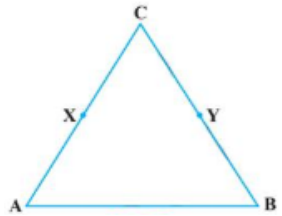
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. In the given figure, we have X and Y are the mid-points of AC and BC and AX = CY. Show that AC = BC.



22. If P, Q, and R are three points on a line and Q is between P and R, then prove that PR - QR = PQ.

23. Name the quadrant in which the point lies :(i) A(1, 1) (ii) (–2, –4) (iii) C(1, –2).

24. Express the number in decimal form: $\frac{1}{9}$

OR

Simplify: $\left(\frac{1}{3^3}\right)^7$

25. The ratio of the volumes of the two cones is 4 : 5 and the ratio of the radii of their bases is 2 : 3. Find the ratio of their vertical heights.

OR

A cylinder and a cone have equal heights and equal radii of their bases. If their curved surface areas are in the ratio 8:5. Show that the ratio of radius to height of each is 3:4.

Section C

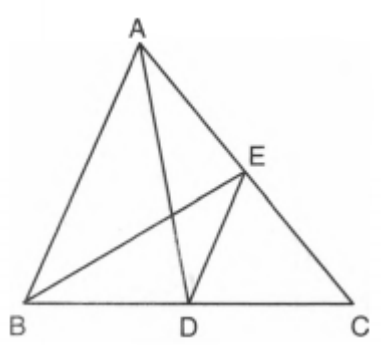
26. If $\sqrt{2}$=1.4142, find the value of $\sqrt{\frac{\sqrt{2}-1}{\sqrt{2}+1}}$.

27. The marks obtained (out of 100) by a class of 80 students are given below:

Marks	10-20	20-30	30-50	50-70	70-100
Number of students	6	17	15	16	26

Construct a histogram to represent the data above.

28. In Fig., AD is the median and DE || AB. Prove that BE is the median.



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

30. The production of oil (in lakh tonnes) in some of the refineries in India during 1982 was given below:

Refinery:	Barauni	Koyali	Mathura	Mumbai	Florida
Production of oil (in lakh tonnes)	30	70	40	45	25

Construct a bar graph to represent the above data so that the bars are drawn horizontally.

OR

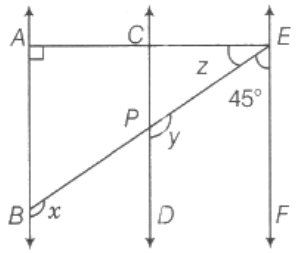
Draw a histogram to represent the following grouped frequency distribution:

Ages (in years)	**Number of teacher**
20 - 24	10
25 - 29	28
30 - 34	32
35 - 39	48
40 - 44	50
45 - 49	35
50 - 54	12

31. Simplify the following expression: $(x + y + z)^2 + (x + \frac{y}{2} + \frac{z}{3})^2 - (\frac{x}{2} + \frac{y}{3} + \frac{z}{4})^2$

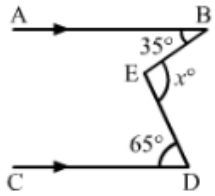
Section D

32. In the given figure, AB || CD and CD || EF. Also, EA $\perp$ AB. If $\angle BEF = 45°$, then find the values of x, y and z.



OR

In each of the figures given below, AB || CD. Find the value of x° in each case.



33. The internal and external diameters of a hollow hemispherical vessel are 24 cm and 25 cm respectively. The cost of painting one sq. cm of the surface is 7 paise. Find the total cost to paint the vessel all over, (ignore the area of edge).
34. The sides of a triangle are in the ratio 5:12:13, and its perimeter is 150 m. Find the area of the triangle.

OR

One side of a right triangle measures 126 m and the difference in lengths of its hypotenuse and other side is 42 cm. Find the measures of its two unknown sides and calculate its area. Verify the result using Heron's Formula.

35. Using factor theorem, factorize the polynomial: $x^4 + 10x^3 + 35x^2 + 50x + 24$

Section E

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

Reeta was studying in the class 9th C of St. Surya Public school, Mehrauli, New Delhi-110030

Once Ranjeet and his daughter Reeta were returning after attending teachers' parent meeting at Reeta's school. As the home of Ranjeet was close to the school so they were coming by walking.

Reeta asked her father, "Daddy how old are you?"

