

**Class IX Session 2023-24**  
**Subject - Mathematics**  
**Sample Question Paper - 3**

**Time Allowed: 3 hours**

**Maximum Marks: 80**

**General Instructions:**

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

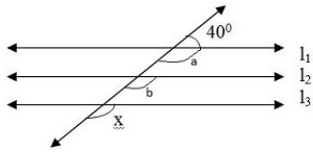
**Section A**

1. The number  $0.\overline{3}$  in the form  $\frac{p}{q}$ , where p and q are integers and  $q \neq 0$ , is [1]
  - a)  $\frac{3}{100}$
  - b)  $\frac{3}{10}$
  - c)  $\frac{33}{100}$
  - d)  $\frac{1}{3}$
2. The line represented by the equation  $x + y = 16$  passes through (2, 14). How many more lines pass through the point (2, 14) [1]
  - a) 10
  - b) 2
  - c) many
  - d) 100
3. The point whose ordinate is 3 and which lies on the y-axis is [1]
  - a) (3,3)
  - b) (3,0)
  - c) (1,3)
  - d) (0,3)
4. In a histogram the class intervals or the groups are taken along [1]
  - a) X-axis
  - b) Y-axis
  - c) both of X-axis and Y-axis
  - d) in between X and Y axis
5. Which of the following point does not lie on the line  $y = 2x + 3$ ? [1]
  - a) (-5, -7)
  - b) (-1, 1)
  - c) (3, 9)
  - d) (3, 7)

6. The total number of propositions in the Euclid's Elements is [1]

- a) 460
- b) 465
- c) 32
- d) 13

7. Given that lines  $l_1$ ,  $l_2$  and  $l_3$  in figure are parallel. The value of  $x$  is: [1]



- a)  $140^\circ$
- b)  $40^\circ$
- c)  $50^\circ$
- d)  $80^\circ$

8. ABCD is a trapezium in which  $AB \parallel DC$ . M and N are the mid-points of AD and BC respectively. If  $AB = 12$  cm,  $MN = 14$  cm, then  $CD =$  [1]

- a) 10 cm
- b) 14 cm
- c) 12 cm
- d) 16 cm

9. If  $x^3 + \frac{1}{x^3} = 110$ , then  $x + \frac{1}{x} =$  [1]

- a) 15
- b) none of these
- c) 5
- d) 10

10. If  $(-2, 5)$  is a solution of  $2x + my = 11$ , then the value of 'm' is [1]

- a) -2
- b) 2
- c) 3
- d) -3

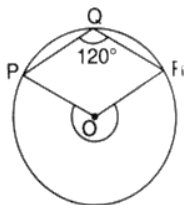
11. ABCD is a Rhombus such that  $\angle ACB = 40^\circ$ , then  $\angle ADB$  is [1]

- a)  $100^\circ$
- b)  $40^\circ$
- c)  $60^\circ$
- d)  $50^\circ$

12. The Quadrilateral formed by joining the mid-points of the sides of a Quadrilateral PQRS, taken in order, is a rectangle if [1]

- a) PQRS is a Rectangle
- b) None of these
- c) PQRS is a Parallelogram
- d) Diagonals of PQRS are at right angles.

13. What fraction of the whole circle is minor arc RP in the given figure? [1]



- a)  $\frac{1}{4}$  of the circle
- b)  $\frac{1}{5}$  of the circle
- c)  $\frac{1}{3}$  of the circle
- d)  $\frac{1}{2}$  of the circle

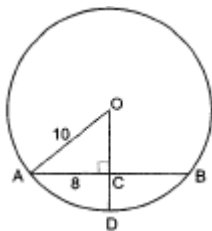
14. The sum of  $0.\bar{3}$  and  $0.\bar{4}$  is [1]

- a)  $\frac{7}{11}$
- b)  $\frac{7}{99}$
- c)  $\frac{7}{10}$
- d)  $\frac{7}{9}$

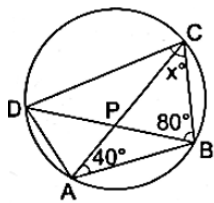
15. The graph of the linear equation  $2x + 3y = 6$  is a line which meets the x-axis at the point [1]  
 a) (0,3) b) (3,0)  
 c) (2, 0) d) (0 ,2)
16. The side BC of  $\triangle ABC$  is produced to a point D. The bisector of  $\angle A$  meets side in L. If  $\angle ABC = 30^\circ$  and  $\angle ACD = 115^\circ$ , then  $\angle ALC =$  [1]  
 a)  $85^\circ$  b) None of these  
 c)  $145^\circ$  d)  $72\frac{1}{2}^\circ$
17. In a bar graph, 0.25 cm length of a bar represents 100 people. Then, the length of bar which represents 2000 people is [1]  
 a) 4.5 cm b) 4 cm  
 c) 5 cm d) 3.5 cm
18. If the ratio of volumes of two spheres is 1 : 8, then the ratio of their surface areas is [1]  
 a) 1 : 4 b) 1 : 2  
 c) 1 : 16 d) 1 : 8
19. **Assertion (A):** The sides of a triangle are in the ratio of 25 : 14 : 12 and its perimeter is 510 cm. Then the area of the triangle is  $4449.08 \text{ cm}^2$ . [1]  
**Reason (R):** Perimeter of a triangle =  $a + b + c$ , where a, b, c are sides of a triangle.  
 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) R is not the correct explanation of A. d) A is false but R is true.
20. **Assertion (A):** There are infinite number of lines which passes through (2, 14). [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 height. Given ( $\sqrt{3} = 1.732$ ). [2]
22. In given figure, if  $OA = 10$ ,  $AB = 16$  and  $OD \perp$  to  $AB$ . Find the value of the CD. [2]



23. A conical pit of top diameter 3.5 m is 12 m deep. What is its capacity in kilolitres? [2]
24. If O is the centre of the circle, find the value of x in given figure: [2]



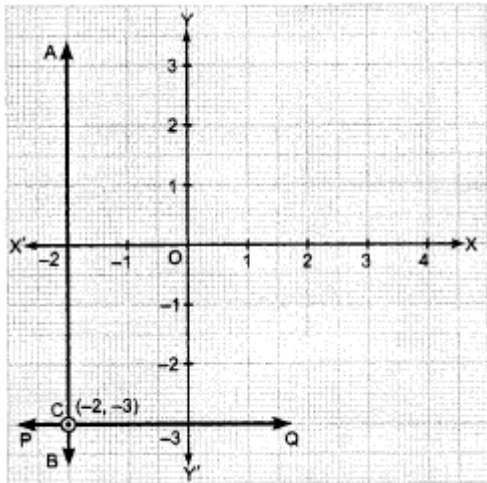
OR

On a common hypotenuse AB, two right triangles ACB and ADB are situated on opposite sides. Prove that  $\angle BAC = \angle BDC$ .

