CBSE SAMPLE PAPER - 03

Class 09 - Mathematics

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

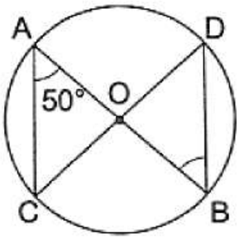
1. The point (0, 9) lies **[1]**

a) on the positive direction of y-axis
b) in quadrant III
c) on the positive direction of x-axis
d) in quadrant IV

2. If the length of a median of an equilateral triangle is x cm, then its area, is **[1]**

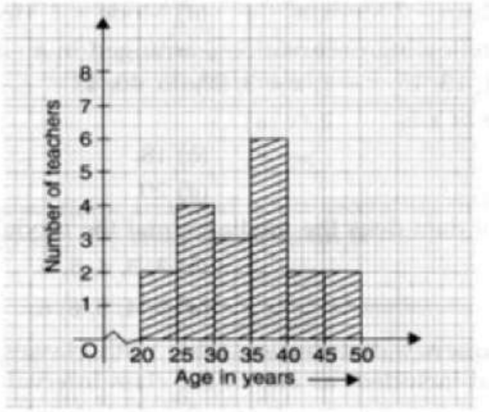
a) $\frac{x^2}{\sqrt{3}}$
b) x^2
c) $\frac{\sqrt{3}}{2}x^2$
d) $\frac{x^2}{2}$

3. In the given figure, O is the centre of a circle. If ∠OAC = 50°, then ∠ODB = ? **[1]**



a) 50^o
b) 60^o
c) 75^o
d) 40^o

4. The graph given below shows the frequency distribution of the age of 22 teachers in a school. The number of teachers whose age is less than 40 years is **[1]**



a) 17

b) 16

c) 15

d) 14

5. The value of $\frac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\frac{x^b}{x^a}\right)^c$ is **[1]**

a) 1

b) 3

c) 4

d) 2

6. An exterior angle of a triangle is equal to 100° and two interior opposite angles are equal. Each of these angles is equal to **[1]**

a) 40°

b) 80°

c) 75°

d) 50°

7. For what value of 'k', x = 2 and y = -1 is a solution of x + 3y – k = 0? **[1]**

a) 2

b) -2

c) -1

d) 1

8. $x + 1$ is a factor of the polynomial **[1]**

a) $x^3 + 2x^2 - x - 2$

b) $x^3 + 2x^2 - x + 2$

c) $x^3 - 2x^2 + x + 2$

d) $x^3 + 2x^2 + x - 2$

9. The value of $\sqrt[4]{\sqrt[3]{2^2}}$ is **[1]**

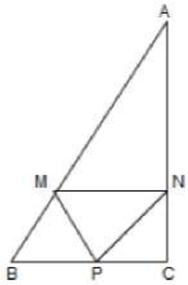
a) 2^6

b) $2^{\frac{-1}{6}}$

c) $2^{\frac{1}{6}}$

d) 2^{-6}

10. M,N and P are the mid-points of AB, AC and BC res. If MN = 3 cm, NP = 3.5 cm and MP = 2.5 cm, calculate BC, AB and AC **[1]**



a) 2cm, 3cm, 11cm

b) 5cm, 6cm, 7cm

c) 5cm, 6cm, 8cm

d) 9cm, 8cm, 11cm

11. If $x^{\frac{1}{12}} = 49^{\frac{1}{24}}$, then the value of x is **[1]**

a) 7
b) 12
c) 49
d) 2

12. Any solution of the linear equation 2x + 0y + 9 = 0 in two variables is of the form **[1]**

a) $\left(-\frac{9}{2}, m\right)$
b) (-9 , 0)
c) $\left(0, -\frac{9}{2}\right)$
d) $\left(n, -\frac{9}{2}\right)$

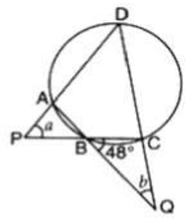
13. The angles of a triangle are in the ratio 5 : 3 : 7, the triangle is **[1]**

a) An isosceles triangle.
b) An obtuse angled triangle
c) A right triangle
d) An acute angled triangle

14. If $\sqrt{13 - a\sqrt{10}} = \sqrt{8} + \sqrt{5}$, then a = **[1]**

a) -5
b) -2
c) -4
d) -6

15. In the given figure, ABCD is a cyclic quadrilateral, $\angle CBQ = 48^o$ and a = 2b. Then, b is equal to **[1]**



a) 48^o
b) 18^o
c) 38^o
d) 28^o

16. The perpendicular distance of the point P (3, 4) from the y-axis is **[1]**

a) 7
b) 4
c) 3
d) 5

17. The taxi fare in a city is as follows: For the first kilometer, the fare is ₹8 and for the subsequent distance it is ₹5 per kilometer. Taking the distance covered as x km and total fare as ₹y, write a linear equation for this information. **[1]**

a) y = 5x + 3
b) y = 5x – 3
c) x = 5y – 3
d) x = 5y + 3

18. The possible expressions for the length and breadth of the rectangle whose area is given by $4a^2 + 4a - 3$ is **[1]**

a) (2a - 1) and (2a - 3)
b) None of these
c) (2a + 1) and (2a + 3)
d) (2a - 1) and (2a + 3)

19. **Assertion (A):** The angles of a quadrilateral are x^o, $(x - 10)^o$, $(x + 30)^o$ and $(2x)^o$, the smallest angle is equal to 58^o. **[1]**

Reason (R): Sum of the angles of a quadrilateral is 360^o.

