# Class X Session 2024-25
# Subject - Mathematics (Standard)
# Sample Question Paper - 12

**Time: 3 Hours** **Total Marks: 80**

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**General Instructions:**

1. This Question Paper has 5 Sections A - E.
2. Section A has 18 multiple choice questions and 2 Assertion-Reason based questions 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 2 marks questions of Section E.
8. Draw neat figures wherever required. Take π = 22/7 wherever required if not stated.

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## Section A

**Section A consists of 20 questions of 1 mark each.**

Choose the correct answers to the questions from the given options. [20]

**1.** Each rational number can be represented as p/q, such that______

A. p and q are co-prime
B. p and q are even numbers
C. p and q are odd numbers
D. p and q are equal to prime numbers

**2.** Find the zeroes of the following quadratic polynomial $x^2 - 2x - 8$.

A. 2 and 4
B. 4 and −2
C. ±2
D. −2 and −4

**3.** Sum of the zeroes of the polynomial $x^2 - 5x + 6 = 0$ is...

A. 3
B. 2
C. 5
D. 6

**4.** The sum of two numbers is 18, and they are alternate even numbers, find the largest out of the two.

A. 4
B. 6
C. 8
D. 10

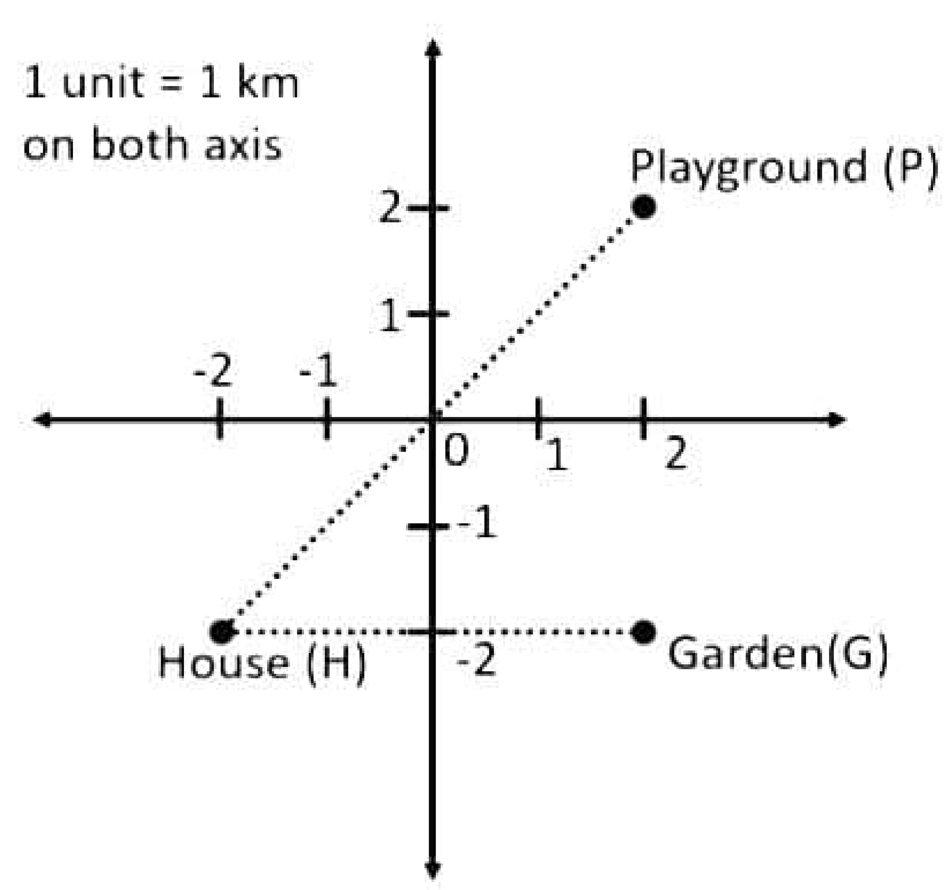
**5.** The lines represented by system of equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are not parallel if

A. $a_1b_2 \neq a_2b_1$
B. $\frac{a_1}{a_2} = \frac{b_1}{b_2}$
C. $\frac{a_1}{b_2} \neq \frac{b_1}{a_2}$
D. $a_1b_1 = a_2b_2$

**6.** Any point on x axis will have...

A. Both x and y coordinate zero
B. x coordinate zero
C. y coordinate zero
D. Both x and y coordinate 1

**7.** Given below, is the graph showing the location of Raju's house, garden and playground.




Now, which of the following options is incorrect?