Ranjeet said, "Sum of ages of both of us is 55 years, After 10 years my age will be double of you.

i. What is the second equation formed?

ii. What is the present age of Reeta in years?

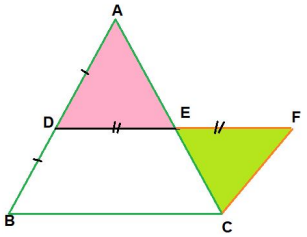
iii. What is the present age of Ranjeet in years?

OR

If the ratio of age of Reeta and her mother is 3 : 7 then what is the age of Reeta's mother in years?

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

Haresh and Deep were trying to prove a theorem. For this they did the following



i. Draw a triangle ABC
ii. D and E are found as the mid points of AB and AC
iii. DE was joined and DE was extended to F so DE = EF
iv. FC was joined.

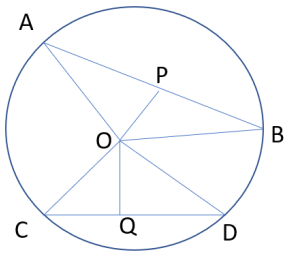
i. △ADE and △EFC are congruent by which criteria?
ii. Show that CF ∥ AB.
iii. Show that CF = BD.

OR

Show that DF = BC and DF ∥ BC.

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

Rohan draws a circle of radius 10 cm with the help of a compass and scale. He also draws two chords, AB and CD in such a way that the perpendicular distance from the center to AB and CD are 6 cm and 8 cm respectively. Now, he has some doubts that are given below.



i. Show that the perpendicular drawn from the Centre of a circle to a chord bisects the chord.
ii. What is the length of CD?
iii. What is the length of AB?

OR

How many circles can be drawn from given three noncollinear points?

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Sample Papper - 01

Solution

Section A

1. (d) 2 units

   Explanation: The distance from y-axis is equal to the x-coordinate, so distance = 2 units

2. (c) 36 cm

   Explanation: $36\sqrt{3} = \frac{\sqrt{3}}{4}a^2$

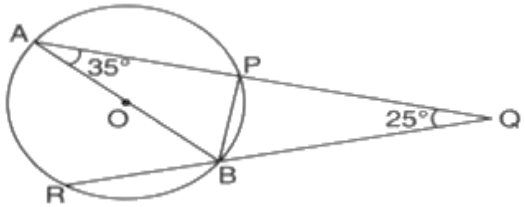
   $a^2 = \frac{36\sqrt{3} \times 4}{\sqrt{3}} = 144$

   a = 12 cm

   Perimeter = 3 × 12 = 36 cm

3. (d) 115^o

   Explanation:

   $\angle APB = \angle BPQ = 90^0$

   Now,

   In $\triangle$APB,

   $\angle BAP + \angle APB + \angle ABP = 180^o$

   $35^o + 90^o + \angle ABP = 180^o$

   $\angle ABP = 55^o$

   Again,

   In $\triangle$BPQ

   $\Rightarrow \angle BPQ + \angle PQB + \angle PBQ = 180^o$

   $\Rightarrow 90^o + 25^o + \angle PBQ = 180^o$

   $\Rightarrow \angle PBQ = 65^o$

   Since, RBQ is a straight line,

   $\angle RBA + \angle ABP + \angle PBQ = 180^o$

   $\angle RBA + 55^o + 65^o = 180^o$

   $\angle RBA = 60^o$

   Finally,

   $\angle PBR = \angle ABP + \angle RBA$

   $= 55^o + 60^o = 115^o$

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4. (d) EC

   Explanation: By midpoint theorem of a triangle E is the midpoint of AC, hence AE = EC

5. (d) -14

Explanation: x = 2, y = -2

$x - y^{x-y} = 2 - (-2)^{2-(-2)}$

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

$= 2 - (-2)^4$

= 2- (+16)

= 2 - 16

= -14

6. (a) 50°

Explanation: EC || AB and CD is transverse to it.