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

explanation of A. correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

20. **Assertion (A):** $\sqrt{3}$ is an irrational number. **[1]**

Reason (R): The sum of a rational number and an irrational number is an irrational number.

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

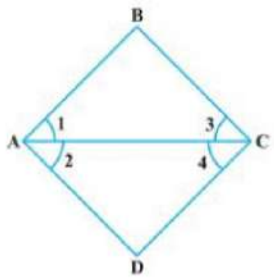
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

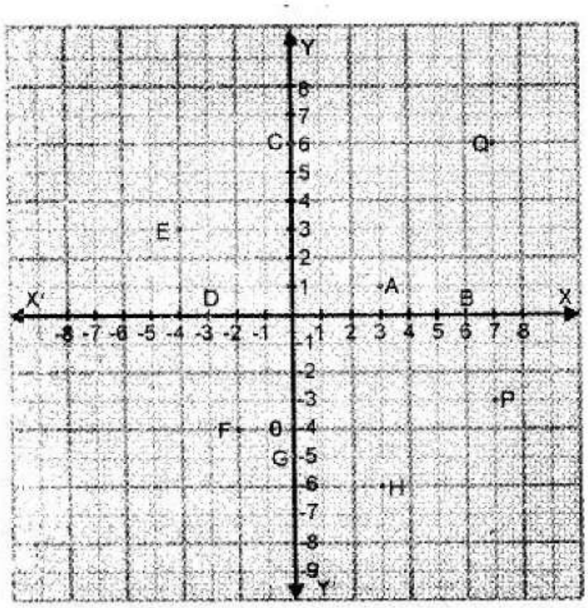
Section B

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



22. Does Euclid's fifth postulate imply the existence of parallel lines ? Explain. **[2]**

23. Write the co-ordinates of each of the following points marked in the graph paper. **[2]**



24. Simplify: $\frac{2\sqrt{6}}{\sqrt{2}+\sqrt{3}} + \frac{6\sqrt{2}}{\sqrt{6}+\sqrt{3}} - \frac{8\sqrt{3}}{\sqrt{6}+\sqrt{2}}$. **[2]**

OR

Express $1.\overline{4}$ as a fraction in simplest form.

25. Find the volume and the total surface area of a hemisphere of radius 3.5 cm. (Use π = 22/7). **[2]**

OR

If the radius and slant height of a cone are in the ratio 7 : 13 and its curved surface area is 286 cm^2, find its radius.

Section C

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

27. Draw a histogram to represent the following grouped frequency distribution: **[3]**

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

28. Show that the quadrilateral formed by joining the mid-points the sides of a rhombus, taken in order, form a rectangle. **[3]**

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]**

$5x + 3y = 15$ and $5x + 2y = 10$

30. The following data on the number of girls (to the nearest ten) per thousand boys in different sections of the society is given below : **[3]**

Section	Number of girls per thousand boys
Scheduled caste	940
scheduled tribe	970
Non SC/ST	920
Backward districts	950
Non-backward districts	920
Rural	930
Urban	910

i. Represent the information above by a bar graph.

ii. In the classroom discuss what conclusion can be arrived at from the graph.

OR

Below are the scores of two groups of Class IV students on a test of reading ability :

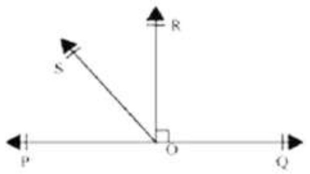
Class interval	Group A	Group B
50-52	4	2
47-49	10	3
44-46	15	4
41-43	18	8
38-40	20	12
35-37	12	17
32-34	13	22
Total	92	68

Construct a frequency polygon for each of these groups on the same axes.

31. Find the remainder when $x^3 + 3x^2 + 3x + 1$ is divided by $5 + 2x$ **[3]**

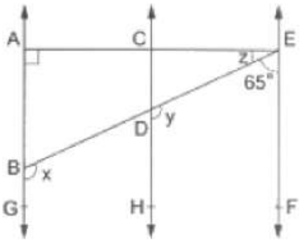
Section D

32. In the given figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$. **[5]**



OR

In the given figure, AB || CD || EF, $\angle DBG = x, \angle EDH = y, \angle AEB = z, \angle EAB = 90^\circ$ and $\angle BEF = 65^\circ$. Find the values of x, y and z.