25. Express the linear equation in the form  $ax + by + c = 0$  and indicate the values of a, b and c in  $2x = -5y$ . [2]

OR

Write the linear equation represented by line AB and PQ. Also find the co-ordinate of intersection of line AB and PQ.



### Section C

26. If  $a = \frac{2+\sqrt{5}}{2-\sqrt{5}}$  and  $b = \frac{2-\sqrt{5}}{2+\sqrt{5}}$ , then find the value of  $a^2 - b^2$ . [3]
27. Find the remainder when  $x^3 + 3x^2 + 3x + 1$  is divided by  $5 + 2x$  [3]
28. One side of an equilateral triangle is 8 cm. Find its area by using Heron's Formula. Find its altitude also. [3]

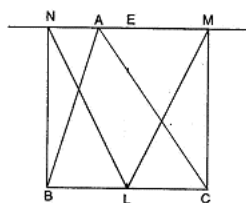
OR

The sides of a triangle are in the ratio of 13 : 14 : 15 and its perimeter is 84 cm. Find the area of the triangle.

29. For what value of c, the linear equation  $2x + cy = 8$  has equal values of x and y for its solution? [3]
30. In a parallelogram, show that the angle bisectors of two adjacent angles intersect at right angles. [3]

OR

BN and CM are perpendiculars to a line passing through the vertex A of a triangle ABC. If L is the mid point of BC, Prove that  $LM = LN$ .



31. Draw the graphs of  $y = x$  and  $y = -x$  in the same graph. Also find the co-ordinates of the point where the two lines intersect. [3]

### Section D

32. Represent each of the numbers  $\sqrt{5}$ ,  $\sqrt{6}$  and  $\sqrt{7}$  the real line. [5]

OR

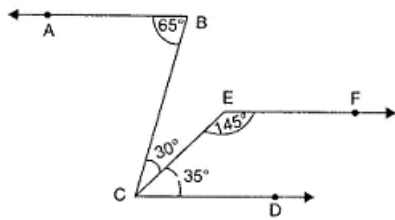
If  $a = \frac{1}{7-4\sqrt{3}}$  and  $b = \frac{1}{7+4\sqrt{3}}$ , then find the value of:

i.  $a^2 + b^2$

ii.  $a^3 + b^3$

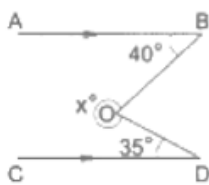
33. In a line segment AB point C is called a mid-point of line segment AB, prove that every line segment has one and only one mid-point. [5]

34. In figure,  $\angle ABC = 65^\circ$ ,  $\angle BCE = 30^\circ$ ,  $\angle DCE = 35^\circ$  and  $\angle CFE = 145^\circ$ . Prove that  $AB \parallel EF$ . [5]



OR

In the given figure,  $AB \parallel CD$ ,  $\angle ABO = 40^\circ$ ,  $\angle CDO = 35^\circ$ . Find the value of the reflex  $\angle BOD$  and hence the value of x.

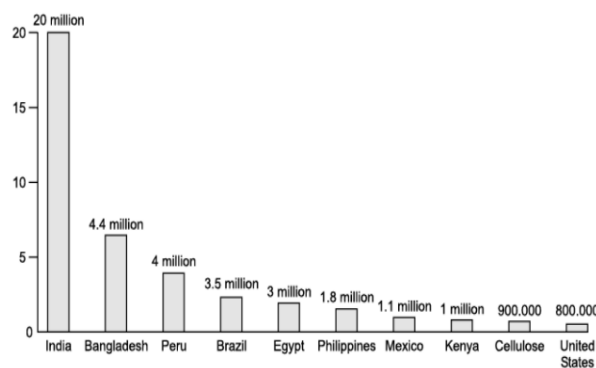


35. Verify that  $x^3 + y^3 + z^3 - 3xyz = \frac{1}{2}(x + y + z) [(x - y)^2 + (y - z)^2 + (z - x)^2]$  [5]

**Section E**

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

Child labour refers to any work or activity that deprives children of their childhood. It is a violation of children's rights. This can harm them mentally or physically. It also exposes them to hazardous situations or stops them from going to school. Naman got data on the number of child laborers (in million) in different countries that is given below.



- (i) What is the difference between highest no. of child labor and the minimum no. of child labor?
- (ii) What is the percentage of no. of child labor in Peru over the no. of child labor in India?
- (iii) What is the total no. of child labor in the countries having child labor more than 2 million?

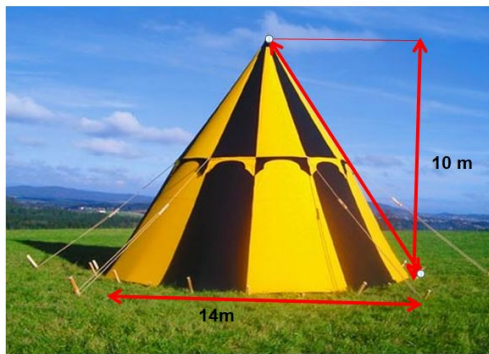
OR

How many countries are having child labor more than Mexico?

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<sup>2</sup> cloth with them. As shown in the figure they made the tent with height 10 m and diameter 14 m. The remaining cloth was used for the floor.