Now ∠ECD = ∠AOD = 70° (Corresponding angles)

In ∠OBD

∠OBD + ∠BOD + ∠ODB = 180°

∠BOD = 180° - ∠AOD = 180° - 70° = 110°

∠ODB = 20° (Given)

So ∠OBD = 180° - ∠BOD - ∠ODB

= 180° - 110° - 20°

= 50°

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

Explanation:

$2x - 3y - 5 = 0$

$2x = 3y + 5$

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

8. (a) 23

Explanation: Using ,$(a + b)^2 = a^2 + b^2 + 2ab$

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

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

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

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

9. (b) 1

Explanation: $\frac{3-\sqrt{5}}{3+2\sqrt{5}} = a\sqrt{5} - \frac{19}{11}b$

taking LHS,

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

$$\Rightarrow \frac{3(3-2\sqrt{5}) - \sqrt{5}(3-2\sqrt{5})}{9-20}$$

$$\Rightarrow \frac{9-6\sqrt{5}-3\sqrt{5}+10}{-11}$$

$\Rightarrow \frac{19-9\sqrt{5}}{-11}$

$\Rightarrow \frac{-19}{11} + \frac{9\sqrt{5}}{11}$

equating this with RHS,

we get,

$\frac{-19}{11}b = -\frac{19}{11}$

$\Rightarrow$ b = 1

10. (c) 51 cm

Explanation: $\Rightarrow$ ln $\triangle ABC$, R and P are the mid-points of AB and BC

$\therefore RP \| AC,\ RP = \frac{1}{2}AC$ [By mid-point theorem]

In a quadrilateral RPQA,

$\Rightarrow RP \| AQ$, RP = AQ

$\therefore$ RPQA is a parallelogram

$\Rightarrow AR = \frac{1}{2}AB$

$\therefore AR = \frac{1}{2} \times 30 = 15$cm

$\Rightarrow$ AR = PQ = 15cm [Since, opposite sides are equal]

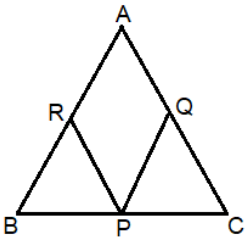
$\Rightarrow RP = \frac{1}{2}AC = \frac{1}{2} \times 21 = 10.5$cm [Since, opposite sides are equal]

$\Rightarrow$ Perimeter of ARPQ = AR + QP + RP + AQ

= 15 + 15 + 10.5 + 10.5

= 51cm

$\therefore$ Perimeter of ARPQ is 51 cm



11. (d) 3

Explanation: $3 + 2^x = (64)^{\frac{1}{2}} + (27)^{\frac{1}{3}}$

$\Rightarrow 3 + 2^x = \sqrt{64} + \sqrt[3]{27}$

$\Rightarrow 3 + 2^x = 8 + 3$

$\Rightarrow 2^x = 8 = 2^3$

equating both,

x = 3

12. (b) 1.x + 0.y = 7

Explanation: The equation x = 7 in two variables can be written as exactly 1.x + 0.y = 7

because it contain two variable x and y and coefficient of y is zero as there is no term containing y in equation x = 7

13. (b) 30°, 60°

Explanation: x + y + 90° = 180° (Linear Pair)

2a + a + 90° = 180° (Since, x:y = 2:1)

a = 30°

x = 2a = ∠COE = 60° (Vertically opposite angles)

y = ∠BOD = 30° (Vertically opposite angles)

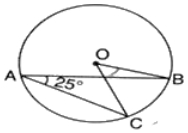
14. (d) $\frac{\sqrt{5}-\sqrt{2}}{3}$

Explanation: $\frac{1}{\sqrt{5}+\sqrt{2}}$

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

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

15. (a) 50^o

Explanation: 

Angle made at centre by an arc is double the angle made by it on any point on the circumference.

16. (a) 4 units

Explanation: Distance of point from y-axis is x -coordinate of given point,

So, since, value of x-coordinate is 4

so, distance = 4 units

17. (a) 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.

18. (a) 3xyz

Explanation: $x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$

$= x^3 + y^3 + z^3 - 3xyz = (0)(x^2 + y^2 + z^2 - xy - yz - zx)$

$= x^3 + y^3 + z^3 - 3xyz = 0$

$= x^3 + y^3 + z^3 - 3xyz$

If x + y + z = 0, then $x^3 + y^3 + z^3$ is

3xyz

19. (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.

20. (d) A is false but R is true.

    Explanation: $\sqrt{2} + \sqrt{3} \neq 5$

    $\sqrt{3} + \sqrt{2} = 1.732 + 1.414 = 3.146 \neq \sqrt{5}$ as $\sqrt{5} = 2.236$

Section B

21. We have AX = CY [Given]

    Now, by Euclid's axiom 6, we have things which are double of the same thing are equal to one another,

    so 2AX = 2CY

    Hence, AC = BC. [$\because$ X and Y are the mid- points of AC and BC]

22. From the given condition, we get the following figure

    In the above figure, PQ coincides with PR - QR.