33. A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40 cm and height 1 m. If the outer side of each of the cones is to be painted and the cost of painting is ₹ 12 per m^2, what will be the cost of painting all these cones? (Use π = 3.14 and take $\sqrt{1.04}$ = 1.02) **[5]**

34. The perimeter of a triangle is 50 cm. One side of a triangle is 4 cm longer than the smaller side and the third side is 6 cm less than twice the smaller side. Find the area of the triangle. **[5]**

OR

Two sides of a triangular field are 85 m and 154 m in length and its perimeter is 324 m. Find the area of the field.

35. If both x + 1 and x - 1 and factors of $ax^3 + x^2 - 2x + b$, find the values of a and b. **[5]**

Section E

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

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?

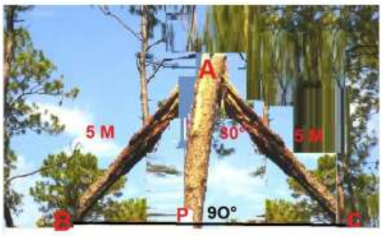
(iii) What is the present age of Ranjeet in years?

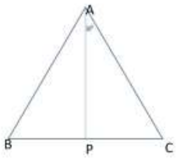
OR

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:** **[4]**

In a forest, a big tree got broken due to heavy rain and wind. Due to this rain the big branches AB and AC with lengths 5m fell down on the ground. Branch AC makes an angle of 30° with the main tree AP. The distance of Point B from P is 4 m. You can observe that ΔABP is congruent to ΔACP.





(i) Show that $\triangle ACP$ and $\triangle ABP$ are congruent.

(ii) Find the value of $\angle ACP$?

OR

What is the total height of the tree?

(iii) Find the value of $\angle BAP$?

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

There is a race competition between all students of a sports academy, so that the sports committee can choose better students for a marathon. The race track in the academy is in the form of a ring whose inner most circumference is 264 m and the outer most circumference is 308 m.

(i) Find the radius of the outer most circle.

(ii) Find the radius of the inner most circle.

OR

Find the area of the racetrack.

(iii) Find the width of the track.

Solution

CBSE SAMPLE PAPER - 03

Class 09 - Mathematics

Section A

1. **(a)** on the positive direction of y-axis

Explanation: Any point P in co-ordinate plane is written as P(x,y)

when the value of x-coordinate is equal to zero then the point P lies on y axis

Since,here x=0 so,point lies on y-axis

And the value of y is positive so,

Points lies in the positive direction of y-axis

2. **(a)** $\frac{x^2}{\sqrt{3}}$

Explanation: Let the side of equilateral ΔABC be a cm

The median of equilateral triangle is its altitude drawn from A to BC. (i.e. the height of Δ over Base BC)

$\Rightarrow$ AD = a sin 60^o

$\Rightarrow x = \frac{a\sqrt{3}}{2}$ [AD = x (given)

$\Rightarrow a = \frac{2x}{\sqrt{3}}$

Area of equilateral Δ of side a = $\frac{\sqrt{3}a^2}{4}$

$= \frac{\sqrt{3}}{4}\left(\frac{2x}{\sqrt{3}}\right)^2$

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

3. **(a)** 50^o

Explanation: $\angle$ODB = $\angle$OAC = 50^o (Angles in the same segment of a circle)

$\Rightarrow \angle$ODB = 50^o

4. **(c)** 15

Explanation: Add the values corresponding to the height of the bar before 40.

6 + 3 + 4 + 2 = 15

5. **(a)** 1

Explanation: $\frac{x^{a(b-c)}}{x^{b(a-c)}} \div \left(\frac{x^b}{x^a}\right)^c$

$\Rightarrow \frac{x^{ab-ac}}{x^{ba-be}} \div \left(\frac{x^{bc}}{x^{ac}}\right)$

$\Rightarrow x^{ab-ac-ab+bc} \div x^{bc-ac}$

$\Rightarrow x^{bc-ac} \div x^{bc-ac}$

$\Rightarrow 1$

6. **(d)** 50°

Explanation: Let the two interior opposite angles be x° each.

Now, the exterior angle is equal to the sum of the two interior opposite angles.

x° + x° = 180°

$\Rightarrow 2x^\circ = 100^\circ$

$\Rightarrow x^0 = 50^\circ$

7. **(c)** -1

Explanation: For finding value of ‘k’, we put x = 2 and y = -1 iin a equation x + 3y – k = 0

x+3 y-k=0

2+3(-1)=k

2-3=k

k=-1

8. **(a)** $x^3 + 2x^2 - x - 2$

Explanation: $x^3 + 2x^2 - x - 2$

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

9. **(c)** $2^{\frac{1}{6}}$

$\sqrt[4]{\sqrt[3]{2^2}}$

Explanation: $= \sqrt[4]{2^{\frac{2}{3}}}$

$= 2^{\frac{2}{3\times 4}} = 2^{\frac{1}{6}}$

10. **(b)** 5cm, 6cm, 7cm

Explanation: AB = 7 cm (by mid-point theorm)
AC = 5 cm (by mid-point theorm)
BC = 6 cm (by mid-point theorm)

11. **(a)** 7

Explanation: $x^{\frac{1}{12}} = 49^{\frac{1}{24}}$
$\Rightarrow x^{\frac{1}{12}} = 7^{\frac{2}{24}} = 7^{\frac{1}{12}}$
Equating both, x = 7

12. **(a)** $\left(-\frac{9}{2}, m\right)$

Explanation: 2x + 9 = 0
$\Rightarrow x = \frac{-9}{2}$ and y = m, where m is any real number
Hence, $\left(-\frac{9}{2}, m\right)$ is the solution of the given equation.