A. d(HP) > d(HG)
B. d(GP) = d(HG)
C. d(HP) < d(GP)
D. d(HP) > d(GP)

**8.** P and Q are points on sides AB and AC, respectively, of ΔABC. If AP = 3 cm, PB = 6 cm, AQ = 5 cm and QC = 10 cm, then BC =?

A. 4PQ
B. 3PQ
C. 2PQ
D. PQ

**9.** ΔABC ~ ΔDEF, such that AB = 3 cm, BC = 2 cm, CA = 2.5 cm, EF = 4 cm. The perimeter of ΔDEF is

A. 15 cm
B. 20 cm
C. 12 cm
D. 18 cm

**10.** The perimeters of two similar triangles ABC and PQR are 32 cm and 24 cm, respectively. If PQ = 12 cm, then find AB.

A. 12 cm
B. 16 cm
C. 18 cm
D. 23 cm

**11.** Find the value of sec A, if tan A = $\sqrt{3}$.

A. 2
B. −2
C. ±2
D. None of these

**12.** sin 2A = $\sqrt{3}$ sin A for the value of A =

A. 30°
B. 45°
C. 60°
D. 90°

**13.** If ΔABC is right angled at C, then find the value of cos (A + B).

A. 0
B. −1
C. 1
D. 2

**14.** The total surface area of a right circular cylinder is given by...

A. $2\pi r(r + h)$
B. $2\pi r(r - h)$
C. $2r(r + h)$
D. $\pi r(r + h)$

**15.** The length of a chain used as the boundary of a semi-circular park is 90 m. Find the area of the park.

A. 481.5 $m^2$

B. 481.35 $m^2$

C. 4812.5 $m^2$

D. 481.25 $m^2$

**16.** Find the mode

| Marks obtained | Frequency |
|---|---|
| 15 | 11 |
| 21 | 15 |
| 24 | 20 |
| 26 | 30 |
| 28 | 14 |
| 29 | 10 |

A. 21

B. 24

C. 26

D. 29

**17.** 250 lottery tickets were sold and there are 5 prizes on these tickets. If Kunal has purchased one lottery ticket, what is the probability that he wins a prize?

A. $\frac{1}{50}$

B. $\frac{1}{25}$

C. $\frac{1}{5}$

D. 1

**18.** The median of a distribution divides it into

A. Two equal parts

B. Three equal parts

C. Four equal parts

D. Does not divide into any parts

**DIRECTION**: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option

**19.** **Statement A (Assertion):** If the points A(4, 3) and B(x, 5) lie on a circle with centre O(2, 3), then the value of x is 2.

**Statement R (Reason):** Centre of a circle is the mid-point of each chord of the circle.

A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
B. Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
C. Assertion (A) is true but reason (R) is false.
D. Assertion (A) is false but reason (R) is true.