    So, according to Euclid's axiom, "things" which coincide with one another are equal to 'one another'. We have,

    PQ + QR = PR i.e. PR - QR = PQ.

23. (i) (+, +) are the signs of the co-ordinates of points in the I quadrant.

    $\therefore$ A(1, 1) lies in the I quadrant.

    (ii) (–, –) are the signs of the co-ordinates of points in the III quadrant.

    $\therefore$ B(–2, –4) lies in the III quadrant.

    (iii) (+, –) are the signs of the co-ordinates of points in the IV quadrant.

    $\therefore$ C(1, –2) lies in the IV quadrant.

24. $\frac{1}{9} = 0.111 \ldots = 0.\overline{1}$

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9 )1.000 ( 0.111.....
   9
  ---
   10
    9
  ---
    10
     9
  ---
     1
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OR

$$\left(\frac{1}{3^3}\right)^7 = \frac{1^7}{\left(3^3\right)^7} = \frac{1}{3^{21}} = 3^{-21}$$

25. Let the radii of bases, vertical heights and volumes of the two cones be r_1, h_1, v_1 and r_2, h_2, v_2 respectively.

    According to the question,

    $\frac{v_1}{v_2} = \frac{4}{5}$ ....(1)

    $\frac{r_1}{r_2} = \frac{2}{3}$ ...(2)

    From (1), we have

    $\frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = \frac{4}{5}$

$\Rightarrow \frac{r_1^2 h_1}{r_2^2 h_2} = \frac{4}{5} \Rightarrow (\frac{r_1}{r_2})^2 \frac{h_1}{h_2} = \frac{4}{5}$

$\Rightarrow (\frac{2}{3})^2 \frac{h_1}{h_2} = \frac{4}{5}$

$\Rightarrow \frac{h_1}{h_2} = \frac{4}{5}(\frac{3}{2})^2$ . . . [Using (2)]

$\Rightarrow \frac{h_1}{h_2} = \frac{9}{5}$

$\therefore$ The ratio of their vertical height is 9 : 5

OR

A cylinder and a cone have equal heights and equal radii of their bases.

So, According to the question,

$= \frac{Curved\ surface\ area\ of\ cylinder}{Curved\ surface\ area\ of\ cone} = \frac{2\pi rh}{\pi rl} = \frac{2\pi rh}{\pi r\sqrt{r^2+h^2}}$

$\frac{8}{5} = \frac{2h}{\sqrt{r^2+h^2}}$

$\Rightarrow \frac{64}{25} = \frac{4h^2}{r^2+h^2}$

$\Rightarrow 64r^2 + 64h^2 = 100h^2$

$\Rightarrow 64r^2 = 100h^2 - 64h^2$

$\Rightarrow 64r^2 = 36h^2$

$\Rightarrow \frac{r^2}{h^2} = \frac{36}{64} = \frac{9}{16}$

$\Rightarrow \frac{r}{h} = \frac{3}{4}$

$\therefore$ r:h = 3:4

Section C

26. Given,

$\sqrt{2} = 1.4142$

Now, $\sqrt{\frac{\sqrt{2}-1}{\sqrt{2}+1}} = \sqrt{\frac{(\sqrt{2}-1)}{(\sqrt{2}+1)} \times \frac{(\sqrt{2}-1)}{(\sqrt{2}-1)}}$ [by rationalising]

$= \sqrt{\frac{(\sqrt{2}-1)^2}{2-1}} = \frac{\sqrt{(\sqrt{2}-1)^2}}{1}$ [$\because$ (a + b)(a - b) = $a^2 - b^2$]

$= \sqrt{2} - 1 = 1.4142 - 1$ [$\because \sqrt{2} = 1.4142$]