13. **(d)** An acute angled triangle

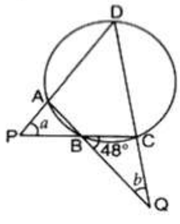
Explanation: Let the angles of the triange be 5x, 3x and 7x
We know that the sum of the angles of a triangle is 180°
5x + 3x + 7x = 180°
15x = 180°
x = 12^{o}
Therefore the angles are
$5x = 5 \times 12^0 = 60^\circ$
$3x = 3 \times 12^0 = 36^0$
$7x = 7 \times 12^0 = 84^0$
Since all the angles are less than 90^{o} there fore it is a acute angled triangle.

14. **(c)** -4

Explanation: $\sqrt{13 - a\sqrt{10}} = \sqrt{8} + \sqrt{5}$
Squaring both sides we get,
$(\sqrt{13 - a\sqrt{10}})^2 = (\sqrt{8} + \sqrt{5})^2$
$\Rightarrow 13 - a\sqrt{10} = 8 + 5 + 2(\sqrt{8})(\sqrt{5})$
$\Rightarrow 13 - a\sqrt{10} = 13 + 2\sqrt{40}$
$\Rightarrow -a\sqrt{10} = 2(2\sqrt{10})$
$\Rightarrow -a\sqrt{10} = 4\sqrt{10}$
$\Rightarrow a = -4$

15. **(d)** 28^o

Explanation:



Here, $\angle ABC$ is supplementary to $\angle CBQ$

So, $\angle ABC$ = 180 - 48 = 132°

Since, ABCD is cyclic quadrilateral, $\angle B + \angle D = 180^\circ$ {opposite angles are supplementery}

So, $\angle D$ = 180 - 132 = 48°

Now, in triangle PDC, $\angle P + \angle D + \angle C$ = 180°

= a + 48° + (48°+ b) =180° {since, $\angle C$ is external angle to B and b, and sum of two opposite interior angles is equal to external angle}

= 3b + 96 = 180°

= 3b = 180 - 96 = 84

b = 28°

16. **(c)** 3

Explanation: We know that abscissa or the x-coordinate of a point is its perpendicular distance from the Y-axis. So, perpendicular distance of the point P(3, 4) from Y-axis is 3

17. **(a)** y = 5x + 3

Explanation: Taxi fare for first kilometer = ₹8

Taxi fare for subsequent distance = ₹5

Total distance covered = x

Total fare = y

Since the fare for first kilometer = ₹8

According to problem, Fare for (x - 1) kilometer = 5(x - 1)

So, the total fare y = 5(x - 1) + 8

⇒ y = 5(x - 1) + 8

⇒ y = 5x – 5 + 8

⇒ y = 5x + 3

Hence, y = 5x + 3 is the required linear equation.

18. **(d)** (2a - 1) and (2a + 3)

Explanation: $4a^2 + 4a - 3$

To find the length and breadth, we will factorize the given polynomial.

$= 4a^2 + 6a - 2a - 3$

= 2a(a + 3) - 1(2a + 3)

= (2a + 3)(2a - 1)

Therefore, the possible expressions for the length and breadth of the rectangle whose area is given by $4a^2 + 4a - 3$ is (2a + 3) and (2a - 1).

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

Explanation: Both A and R are true but R is not the correct explanation of A.

Section B

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

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

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

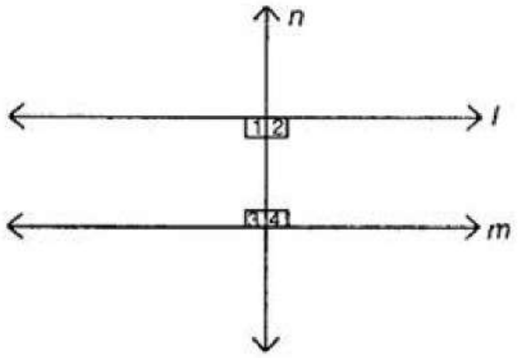
Adding (1) and (2), we get

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

Hence, $\angle A = \angle C$.

22. Yes, According to Euclid's 5th postulate when n line falls on l and m if $\angle 1 + \angle 3 < 180^o$ and $\angle 2 + \angle 4 > 180^o$ then producing the l and m further will meet in the side of $\angle 1$ and $\angle 3$ which is less than 180^o.