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

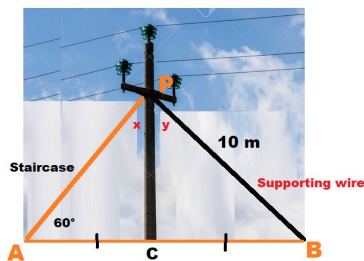
OR

What was the total surface area of the tent?

38. Read the text carefully and answer the questions:

[4]

As shown In the village of Surya there was a big pole PC. This pole was tied with a strong wire of 10 m length. Once there was a big spark on this pole, thus wires got damaged very badly. Any small fault was usually repaired with the help of a rope which normal board electricians were carrying on bicycles. This time electricians need a staircase of 10 m so that it can reach at point P on the pole and this should make 60° with line AC.



- (i) Show that  $\triangle APC$  and  $\triangle BPC$  are congruent.
- (ii) Find the value of  $\angle x$ .
- (iii) What is the value of  $\angle PBC$ ?

OR

Find the value of  $\angle y$ .

# Solution

## Section A

1.

(d)  $\frac{1}{3}$

**Explanation:** Let  $x = 0.\overline{3}$

i.e,  $x = 0.333\ldots$ ---(i)

multiply eq.(i) by 10 we get,

$10x = 3.333\ldots$  ---(ii)

Subtracting eq. (i) from (ii) we get

$10x - x = 3.333\ldots - 0.333\ldots$

$9x = 3$

$x = \frac{3}{9}$

$x = \frac{1}{3}$

2.

(c) many

**Explanation:** There are many lines pass through the point (2, 14).

For example

$x - y = -12$

$2x + y = 18$

and many more.

3.

(d) (0,3)

**Explanation:** Since the point lies on y-axis, so,  $x = 0$ . Hence, the required point is: (0, 3)

4.

(a) X-axis

**Explanation:** Histogram states that a two dimensional frequency density diagram is called as a histogram. The histograms are diagrams which represent the class interval and the frequency in the form of a rectangle. There will be as many adjoining rectangles as there are class intervals.

5.

(d) (3, 7)

**Explanation:** Let us put  $x = 3$  in the give equation,

Then,  $y = 2(3) + 3$

$y = 6 + 3 = 9$

So, the point will be (3, 9)

For  $x = 3$ ,  $y = 9$ . But in the given option,  $y = 7$

So, the given point (3, 7) will not lie on the line  $y = 2x + 3$ .

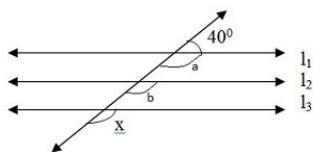
6.

(b) 465

**Explanation:** Euclid's Elements is a mathematical and geometric treatise consisting of 13 books attributed to the ancient Greek mathematician Euclid in Alexandria, Ptolemaic Egypt circa 300 BC. It is a collection of definitions, postulates (axioms), propositions (theorems and constructions), and mathematical proofs of the propositions. There are 131 definitions, 465 propositions, 5 Postulates and 5 common notions in Euclid's Elements.

7. (a)  $140^\circ$

**Explanation:**



In the given figure

$$40^\circ + \angle a = 180^\circ \text{ (linear - pair)}$$

$$\text{Therefore } \angle a = 180^\circ - 40^\circ = 140^\circ$$

Now  $\angle a = \angle b$  (corresponding - angles)

$$\text{Similarly } \angle b = \angle x = 140^\circ$$

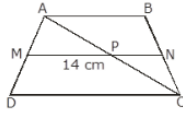
$$\text{Therefore } \angle x \angle x = 140^\circ$$

8.

**(d)** 16 cm

**Explanation:**

Given,



ABCD is a trapezium

$AB \parallel DC$

M, N are mid points of AD & BC

$AB = 12 \text{ cm}$ ,  $MN = 14 \text{ cm}$

$\therefore AB \parallel MN \parallel CD$  [M, N are mid points of AD & BC]

$MP = NP$

By mid point theorem,

$$MP = \frac{1}{2}CD \text{ and } NP = \frac{1}{2}AB$$

$$\therefore MN = \frac{1}{2}(AB + CD)$$

$$\Rightarrow 14 = \frac{1}{2}(12 + CD)$$

$$\Rightarrow CD = 28 - 12 = 16 \text{ cm}$$

9.

**(c)** 5

$$\text{Explanation: } x^3 + \left(\frac{1}{x^3}\right) = 110$$

$$x^3 + \left(\frac{1}{x^3}\right) + 3x \cdot \frac{1}{x} \left(x + \frac{1}{x}\right) = 110 + 3x \cdot \frac{1}{x} \left(x + \frac{1}{x}\right)$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 = 110 + 3 \left(x + \frac{1}{x}\right)$$

$$\Rightarrow \left(x + \frac{1}{x}\right)^3 - 3 \left(x + \frac{1}{x}\right) - 110 = 0$$

$$\text{Let } x + \frac{1}{x} = a$$

$$\Rightarrow a^3 - 3a - 110 = 0$$

$$\Rightarrow a^3 - 5a^2 + 5a^2 - 25a + 22a - 110 = 0$$

$$\Rightarrow a^2(a - 5) + 5a(a - 5) + 22(a - 5) = 0$$

$$\Rightarrow (a - 5)(a^2 + 5a + 22) = 0$$

$$\Rightarrow a - 5 = 0 \text{ or } a^2 + 5a + 22 = 0 \text{ neglected}$$

$$\Rightarrow a = 5$$

$$\Rightarrow x + \frac{1}{x} = 5$$

10.

**(c)** 3

**Explanation:** If  $(-2, 5)$  is a solution of  $2x + my = 11$

then it will satisfy the given equation

$$2 \cdot (-2) + 5m = 11$$

$$-4 + 5m = 11$$

$$5m = 11 + 4$$

$$5m = 15$$

$$m = \frac{15}{5} = 3$$

$$m = 3$$



11.

(d)  $50^\circ$

**Explanation:** In Rhombus, diagonals bisect each other right angle. By using angle sum property in any of the four triangles formed by intersection of diagonals, we get  $\angle CBD = 50$  and  $\angle CBD = \angle ADC$  ( alternate angles).