= 0.4142

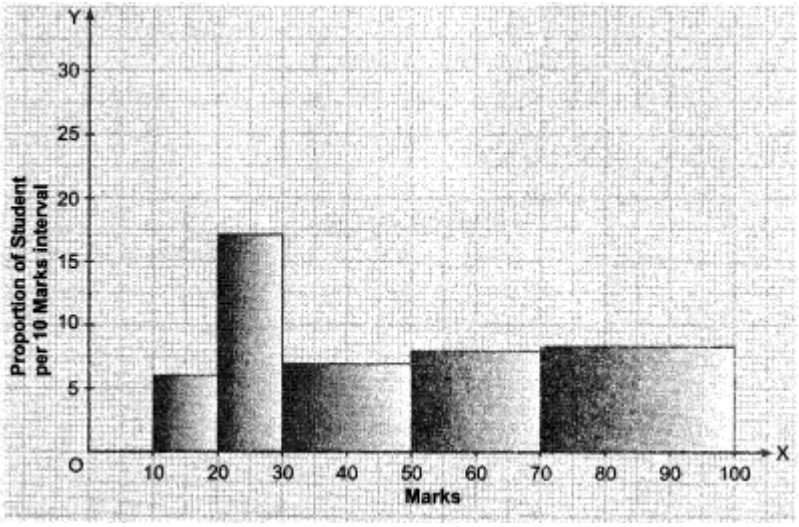
27. In the given frequency distribution, the class intervals are not of equal width. $\therefore$ we would make modification in the lengths of the

rectangle in the histogram so that the areas of the rectangle are proportional to the frequencies.

Marks	Frequency	Width of the class	Length of the rectangle
10 − 20	6	10	$\frac{10}{10} \times 6 = 6$
20 − 30	17	10	$\frac{10}{10} \times 17 = 17$
30 − 50	15	20	

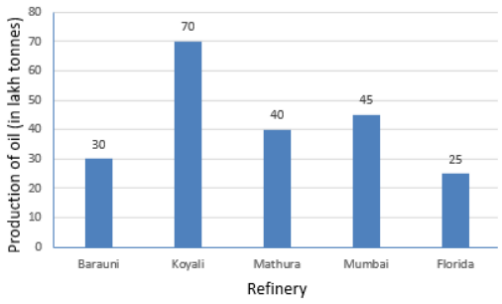
			$\frac{10}{20} \times 15 = 7.5$
50 − 70	16	20	$\frac{10}{20} \times 16 = 8$
70 − 100	26	30	$\frac{10}{30} \times 26 = 8.67$

The histogram of data is given below:



28. In order to prove that BE is the median, it is sufficient to show that E is the mid-point of AC.
Now, AD is the median in $\triangle ABC \Rightarrow$ D is the mid-point of BC.
Since DE is a line drawn through the mid-point of side BC of $\triangle ABC$ and is parallel to AB (given). Therefore, E is the mid-point of AC.
Hence, BE is the median of $\triangle ABC$.
29. We have the equation as 3x + 2y = 18
In standard form
3x + 2y - 18 = 0
Or 3x + 2y + (-18) =0
But standard linear equation is
ax + by + c = 0
On comparison we get, a = 3, b = 2, c = -18
If (4, 3) lie on the line, i.e., solution of the equation LHS = RHS
$\therefore$ 3(4) + 2(3) = 18
12 + 6 = 18
18 = 18
As LHS = RHS, Hence (4, 3) is the solution of given equation.
Again for (1,2)
3x + 2y = 18
$\therefore$ 3(1)+2(2)=18
3 + 4 = 18
7 = 18
LHS $\neq$ RHS
Hence (1, 2) is not the solution of given equation.
Therefore (4,3) is the point where the equation of the line 3x + 2y = 18 passes through where as the line for the equation 3x + 2y =18 does not pass through the point (1,2).

30. The production of oil (in lakh tonnes) in some of the refineries in India during 1982

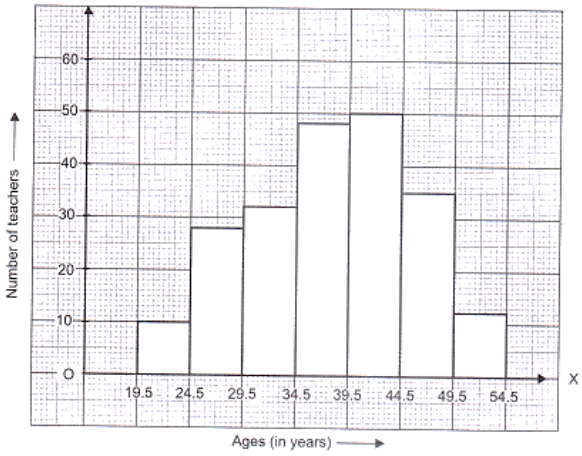


OR

The given table is in inclusive form. So, we first convert it into an exclusive form, as given below.