**20. Statement A (Assertion):** $\frac{4}{5}$, a, 2 are three consecutive terms of an AP only if $a = \frac{7}{5}$.

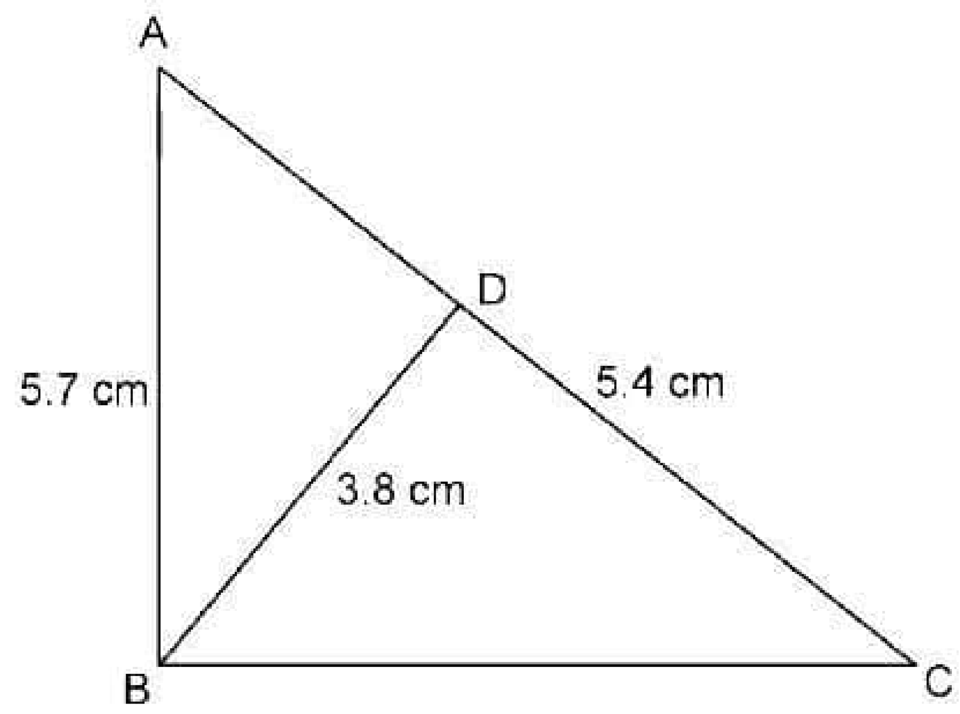
**Statement R (Reason):** If p, q and r are in A.P then $q - p = r - q$.

A. Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
B. Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
C. Assertion (A) is true but reason (R) is false.
D. Assertion (A) is false but reason (R) is true.

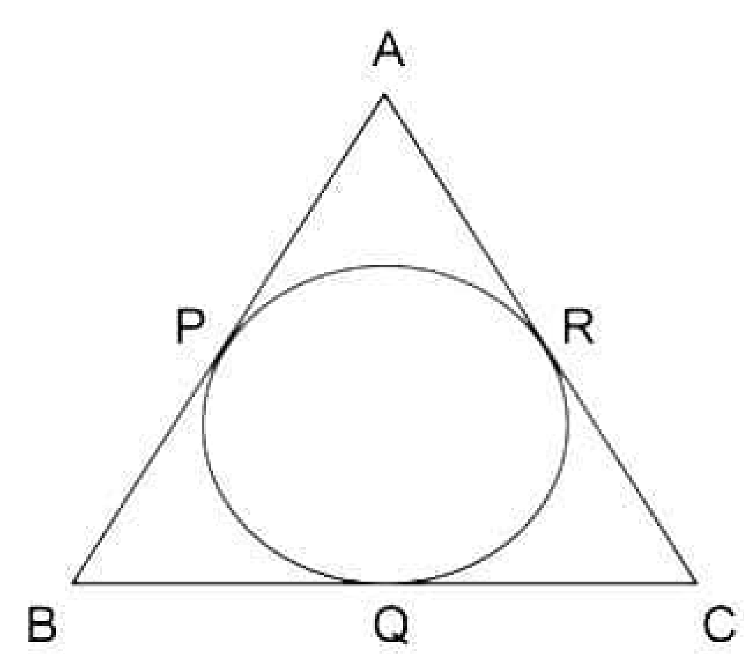
## Section B

21. If HCF (185, 25) = 5, then find LCM (185, 25). [2]

22. In the given figure, $\angle ABC = 90^\circ$ and $BD \perp AC$. If AB = 5.7 cm, BD = 3.8 cm and CD = 5.4 cm, find BC. [2]