So,  $\angle ADC = 50$

12.

(d) Diagonals of PQRS are at right angles.

**Explanation:** Diagonals of PQRS are at right angles form all the internal angles as right angles. [according to angle property of rectangle, i.e, all the angles of a rectangle are right angle( $90^\circ$ )]

13.

(c)  $\frac{1}{3}$  of the circle

**Explanation:** Complete the cyclic quadrilateral PQRS, with S being a point on a point on the major arc. Then  $\angle S = 60^\circ$  (Opposite angles of a cyclic quadrilateral)

Then Major  $\angle POR = 120^\circ$

Thus fraction the minor arc =  $\frac{120^\circ}{360^\circ} = \frac{1}{3}$

14.

(d)  $\frac{7}{9}$

**Explanation:**  $0.\bar{3} + 0.\bar{4}$

$= 0.\bar{7} = \frac{7}{9}$

15.

(b) (3,0)

**Explanation:**  $2x + 3y = 6$  meets the X-axis.

Put  $y = 0$ ,

$2x + 3(0) = 6$

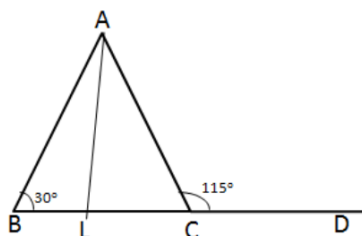
$x = 3$

Therefore, graph of the given line meets X-axis at (3, 0).

16.

(d)  $72\frac{1}{2}^\circ$

**Explanation:**



$$\angle C = 180^\circ - \angle ACD = 180^\circ - 115^\circ = 65^\circ$$

In  $\triangle ABC$

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

$$\Rightarrow \angle A = 180 - 30^\circ - 65^\circ$$

$$\Rightarrow \angle A = 85^\circ$$

Now in  $\triangle ALC$

$$\angle ALC + \angle LAC + \angle C = 180^\circ$$

$$\Rightarrow \angle ALC = 180^\circ - \angle LAC - \angle C$$

$$= 180^\circ - \frac{\angle A}{2} - \angle C$$

$$= 180^\circ - \frac{85^\circ}{2} - 65^\circ$$

$$= \frac{145^\circ}{2}$$

$$= 72\frac{1}{2}^\circ$$

17.

(c) 5 cm

**Explanation:** Use unitary method

0.25 cm - 100 people

So 1 cm - 400 people

So for 2000 people:

$$\frac{2000}{400} = 5 \text{ cm}$$

18. (a) 1 : 4

**Explanation:** Ratio of volume of spheres = (ratio of radius)<sup>3</sup>

Given, ratio of volumes of two spheres is 1: 8

$$\Rightarrow (\text{ratio of radius})^3 = 1 : 8$$

$$\Rightarrow \text{ratio of radius} = 1 : 2$$

Ratio of surface area = (ratio of radius)<sup>2</sup>

$$\Rightarrow \text{Ratio of surface area} = 1 : 4$$

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

**Explanation:** 510 = a + b + c

$$510 = 25x + 14x + 12x$$

$$510 = 51x$$

$$x = 10$$

Three side of the triangle are

$$25x = 25 \times 10 = 250 \text{ cm}$$

$$14x = 14 \times 10 = 140 \text{ cm and}$$

$$12x = 12 \times 10 = 120 \text{ cm}$$

$$s = \frac{250+140+120}{2} = 255 \text{ cm}$$

$$\text{Area} = \sqrt{255 \times 5 \times 115 \times 135}$$

$$= 4449.08 \text{ cm}^2$$

20.

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

**Explanation:** Through a point infinite lines can be drawn. Through (2, 14) infinite number of lines can be drawn. Also a line has infinite points on it hence a linear equation representing a line has infinite solutions.

### Section B

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

As every side of the equilateral triangle is equal.

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

$$\text{Area of equilateral triangle} = \frac{\sqrt{3}}{4} a^2 = \frac{1.732}{4} (20)^2 = 173.2 \text{ cm}^2 \dots\dots(1)$$

Let the height of the given triangle be h cm. Then

$$\text{its area} = \left(\frac{1}{2} \times \text{base} \times \text{height}\right) = \left(\frac{1}{2} \times 20 \times h\right) \text{ cm}^2$$

$$\therefore \frac{1}{2} \times 20 \times h = 173.2 \text{ cm}^2 \text{ [from (1)]}$$

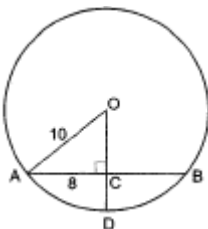
$$\Rightarrow h = \frac{173.2}{10}$$

$$\Rightarrow \text{height} = 17.32 \text{ cm}$$

Hence, the height of the given triangle is 17.32 cm

22. Given : In given figure OA=10cm and Ab=16 cm

To find : Length of CD



Solution : As OD  $\perp$  AB

$$\Rightarrow AC = CB$$

( $\perp$  from the centre to the chord bisects the chord)

$$\therefore AC = \frac{AB}{2} = 8$$

In right  $\triangle OCA$ ,

$$OA^2 = AC^2 + OC^2$$

$$(10)^2 = 8^2 + OC^2$$

$$OC^2 = 100 - 64$$

$$OC^2 = 36$$

$$\therefore OC = \sqrt{36}$$

$$OC = 6 \text{ cm}$$

$$CD = OD - OC = 10 - 6 = 4 \text{ cm.}$$

23. For conical pit : Diameter = 3.5 m.

$$\therefore \text{Radius (r)} = \frac{3.5}{2} \text{ m} = 1.75 \text{ m}$$

Depth (h) = 12 m

$$\therefore \text{Capacity of the conical pit} = \frac{1}{3} \pi r^2 h$$

$$\frac{1}{3} \times \frac{22}{7} \times (1.75)^2 \times 12 \text{ m}^3$$

$$= 38.5 \text{ m}^3 = 38.5 \times 1000 \text{ l}$$

$$= 38.5 \text{ kl.}$$

24.  $\angle BDC = \angle BAC = 40^\circ$  [ $\angle$  in the same segment].