Ages (in years)	Number of teachers
19.5 – 24.5	10
24.5 – 29.5	28
29.5 – 34.5	32
34.5 – 39.5	48
39.5 – 44.5	50
44.5 – 49.5	35
49.5 – 54.5	12

A histogram for this table is shown in the figure given below:



31. We have,

$(x + y + z)^2 + (x + \frac{y}{2} + \frac{z}{3})^2 - (\frac{x}{2} + \frac{y}{3} + \frac{z}{4})^2$

$= [x^2 + y^2 + z^2 + 2(xy + yz + zx)] + [x^2 + \frac{y^2}{4} + \frac{z^2}{9} + 2(\frac{xy}{2} + \frac{yz}{6} + \frac{zx}{3})] - [\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} + 2(\frac{xy}{6} + \frac{yz}{12} + \frac{zx}{8})]$

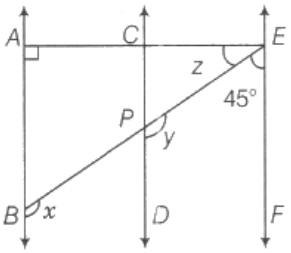
$= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx + x^2 + \frac{y^2}{4} + \frac{z^2}{9} + \frac{2xy}{2} + \frac{2yz}{6} + \frac{2zx}{3} - \frac{x^2}{4} - \frac{y^2}{9} - \frac{z^2}{16} - \frac{2xy}{6} - \frac{2yz}{12} - \frac{2zx}{8}$

$= 2x^2 - \frac{x^2}{4} + y^2 + \frac{y^2}{4} - \frac{y^2}{9} + z^2 + \frac{z^2}{9} - \frac{z^2}{16} + 2xy + xy - \frac{xy}{3} + 2yz + \frac{yz}{3} - \frac{yz}{6} + 2zx + \frac{2zx}{3} - \frac{zx}{4}$

$= \frac{8x^2 - x^2}{4} + \frac{36y^2 + 9y^2 - 4y^2}{36} + \frac{144z^2 + 16z^2 - 9z^2}{144} + \frac{6xy + 3xy - xy}{3} + \frac{12yz + 2yz - yz}{6} + \frac{24zx + 8zx - 3zx}{12}$

$= \frac{7x^2}{4} + \frac{41y^2}{36} + \frac{151z^2}{144} + \frac{8xy}{3} + \frac{13yz}{6} + \frac{29zx}{12}$

Section D

32. 

Given, CD ∥ EF and EP is a transversal.

∴ ∠EPD + ∠FEP = 180^o [since, sum of interior angles on the same side of the transversal EP is 180^o]

⇒ $y + 45^o = 180^o$ [∵ ∠FEP = 45^o, given]

⇒ $y = 180^o - 45^o$ ⇒ $y = 135^o$

Also, given AB ∥ CD and BP is a transversal.

So, x = y [corresponding angles axiom]

∴ $x = 135^o$

Now, AB ∥ CD and CD ∥ EF

∴ AB ∥ EF

Then, ∠EAB + ∠FEA = 180^o

[since, sum of interior angles on the same side of the transversal EA is 180^o]

⇒ $90^o + z + 45^o = 180^o$ [∵ EA ⊥ AB ⇒ ∠EAB = 90^o]

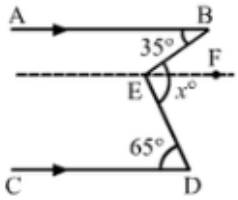
⇒ $z + 135^o = 180^o$

⇒ $z = 180^o - 135^o$

⇒ $z = 45^o$

Hence, $x = 135^o$, $y = 135^o$ and $z = 45^o$

OR



Draw EF ∥ AB ∥ CD

Now, AB ∥ EF and BE is the transversal.

Then,

$\angle ABE = \angle BEF$ [Alternate Interior Angles]

⇒ $\angle BEF = 35^\circ$

Again, EF ∥ CD and DE is the transversal

Then,

$\angle DEF = \angle FED$

⇒ $\angle FED = 65^\circ$

∴ $x^\circ = \angle BEF + \angle FED$

$x^\circ = 35^\circ + 65^\circ$

$x^\circ = 100^\circ$

33. Let R cm and r cm be respectively the external and internal radii of the hemispherical vessel. Then, R = 12.5 cm, r = 12 cm.