Which gave the clue about the condition that $\angle 1 + \angle 2 = 180^o$ and the line l and m will not meet at any point.



23. A(3, 1), B(6, 0), C(0, 6), D(–3, 0), E(–4, 3), F(–2, –4), G(0, –5), H(3, –6), P(7, –3), Q(7, 6).

24. $\frac{2\sqrt{6}}{\sqrt{2}+\sqrt{3}}+\frac{6\sqrt{2}}{\sqrt{6}+\sqrt{3}}-\frac{8\sqrt{3}}{\sqrt{6}+\sqrt{2}}$

$=\frac{2\sqrt{6}}{\sqrt{2}+\sqrt{3}}\times\frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}-\sqrt{3}}+\frac{6\sqrt{2}}{\sqrt{6}+\sqrt{3}}\times\frac{\sqrt{6}-\sqrt{3}}{\sqrt{6}-\sqrt{3}}-\frac{8\sqrt{3}}{\sqrt{6}+\sqrt{2}}\times\frac{\sqrt{6}-\sqrt{2}}{\sqrt{6}-\sqrt{2}}$

$=\frac{2\sqrt{6}(\sqrt{2}-\sqrt{3})}{\sqrt{2}^2-\sqrt{3}^2}+\frac{6\sqrt{2}(\sqrt{6}-\sqrt{3})}{\sqrt{6}^2-\sqrt{3}^2}-\frac{8\sqrt{3}(\sqrt{6}-\sqrt{2})}{\sqrt{6}^2-\sqrt{2}^2}$

$=\frac{2\sqrt{12}-2\sqrt{18}}{2-3}+\frac{6\sqrt{12}-6\sqrt{6}}{6-3}-\frac{8\sqrt{18}-8\sqrt{6}}{6-2}$

$=\frac{2\sqrt{4\times3}-2\sqrt{9\times2}}{-1}+\frac{6\sqrt{4\times3}-6\sqrt{6}}{3}-\frac{8\sqrt{9\times2}-8\sqrt{6}}{4}$

$=\frac{4\sqrt{3}-6\sqrt{2}}{-1}+\frac{12\sqrt{3}-6\sqrt{6}}{3}-\frac{24\sqrt{2}-8\sqrt{6}}{4}$

$=\frac{4\sqrt{3}-6\sqrt{2}}{-1}+\frac{4\sqrt{3}-2\sqrt{6}}{1}-\frac{6\sqrt{2}-2\sqrt{6}}{1}$

$=-4\sqrt{3}+6\sqrt{2}+4\sqrt{3}-2\sqrt{6}-6\sqrt{2}+2\sqrt{6}$

= 0

OR

Let $x = 1.\bar{4}$

Then, x = 1.444 ....(i)

Multiply eq. (i) by 10, we get

10 x = 14.444 ....(ii)

Subtracting (i) from (ii), we get

10 x - x = 14.444... - 0.444...

$9x = 13$

$\Rightarrow x = \frac{13}{9}$

Hence, $\frac{13}{9} = 1.\bar{4} = 1\frac{4}{9}$.

25. Given that,

r = Radius of the hemisphere = 3.5 cm

Therefore Volume of the hemisphere = $\frac{2}{3}\pi r^3 = \frac{2}{3}\times\frac{22}{7}\times 3.5\times 3.5\times 3.5\text{cm}^3$

= $\frac{2}{3}\times\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times\frac{7}{2}\text{cm}^3$

= $\frac{11\times 49}{3\times 2}\text{cm}^3$ = 89.83 cm^3

Now ,

Total surface area of the hemisphere

= $3\pi r^2$ = $3\times\frac{22}{7}\times 3.54\times 3.5\text{cm}^2$ = $3\times\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\text{cm}^2$ = $\frac{231}{2}\text{cm}^2$ = 115.5 cm^2

OR

We are given that,Two ratio in radius and slant height of a cone = 7 : 13

Let radius (r) = 7x

and slant height (1) = 3x

Curved surface area = πrl

$=\frac{22}{7}\times 7x\times 13x = 286$

$286x^2 = 286$

$x^2=\frac{286}{286}=1$

$\therefore x=\sqrt{1}=1$

Therefore Radius = 7x = 7 × 1 = 7 cm

Section C

26. Consider, AB = 4.5 units.

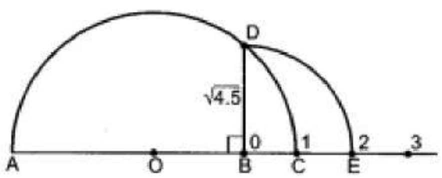
Extend AB upto point C such that BC = 1 unit.

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

Now mark O as the midpoint of AC.

With O as centre and radius OC draw a semicircle.