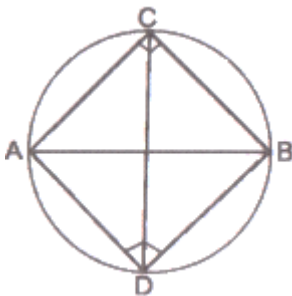
$$\angle BDC + \angle DBC + \angle BCD = 180^\circ$$

$$\therefore 40^\circ + 80^\circ + x^\circ = 180^\circ$$

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

OR

The figure is shown below:



In right triangles ACB and ADB, we have

$$\angle ACB = 90^\circ \text{ and } \angle ADB = 90^\circ$$

$$\therefore \angle ACB + \angle ADB = 90^\circ + 90^\circ = 180^\circ$$

Since, we know that if the sum of any pair of opposite angles of a quadrilateral is  $180^\circ$  then, the quadrilateral is cyclic. So, ADBC is a cyclic quadrilateral.

Now on Joining CD, we can say that the angles  $\angle BAC$  and  $\angle BDC$  are made by  $\widehat{BC}$  in the same segment.

Therefore,  $\angle BAC = \angle BDC$  [ $\because$  Angles in the same segment of a circle are equal]

Hence proved

25. We need to express the linear equation  $2x = -5y$  in the form  $ax + by + c = 0$  and indicate the values of a, b and c.

$$2x = -5y \text{ can also be written as } 2x + 5y + 0 = 0.$$

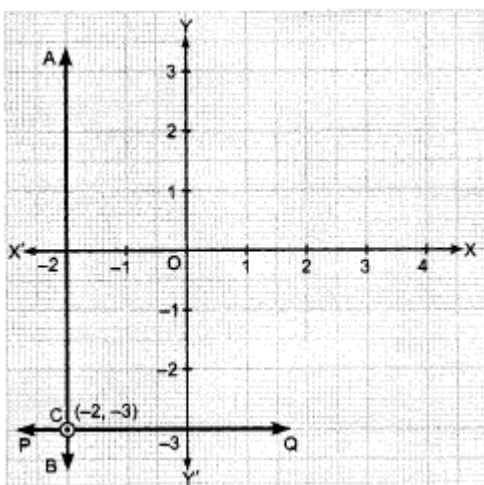
We need to compare the equation  $2x + 5y + 0 = 0$  with the general equation  $ax + by + c = 0$ , to get the values of a, b and c.

Therefore, we can conclude that  $a = 2$ ,  $b = 5$  and  $c = 0$

OR

$$AB \Rightarrow x = -2$$

$$PQ \Rightarrow y = -3$$



Point of intersection of  $AB$  and  $PQ$  is  $C(-2, -3)$ .

### Section C

26. Given,  $a = \frac{2+\sqrt{5}}{2-\sqrt{5}}$

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

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

$$= \frac{4+5+4\sqrt{5}}{4-5}$$

$$= -(9 + 4\sqrt{5})$$

Also,  $b = \frac{2-\sqrt{5}}{2+\sqrt{5}}$

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

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

$$= \frac{2^2+(\sqrt{5})^2-2 \cdot 2\sqrt{5}}{4-5}$$

$$= \frac{4+5-4\sqrt{5}}{-1}$$

$$= -(9-4\sqrt{5})$$

$$= 4\sqrt{5}-9$$

We know,  $a^2 - b^2 = (a + b)(a - b)$

Here,  $a + b = -9 - 4\sqrt{5} + 4\sqrt{5} - 9 = -18$

$a - b = -9 - 4\sqrt{5} - (4\sqrt{5} - 9) = -8\sqrt{5}$

Hence,  $a^2 - b^2 = -18(-8\sqrt{5})$

$$= 144\sqrt{5}$$

27.  $5 + 2x$

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

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

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

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

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

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

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

28.  $a = 8$  cm,  $b = 8$  cm,  $c = 8$  cm.

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

$$\therefore \frac{8+8+8}{2} \text{m} = 12 \text{ cm}$$

$$\begin{aligned}
&\therefore \text{Area of the equilateral triangle} \\
&= \sqrt{s(s-a)(s-b)(s-c)} \\
&= \sqrt{12(12-8)(12-8)(12-8)} \\
&= \sqrt{12(4)(4)(4)} \\
&= \sqrt{(4)(3)(4)(4)(4)} \\
&= 16\sqrt{3} \text{ cm}^2 \\
\text{Area} &= \frac{1}{2} \times \text{Base} \times \text{Altitude} \\
&= 16\sqrt{3} = \frac{1}{2} \times 8 \times \text{Altitude} \\
&= 16\sqrt{3} = 4 \text{ Altitude} \\
\text{Altitude} &= \frac{16\sqrt{3}}{4} = 4\sqrt{3} \text{ cm.}
\end{aligned}$$

OR

Perimeter = 84 cm.

Ratio of sides = 13 : 14 : 15

Sum of the ratios = 13 + 14 + 15 = 42

$\therefore$  One side (a) =  $\frac{13}{42} \times 84 = 26$  cm.

Second side (b) =  $\frac{14}{42} \times 84 = 28$  cm.

Third side (c) =  $\frac{15}{42} \times 84 = 30$  cm

$$\begin{aligned}
\therefore s &= \frac{a+b+c}{2} \\
&= \frac{26+28+30}{2} = \frac{84}{2} = 42 \text{ cm}
\end{aligned}$$

$\therefore$  Area of the triangle

$$\begin{aligned}
&= \sqrt{s(s-a)(s-b)(s-c)} \\
&= \sqrt{42(42-26)(42-28)(42-30)} \\
&= \sqrt{42(16)(14)(12)} \\
&= \sqrt{42(16)(14)(4 \times 3)} \\
&= (42)(4)(2) = 336 \text{ cm}^2
\end{aligned}$$