Now,

External surface area of the vessel = $2\pi R^2 = 2 \times \frac{22}{7} \times (12.5)^2$ cm^2

Internal surface area of the vessel = $2\pi r^2 = 2 \times \frac{22}{7} \times (12)^2$ cm^2

$\therefore$ Total area to be painted = $2 \times \frac{22}{7} \times (12.5)^2 + 2 \times \frac{22}{7} \times 12^2$ cm^2

$\Rightarrow$ Total area to be painted = $2 \times \frac{22}{7} \times \{(\frac{25}{2})^2 + 12^2\}$ cm^2

$\Rightarrow$ Total area to be painted = $2 \times \frac{22}{7} \times (\frac{625}{4} + 144)$ cm^2 = $\frac{13211}{7}$ cm^2

Cost of painting at the rate of 7 paise per sq. cm = Rs. $\frac{13211}{7} \times \frac{7}{100}$ = Rs. 132.11

34. According to question given sides are in the ratio of 5 : 12 : 13

On dividing 150 m in the ratio 5 : 12 : 13, we get

Length of one side = $\left(150 \times \frac{5}{30}\right)m = 25m$

Length of the second side = $\left(150 \times \frac{12}{30}\right)$m = 60m

Length of third side = $\left(150 \times \frac{13}{30}\right)m = 65m$

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

Then, $s = \frac{1}{2}(25 + 60 + 65)m = 75m$

Now (s - a) = 75 cm - 25 cm = 50 cm

(s - b) = 75 cm - 60 cm = 15 cm

(s - c) = 75 cm - 65 cm = 10 cm

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

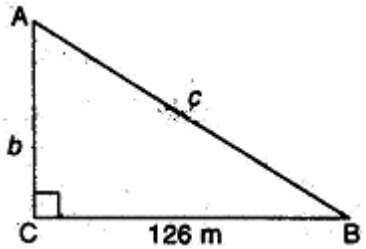
= $\sqrt{75 \times 50 \times 15 \times 10}$m^2

= 750 m^2

Hence, area of the triangle = 750 m^2

OR

Let ABC be the right triangle right angles at C.



a = 126 m . . . (1)

In right triangle ACB.

$AB^2 = AC^2 + BC^2$ . . .[By Pythagoras theorem]

$\Rightarrow$ $c^2 = a^2 + b^2$

$\Rightarrow$ $c = \sqrt{a^2 + b^2}$ . . .(2)

$\Rightarrow$ c – b = 42 . . .(3)

$\Rightarrow$ $\sqrt{a^2 + b^2}$- b = 42 . . .[From (2)]

$\Rightarrow \sqrt{126^2 + b^2}$ - b = 42 . . .[From (1)]

$\Rightarrow \sqrt{126^2 + b^2} = (42+b)$

$\Rightarrow (126)^2 + b^2 = (42 + b)^2$

$\Rightarrow 15876 + b^2 = 1764 + b^2 + 84b$

$\Rightarrow 84b = 15876 – 1764$

$\Rightarrow 84\ b = 14112$

$\Rightarrow b = \frac{14112}{84}$

$\Rightarrow b = 168$ m . . . (4)

From (3) and (4)

c – 168 = 42

$\therefore$ c = 168 + 42 = 210 m . . . (5)

$\therefore$ Area of the right triangle = $\frac{1}{2} \times$ base $\times$ height

$=\frac{1}{2} \times 126 \times 168$

$= 10584\ m^2$

Using Heron's Formula

a = 126 m, b = 168 m, c = 210 m

$\therefore \quad s = \frac{a+b+c}{2}$

$= \frac{126+168+210}{2} = \frac{504}{2} = 252$ m

$\therefore$ Area of the right triangle

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

$= \sqrt{252(252-126)(252-168)(252-210)}$

$= \sqrt{252(126)(84)(42)}$

$= \sqrt{(63 \times 4)(63 \times 2)(42 \times 2)(42)}$

$= 63 \times 2 \times 2 \times 42 = 10584\ m^2$

35. Given, $f(x) = x^4 + 10x^3 + 35x^2 + 50x + 24$

The constant term in f(x) is equal to 24

The factors of 24 are $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$

Let, x + 1 = 0

$\Rightarrow$ x = -1

Substitute the value of x in f(x)

$f(-1) = (-1)^4 + 10(-1)^3 + 35(-1)^2 + 50(-1) + 24$

= 1-10 + 35 - 50 + 24

= 0

$\Rightarrow$ (x + 1) is the factor of f(x)

Similarly, (x + 2), (x + 3), (x + 4) are also the factors of f(x)

Since, f(x) is a polynomial of degree 4, it cannot have more than four linear factors.