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



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

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

Therefore, $BC = 1\, unit.$

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

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

AB = 4.5 units

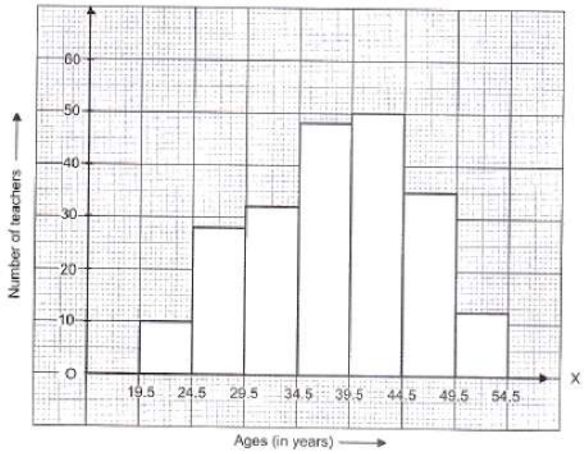
BC = 1 unit

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

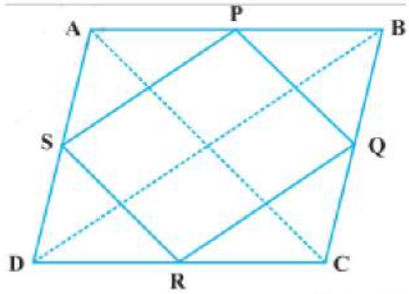
27. The given table is in inclusive form. So, we first convert it into an exclusive form, as given below.

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:



28. Let ABCD be a rhombus and P, Q, R and S be the mid-points of sides AB, BC, CD and DA, respectively (Fig.). Join AC and BD.



From triangle ABD, we have $SP = \frac{1}{2}BD$ and

SP || BD (Because S and P are mid-points)

Similarly $RQ = \frac{1}{2}BD$ and RQ || BD

Therefore, SP = RQ and SP || RQ

So, PQRS is a parallelogram ...(1)

Also, AC $\perp$ BD (Diagonals of a rhombus are perpendicular)

Further PQ || AC (From $\triangle$BAC)

As SP || BD, PQ || AC and AC $\perp$ BD,

therefore, we have BD $\perp$ PQ, i.e. $\angle$SPQ = 90°. ..(2)

Therefore, PQRS is a rectangle. [From (1) and (2)]

29. 5x + 3y = 15

Put x = 0, we get

5(0) + 3y = 15

⇒ 3y = 15

⇒ $y = \frac{15}{3} = 5$

∴ (0, 5) is a solution.

5x + 3y = 15

Put y = 0, we get

5x + 3(0) = 15

⇒ 5x = 15

⇒ $x = \frac{15}{5} = 3$

∴ (3, 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.

5x + 2y = 10

Put y = 0, we get

5x + 2(0) = 10

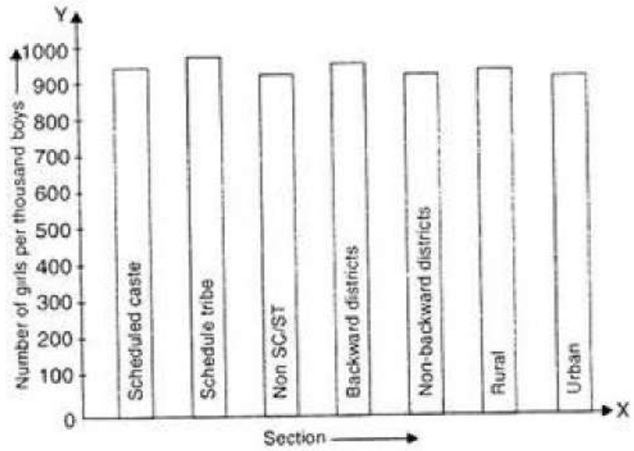
⇒ 5x = 10

⇒ $x = \frac{10}{5} = 2$

∴ (2, 0) is a solution.

The given equations have a common solution (0, 5).

30. i.



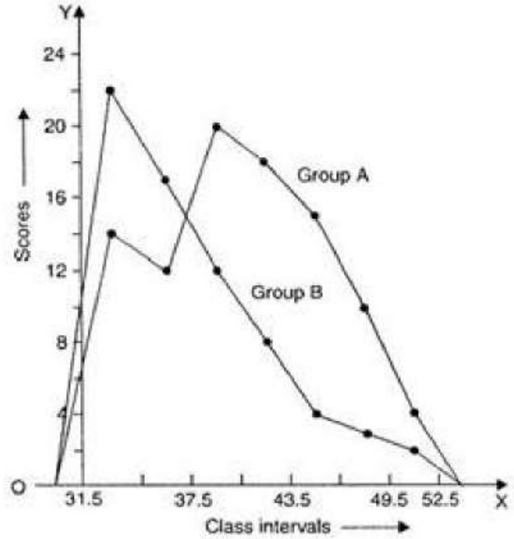
ii. The two conclusions we can arrive at from the graph are as follows:

iii. The numbers of girls to the nearest ten per thousand boys is maximum in Scheduled Tribe section of the society and minimum in Urban section of the society.

iv. The number of girls to the nearest ten per thousand boys is the same for 'Non SC/ST' and 'Non-backward Districts' sections of the society.