29. The value of c for which the linear equation  $2x + cy = 8$  has equal values of x and y

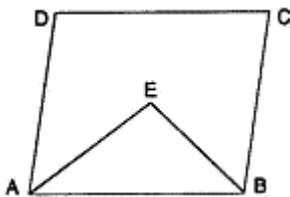
i.e.,  $x = y$  for its solution is

$$2x + cy = 8 \Rightarrow 2x + cx = 8 \quad [\because y = x]$$

$$\Rightarrow cx = 8 - 2x$$

$$\therefore c = \frac{8-2x}{x}, x \neq 0$$

30. Given: ABCD is a parallelogram. The angle bisectors AE and BE of adjacent angles A and B meet at E.



To Prove :  $\angle AEB = 90^\circ$

Proof :  $AD \parallel BC \dots$  [Opposite sides of  $\parallel$  gm]

$\therefore \angle DAB + \angle CBA = 180^\circ \dots$  [As the sum of interior angles on the same side of a transversal is  $180^\circ$ ]

$\Rightarrow 2\angle EAB + 2\angle EBA = 180^\circ \dots$  [As AE and BE are the bisectors of  $\angle DAB$  and  $\angle CBA$  respectively]

$\Rightarrow \angle EAB + \angle EBA = 90^\circ$

In  $\triangle EAB$ ,

$\angle EAB + \angle EBA + \angle AEB = 180^\circ \dots$  [As the sum of three angles of a triangle is  $180^\circ$ ]

$\Rightarrow 90^\circ + \angle AEB = 180^\circ \dots$  [From (1)]

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

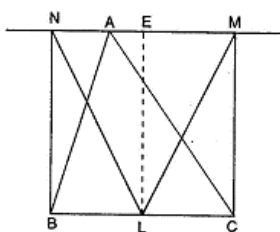
OR

Given: In  $\triangle ABC$ , BN and CM are the perpendicular from B and C respectively on a line passing through the vertex A. L is the mid-point of BC.

To Prove :  $LM = LN$ .

Construction: Draw  $LE \perp MN$ .





Proof :  $BN \parallel LE \parallel CM$  and  $BC$  cuts them such that

$$BL = LC \dots (1)$$

$$\therefore ME = EN \dots [\text{As } MN \text{ cuts them}] \dots (2)$$

In  $\triangle LEM$  and  $\triangle LEN$ ,

$$ME = EN \dots [\text{From (2)}]$$

$$\angle MEL = \angle NEL \dots [\text{Each } 90^\circ]$$

$$LE = LE \dots [\text{Common side}]$$

$$\therefore \triangle LEM \cong \triangle LEN \dots [\text{By SAS axiom}]$$

$$\therefore LM = LN \dots [\text{c.p.c.t.}]$$

31.  $y = x$

We have,  $y = x$

$$\text{Let } x = 1 : y = 1$$

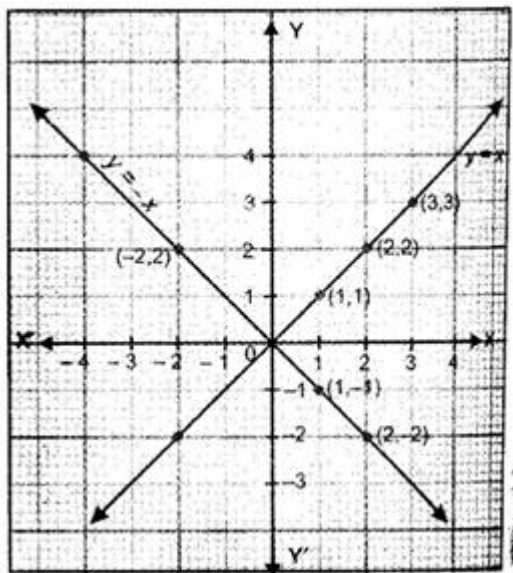
$$\text{Let } x = 2 : y = 2$$

$$\text{Let } x = 3 : y = 3$$

Thus, we have the following table :

x	1	2	3
y	1	2	3

By plotting the points (1, 1), (2, 2) and (3, 3) on the graph paper and joining them by a line, we obtain the graph of  $y = x$ .



$$y = -x$$

We have,  $y = -x$

$$\text{Let } x = 1 : y = -1$$

$$\text{Let } x = 2 : y = -2$$

$$\text{Let } x = -2 : y = -(-2) = 2$$

Thus, we have the following table exhibiting the abscissa and ordinates of the points of the line represented by the equation  $y = -x$ .

x	1	2	-2
y	-1	-2	2

Now, plot the points (1, -1), (2, -2) and (-2, 2) and join them by a line to obtain the line represented by the equation  $y = -x$ .

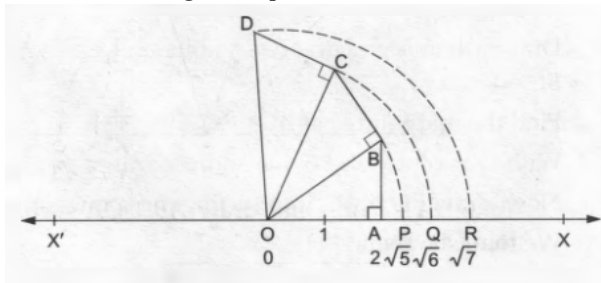
The graphs of the lines  $y = x$  and  $y = -x$  are shown in figure.

Two lines intersect at O (0, 0).

Section D

32. Draw a horizontal line X'OX, taken as the x-axis.

Take O as the origin to represent 0.



Let OA = 2 units and let AB  $\perp$  OA such that AB = 1 unit

Join OB. Then, by Pythagoras Theorem

$$\begin{aligned} OB &= \sqrt{OA^2 + AB^2} \\ &= \sqrt{2^2 + 1^2} \\ &= \sqrt{5} \end{aligned}$$

With O as centre and OB as radius, draw an arc, meeting OX at P.

Then, OP = OB =  $\sqrt{5}$

Thus, P represents  $\sqrt{5}$  or the real line.

Now, draw BC  $\perp$  OB and set off BC = 1 unit.

Join OC. Then, by Pythagoras Theorem

$$OC = \sqrt{OB^2 + BC^2} = \sqrt{(\sqrt{5})^2 + 1^2} = \sqrt{6}$$

With O as centre and OC as radius, draw an arc, meeting OX at Q

Then, OQ = OC =  $\sqrt{6}$

Thus, Q represents  $\sqrt{6}$  on the real line.