$\Rightarrow$ f(x) = k(x + 1)(x + 2)(x + 3)(x + 4)

$\Rightarrow x^4 + 10x^3 + 35x^2 + 50x + 24 = k(x + 1)(x + 2)(x + 3)(x + 4)$

Substitute x = 0 on both sides

$\Rightarrow 0 + 0 + 0 + 0 + 24 = k(1)(2)(3)(4)$

$\Rightarrow 24 = k(24)$

$\Rightarrow$ k = 1

Substitute k = 1 in f(x) = k(x + 1)(x + 2)(x + 3)(x + 4)

f(x) = (1)(x + 1)(x + 2)(x + 3)(x + 4)

f(x) = (x + 1)(x + 2)(x + 3)(x + 4)

hence, $x^4 + 10x^3 + 35x^2 + 50x + 24 = (x + 1)(x + 2)(x + 3)(x + 4)$

This is the required factorisation of f(x).

Section E

36. i. x - 2y = 10

ii. x + y = 55 ...(i) and x - 2y = 10 ...(ii)

Subtracting (ii) from (i)

x + y - x + 2y = 55 - 10

$\Rightarrow$ 3y = 45

$\Rightarrow$ y = 15

So present age of Reeta is 15 years.

iii. x + y = 55 ...(i) and x - 2y = 10 ...(ii)

Subtracting (ii) from (i)

x + y - x + 2y = 55 - 10

$\Rightarrow$ 3y = 45

$\Rightarrow$ y = 15

Put y = 15 in equation (i)

x + y = 55

$\Rightarrow$ x + 15 = 55

$\Rightarrow$ x = 55 − 15 = 40

So Ranjeet's present age is 40 years.

OR

Let Reeta;s mother age be 'z'.

Given Reeta age : Her mother age = 7 : 5

We know that Reeta age = 15 years

$\frac{Mother\ age}{Reeta\ age} = \frac{7}{5}$

$\Rightarrow z = \frac{7}{3} \times y$

$\Rightarrow z = \frac{7}{3} \times 15$

$\Rightarrow$ Here Mother age = 35 years

Hence Reeta's mother's age is 35 years.

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37. i. $\triangle$ADE and $\triangle$CFE

DE = EF (By construction)

$\angle$AED = $\angle$CEF (Vertically opposite angles)

AE = EC(By construction)

By SAS criteria $\triangle$ADE $\cong$ $\triangle$CFE

ii. $\triangle$ADE $\cong$ $\triangle$CFE

Corresponding part of congruent triangle are equal

$\angle EFC = \angle EDA$

alternate interior angles are equal

$\Rightarrow$ AD ∥ FC

$\Rightarrow$ CF ∥ AB

iii. $\triangle ADE \cong \triangle CFE$

Corresponding part of congruent triangle are equal.

CF = AD

We know that D is mid point AB

$\Rightarrow$ AD = BD

$\Rightarrow$ CF = BD

OR

DE = $\frac{BC}{2}$ {line drawn from mid points of 2 sides of $\triangle$ is parallel and half of third side}

DE ∥ BC and DF ∥ BC

DF = DE + EF

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

$\Rightarrow$ DF = BC

38. i. In ΔAOP and ΔBOP

$\angle APO = \angle BPO$ (Given)

OP = OP (Common)

AO = OB (radius of circle)

$\Delta AOP \cong \Delta BOP$

AP = BP (CPCT)

ii. In right ΔCOQ

$CO^2 = OQ^2 + CQ^2$

$\Rightarrow 10^2 = 8^2 + CQ^2$

$\Rightarrow CQ^2 = 100 - 64 = 36$

$\Rightarrow$ CQ = 6

CD = 2CQ

$\Rightarrow$ CD = 12 cm

iii. In right ΔAOB

$AO^2 = OP^2 + AP^2$

$\Rightarrow 10^2 = 6^2 + AP^2$

$\Rightarrow AP^2 = 100 - 36 = 64$

$\Rightarrow$ AP = 8

AB = 2AP

$\Rightarrow$ AB = 16 cm

OR

There is one and only one circle passing through three given non-collinear points.