OR

Frequency polygon for group A and B representing the scores of two groups of Class IV students in a test of reading ability.



Let us convert the given distributions in such a manner that the intervals are continuous. It is shown below

Class interval	Group A	Group B
49.5-52.5	4	2
46.5-49.5	10	3
43.5-46.5	15	4
40.5-43.5	18	8
37.5-40.5	20	12
34.5-37.5	12	17
31.5-34.5	13	22
Total	92	68

31. $5+2x$

We need to find the zero of the polynomial $5+2x$

$5+2x=0$

$\Rightarrow x=-\frac{5}{2}$

While applying the remainder theorem, we need to put the zero of the polynomial $5+2x$ in the polynomial x^3+3x^2+3x+1

,to get

$p(x) = x^3 + 3x^2 + 3x + 1$

$p\left(-\frac{5}{2}\right) = \left(-\frac{5}{2}\right)^3 + 3\left(-\frac{5}{2}\right)^2 + 3\left(-\frac{5}{2}\right) + 1$

$= -\frac{125}{8} + 3\left(\frac{25}{4}\right) - \frac{15}{2} + 1$

$= -\frac{125}{8} + \frac{75}{4} - \frac{15}{2} + 1$

$= \frac{-125+150-60+8}{8}$

$= -\frac{27}{8}.$

Section D

32. To Prove: $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$

Given: OR is perpendicular to PQ, or ∠QOR = 90°

From the given figure, we can conclude that ∠POR and ∠QOR form a linear pair.

We know that sum of the angles of a linear pair is 180°.

∴ ∠POR + ∠QOR = 180°

or ∠POR = 90°

From the figure, we can conclude that

∠POR = ∠POS + ∠ROS

⇒ ∠POS + ∠ROS = 90°

⇒ ∠ROS = 90° - ∠POS...(i)

Again,

∠QOS + ∠POS = 180°

$\Rightarrow \frac{1}{2}(\angle QOS + \angle POS) = 90^\circ$.(ii)

Substitute (ii) in (i), to get

$\angle ROS = \frac{1}{2}(\angle QOS + \angle POS) - \angle POS$

$= \frac{1}{2}(\angle QOS - \angle POS)$.

Therefore, the desired result is proved.

OR

EF || CD and ED is the transversal.

$\therefore \quad \angle FED + \angle EDH = 180^\circ$ [co-interior angles]

⇒ 65° + y = 180°

⇒ y = (180° - 65°) = 115°.

Now CH || AG and DB is the transversal

∴ x = y = 115° [corresponding angles]

Now, ABG is a straight line.

$\therefore \angle ABE + \angle EBG = 180^\circ$ [sum of linear pair of angles is 180°]

$\Rightarrow \angle ABE + x = 180^\circ$

$\Rightarrow \angle ABE + 115^\circ = 180^\circ$

$\Rightarrow \angle ABE = (180^\circ - 115^\circ) = 65^\circ$

We know that the sum of the angles of a triangle is 180°.

From △EAB, we get

$\angle EAB + \angle ABE + \angle BEA = 180^\circ$

⇒ 90° + 65° + z = 180°

⇒ z = (180° - 155°) = 25°

∴ x = 115°, y = 115° and z = 25°

33. Diameter of cone = 40 cm

⇒ Radius of cone (r) = $\frac{40}{2}$

= 20 cm

= $\frac{20}{100}$ m

= 0.2 m

Height of cone (h) = 1 m

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

$= \sqrt{(0.2)^2 + (1)^2}$

= $\sqrt{1.04}$ m

Curved surface area of cone = $\pi r l$

= $3.14 \times 0.2 \times \sqrt{1.04}$

= 0.64056 m^2

$\because$ Cost of painting 1m^2 of a cone = Rs.12

$\therefore$ Cost of painting 0.64056m^2 of a cone = 12 $\times$ 0.64056 = Rs. 7.68672

$\therefore$ Cost of painting of 50 such cones = 50 $\times$ 7.68672 = Rs. 384.34 (approx.)

34. Let the smaller side of the triangle be x cm. therefore, the second side will be (x + 4) cm, and third side is (2x - 6) cm.

Now, perimeter of triangle = x (x + 4) + (2x - 6)

= (4x - 2) cm

Also, perimeter of triangle = 50 cm.