Now, draw CD  $\perp$  OC and set off CD = 1 unit.

Join OD. Then, by Pythagoras Theorem

$$OD = \sqrt{OC^2 + CD^2} = \sqrt{(\sqrt{6})^2 + 1^2} = \sqrt{7}$$

With O as centre and OD as radius, draw an arc, meeting OX at R. Then

OR = OD =  $\sqrt{7}$

Thus, the points P, Q, R represent the real numbers  $\sqrt{5}$ ,  $\sqrt{6}$  and  $\sqrt{7}$  respectively

OR

$$\text{Given, } a = \frac{1}{7-4\sqrt{3}} \text{ and } b = \frac{1}{7+4\sqrt{3}},$$

$$\begin{aligned} \text{Now, } a &= \frac{1}{7-4\sqrt{3}} = \frac{1}{7-4\sqrt{3}} \times \frac{7+4\sqrt{3}}{7+4\sqrt{3}} = \frac{7+4\sqrt{3}}{7^2-(4\sqrt{3})^2} \\ &= \frac{7+4\sqrt{3}}{49-16 \times 3} = \frac{7+4\sqrt{3}}{49-48} \end{aligned}$$

$$\therefore a = \frac{1}{7-4\sqrt{3}} = 7 + 4\sqrt{3}$$

$$\begin{aligned} \text{Now, } b &= \frac{1}{7+4\sqrt{3}} = \frac{1}{7+4\sqrt{3}} \times \frac{7-4\sqrt{3}}{7-4\sqrt{3}} = \frac{7-4\sqrt{3}}{7^2-(4\sqrt{3})^2} \\ &= \frac{7-4\sqrt{3}}{49-16 \times 3} = \frac{7-4\sqrt{3}}{49-48} \end{aligned}$$

$$\therefore b = \frac{1}{7+4\sqrt{3}} = 7 - 4\sqrt{3}$$

$$a + b = 7 + 4\sqrt{3} + 7 - 4\sqrt{3} = 14$$

$$ab = (7 + 4\sqrt{3})(7 - 4\sqrt{3})$$

$$= 7^2 - (4(\sqrt{3}))^2$$

$$= 49 - 16 \times 3 = 49 - 48$$

$$\Rightarrow ab = 1$$

$$\text{Now, } a^2 + b^2 = (a + b)^2 - 2ab$$

$$= (14)^2 - 2 \times 1$$

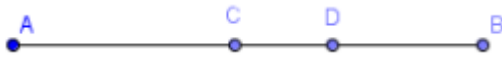
$$= 196 - 2$$

$$\therefore a^2 + b^2 = 194$$

$$\text{Also, } a^3 + b^3 = (a + b)^3 - 3ab(a + b)$$

$$\begin{aligned}
 &= (14)^3 - 3 \times 1 (14) \\
 &= 2744 - 42 \\
 &= 2702
 \end{aligned}$$

33. We need to prove that every line segment has one and only one mid-point. Let us consider the given below line segment AB and assume that C and D are the mid-points of the line segment AB



If C is the mid-point of line segment AB, then  
 $AC = CB$ .

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal."

$$AC + AC = CB + AC \dots (i)$$

From the figure, we can conclude that  $CB + AC$  will coincide with AB.

An axiom of the Euclid says that "Things which coincide with one another are equal to one another."  $AC + AC = AB \dots (ii)$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

Let us compare equations (i) and (ii), to get

$$AC + AC = AB, \text{ or } 2AC = AB \dots (iii)$$

If D is the mid-point of line segment AB, then

$$AD = DB.$$

An axiom of the Euclid says that "If equals are added to equals, the wholes are equal."

$$AD + AD = DB + AD \dots (iv)$$

From the figure, we can conclude that  $DB + AD$  will coincide with AB.

An axiom of the Euclid says that "Things which coincide with one another are equal to one another."

$$AD + AD = AB \dots (v)$$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another."

Let us compare equations (iv) and (v), to get

$$AD + AD = AB, \text{ or}$$

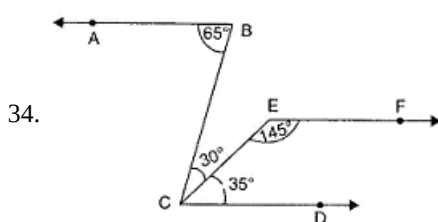
$$2AD = AB \dots (vi)$$

An axiom of the Euclid says that "Things which are equal to the same thing are equal to one another." Let us compare equations (iii) and (vi), to get

$$2AC = 2AD.$$

An axiom of the Euclid says that "Things which are halves of the same things are equal to one another."  $AC = AD$ .

Therefore, we can conclude that the assumption that we made previously is false and a line segment has one and only one mid-point.



$$\angle ABC = 65^\circ$$

$$\angle BCD = \angle BCE + \angle ECD = 30^\circ + 35^\circ = 65^\circ$$

$$\therefore \angle ABC = \angle BCD$$

These angles form a pair of equal alternate angles

$$\therefore AB \parallel CD \dots (1)$$

$$\angle FEC + \angle ECD = 145^\circ + 35^\circ = 180^\circ$$

These angles are consecutive interior angles formed on the same side of the transversal.

$$\therefore CD \parallel EF \dots (2)$$

$$AB \parallel EF \dots [\text{From (1) and (2)}]$$

OR

Through O, draw  $EO \parallel AB \parallel CD$

$$\text{Then, } \angle EOB + \angle EOD = x^\circ,$$

Now,  $AB \parallel EO$  and  $BO$  is the transversal

$$\therefore \angle ABO + \angle BOE = 180^\circ \text{ [consecutive interior angles]}$$



$$\Rightarrow 40^\circ + \angle BOE = 180^\circ$$

$$\Rightarrow \angle BOE = (180^\circ - 40^\circ) = 140^\circ$$

$$\Rightarrow \angle BOE = 140^\circ$$

Again  $CD \parallel EO$  and  $OD$  is the transversal.

$$\therefore \angle EOD + \angle ODC = 180^\circ$$

$$\Rightarrow \angle EOD + 35^\circ = 180^\circ$$

$$\Rightarrow \angle EOD = (180^\circ - 35^\circ) = 145^\circ$$

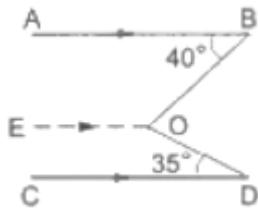
$$\Rightarrow \angle EOD = 145^\circ$$

$$\therefore \text{reflex } \angle BOD = x^\circ = (\angle BOE + \angle EOD)$$

$$= (140^\circ + 145^\circ) = 285^\circ$$

Hence,  $x^\circ = 285^\circ$

$$\Rightarrow \angle BOD = x^\circ = 285^\circ$$



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

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

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

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

$$\text{R.H.S.} = \frac{1}{2}(x + y + z) [(x - y)^2 + (y - z)^2 + (z - x)^2]$$

$$\frac{1}{2}(x + y + z) [(x^2 - 2xy + y^2) + (y^2 - 2yz + z^2) + (z^2 - 2zx + x^2)] \quad [\text{From eq.(i) and (ii)}]$$

$$\frac{1}{2}(x + y + z) (2x^2 + 2y^2 + 2z^2 - 2xy - 2yz - 2zx)$$

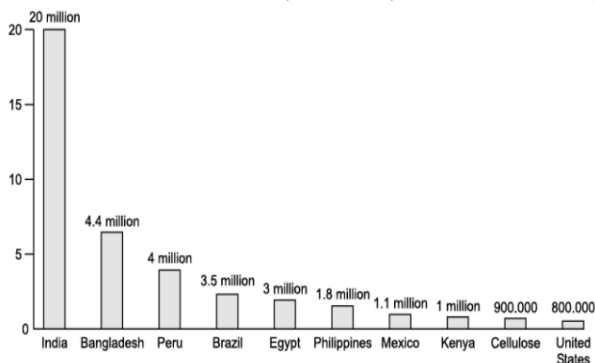
$$(x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx).$$

Therefore, we can conclude that the desired result is verified

### Section E

36. Read the text carefully and answer the questions:

Child labour refers to any work or activity that deprives children of their childhood. It is a violation of children's rights. This can harm them mentally or physically. It also exposes them to hazardous situations or stops them from going to school. Naman got data on the number of child laborers (in million) in different countries that is given below.



(i) The highest number of child laborers are in India and the lowest number of child laborers are in the United States

No. of child laborers in India = 20,000,000

No. of child laborers in United States = 8,00,000

The difference = 20,000,000 - 8,00,000

= 19,200,000

(ii) No. of child laborers in Peru = 4,000,000

No. of child laborers in India = 20,000,000

The percentage =  $\frac{4000000}{20000000} \times 100 = 20\%$

(iii) The countries having child laborers more than 2 million are

Egypt = 3 Million

Brazil = 3.5 million



Peru = 4 million

Bangladesh = 4.4 million

India = 20 million

Total no of these labor child = 3 + 3.5 + 4 + 4.4 + 20 = 34.9 Million.

OR

The countries having child labor more than Mexico are:

Philippines = 1.8 Million

Egypt = 3 Million

Brazil = 3.5 million

Peru = 4 million

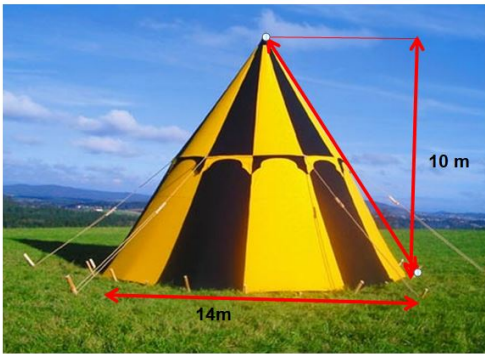
Bangladesh = 4.4 million

India = 20 million

Thus 6 countries are having child labor more than Mexico.

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

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



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

Radius  $r = 7$  m

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

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

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

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

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

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

Radius  $r = 7$  m

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

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

= 513.3 m<sup>3</sup>

(iii) Radius of the floor = 7 m

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

= 154 m<sup>2</sup>

OR

Radius of the floor  $r = 7$  m

Latent height of the tent  $l = 12.2$  m

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

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

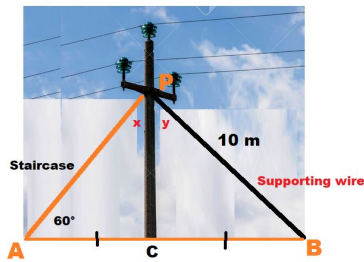
= 22 × 19.2

= 422.4 m<sup>2</sup>

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

As shown In the village of Surya there was a big pole PC. This pole was tied with a strong wire of 10 m length. Once there was a big spark on this pole, thus wires got damaged very badly. Any small fault was usually repaired with the help of a rope which normal board electricians were carrying on bicycles.

This time electricians need a staircase of 10 m so that it can reach at point P on the pole and this should make  $60^\circ$  with line AC.



(i) In  $\triangle APC$  and  $\triangle BPC$

$AP = BP$  (Given)

$CP = CP$  (common side)

$\angle ACP = \angle BCP = 90^\circ$

By RHS criteria  $\triangle APC \cong \triangle BPC$

(ii) In  $\triangle ACP$

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

$\Rightarrow x + 60^\circ + 90^\circ = 180^\circ$  (angle sum property of  $\triangle$ )

$\Rightarrow \angle x = 180^\circ - 150^\circ = 30^\circ$

$\angle x = 30^\circ$

(iii) In  $\triangle APC$  and  $\triangle BPC$

Corresponding part of congruent triangle

$\angle PAC = \angle PBC$

$\Rightarrow \angle PBC = 60^\circ$  (given  $\angle PAC = 60^\circ$ )

OR

In  $\triangle APC$  and  $\triangle BPC$

Corresponding part of congruent triangle

$\angle X = \angle Y$

$\Rightarrow \angle Y = 30^\circ$  (given  $\angle X = 30^\circ$ )