4x = 52; x = 52 ÷ 4 = 13

Therefore, the three sides are 13 cm, 17 cm, 20 cm

$s = \frac{13+17+20}{2} = \frac{50}{2} = 25cm$

$\therefore$ Area of $\Delta = \sqrt{25(25-13)(25-17)(25-20)}$

$= \sqrt{25 \times 12 \times 8 \times 5} = \sqrt{5 \times 5 \times 4 \times 3 \times 4 \times 2 \times 5}$

$= 5 \times 4 \times \sqrt{3 \times 2 \times 5} = 20\sqrt{30}cm^2$

OR

Let:

a = 85 m and b = 154 m

Given that perimeter = 324 m

Perimeter= 2s = 324 m

$\Rightarrow$ s = $\frac{324}{2}$m

or, a + b + c = 324

$\Rightarrow$ c = 324 - 85 - 154 = 85 m

By Herons's formula, we have:

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

$= \sqrt{162(162-85)(162-154)(162-85)}$

$= \sqrt{162 \times 77 \times 8 \times 77}$

$= \sqrt{1296 \times 77 \times 77}$

$= \sqrt{36 \times 77 \times 77 \times 36}$

$= 36 \times 77$

= 2772 m^2

35. Here, f(x) = $ax^3 + x^2 - 2x + b$

(x + 1) and (x - 1) are the factors

From factor theorem, if(x- 1), (x+1) are the factors of f(x) then f(1) = 0 and f(-1) = 0

Let, x - 1= 0

$\Longrightarrow$ x = 1

Substitute x=1 in f(x),then,we have,

f(1) = $a(1)^3 + (1)^2 - 2(1) + b$

= a + 1 - 2 + b

= a + b - 1

Since f(1)=0, therefore

a+b-1=0 ....(1)

Let, x + 1 = 0

$\Longrightarrow$ x = -1

Substitute x=-1 in f(x),then,we have,

f(-1) = $a(-1)^3 + (-1)^2 - 2(-1) + b$

= -a + 1 + 2 + b

= -a + b + 3

Since f(-1)=0, therefore,we have,

-a+b+3=0 ....(2)

Solve equations 1 and 2

a + b = 1

-a + b = -3

2b = -2

$\Longrightarrow$ b = -1

substitute b value in eq 1

$\Longrightarrow$ a - 1 = 1

$\Longrightarrow$ a = 1 + 1

$\Longrightarrow$ a = 2

The values are a= 2 and b = -1

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) 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 = $\frac{7}{3} \times y$

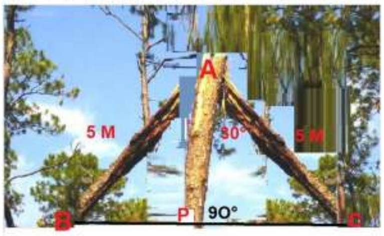
$\Rightarrow$ z = $\frac{7}{3} \times 15$

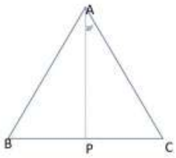
⇒ Here Mother age = 35 years

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

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

In a forest, a big tree got broken due to heavy rain and wind. Due to this rain the big branches AB and AC with lengths 5m fell down on the ground. Branch AC makes an angle of 30° with the main tree AP. The distance of Point B from P is 4 m. You can observe that ΔABP is congruent to ΔACP.





(i) In $\triangle ACP$ and $\triangle ABP$

AB = AC (Given)

AP = AP (common)

$\angle APB = \angle APC = 90^o$

By RHS criteria $\triangle ACP \cong \triangle ABP$

(ii) In $\triangle ACP$

$\angle APC + \angle PAC + \angle ACP = 180^o$

$\Rightarrow 90^o + 30^o + \angle ACP = 180^o$ (angle sum property of $\triangle$)

$\Rightarrow \angle ACP = 180^o - 120^o = 60^o$

$\angle ACP = 60^o$

OR

$\triangle ACP$

$AC^2 = AP^2 + PC^2$

$\Rightarrow 25 = AP^2 + 16$

$\Rightarrow AP^2 = 25 - 16 = 9$

$\Rightarrow AP = 3$

Total height of the tree = AP + 5 = 3 + 5 = 8 m

(iii) $\triangle ACP \cong \triangle ABP$

Corresponding part of congruent triangle

$\angle BAP = \angle CAP$

$\angle BAP = 30^o$ (given $\angle CAP = 30^o$)

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

There is a race competition between all students of a sports academy, so that the sports committee can choose better students for a marathon. The race track in the academy is in the form of a ring whose inner most circumference is 264 m and the outer most circumference is 308 m.

(i) Let the radius of outer most circle be R.

Outer most circumference = 308 m [Given]

$\Rightarrow 2\pi R = 308 \Rightarrow 2 \times \frac{22}{7} \times R = 308$

$\Rightarrow R = \frac{308 \times 7}{2 \times 22} = 49$ m

(ii) Let the radius of inner most circle be r Inner most circumference = 264 m [Given]

$\Rightarrow$ 2nr = 264

$\Rightarrow 2 \times \frac{22}{7} \times$ r = 264 $\Rightarrow$ r = $\frac{264 \times 7}{2 \times 22}$ = 42 m

Radius of inner most circle = r = 42 m

OR

Area of the racetrack = Area of outer circle - Area of inner circle

= $\pi(R^2 - r^2) = \pi\,[(49)^2 - (42)^2]$

= $\frac{22}{7}$ [2401 - 1764] = 2002 m^2

Hence area of racetrack is 2002 m^2.

(iii) Width of the track = Radius of outer most track - Radius of inner most track

= 49 - 42 = 7 m