23. A circle is inscribed in a $\Delta ABC$, touching AB, BC and AC at P, Q and R, respectively. If AB = 10 cm, AR = 7 cm and CR = 5 cm, find the length of BC.[2]




24. Prove: $\frac{\sin\theta}{\operatorname{cosec}\theta} + \frac{\cos\theta}{\sec\theta} = 1$ [2]

**OR**

Show that cos 1° cos 2° cos 3°.....cos 180° = 0

25. The inner circumference of a circular track is 440 m, and the track is 14 m wide. Calculate the length of the outer boundary of the track. [2]

**OR**

A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding minor sector. (Use $\pi = 3.14$)

## Section C

**Section C consists of 6 questions of 3 marks each.**

**26.** There is a circular path around a sports field. Sonia takes 18 minutes to drive one round of the field, while Ravi takes 12 minutes for the same. Suppose they both start at the same point and at the same time, and go in the same direction. After how many minutes will they meet again at the starting point?[3]

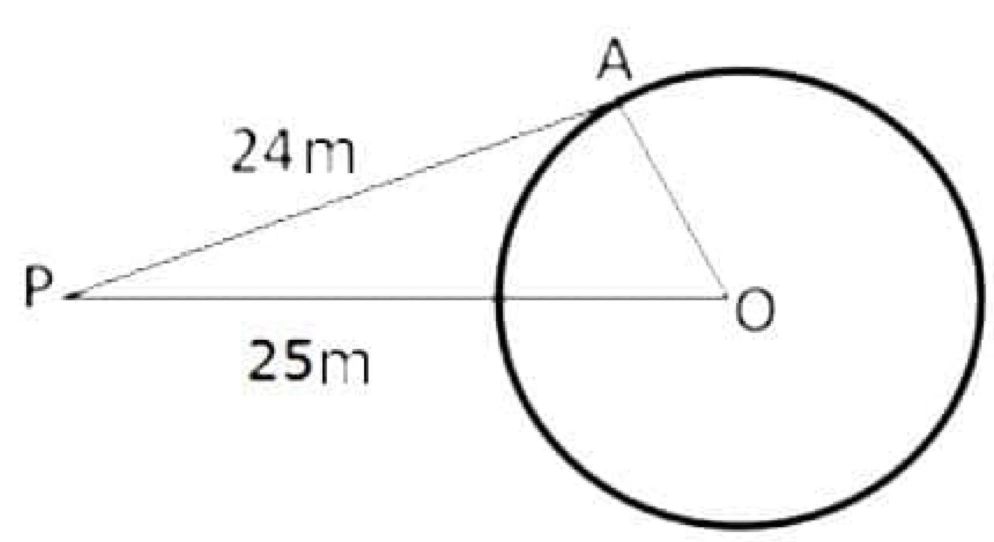
**27.** A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was Rs. 90, find the number of articles produced and the cost of each article. [3]

**28.** The coach of a cricket team buys 7 bats and 6 balls for Rs. 3800. Later, she buys 3 bats and 5 balls for Rs. 1750. Find the cost of each bat and each ball.[3]

**OR**

Five years hence, the age of Jacob will be three times that of his son. Five years ago, Jacob's age was seven times that of his son. What are their present ages?

**29.** Arjun is standing at a point P, which is 25 m away from the centre (O) of a circular park, and the length of a road from the point P to the gate of the park (A) is 24 m. [3]




Find the distance from the centre of the park to the gate.

**OR**

If two tangents inclined at an angle of 60° are drawn to a circle of radius 3 cm, then find the length of each tangent.

**30.** Express the trigonometric ratios sin A, sec A and tan A in terms of cot A. [3]

**31.** A box contains 20 balls bearing numbers 1, 2, 3, ..., 20, respectively. A ball is taken out at random from the box. What is the probability that the number on the ball is [3]

i. an odd number?
ii. divisible by 2 or 3?
iii. a prime number?
iv. not divisible by 10?

## Section D

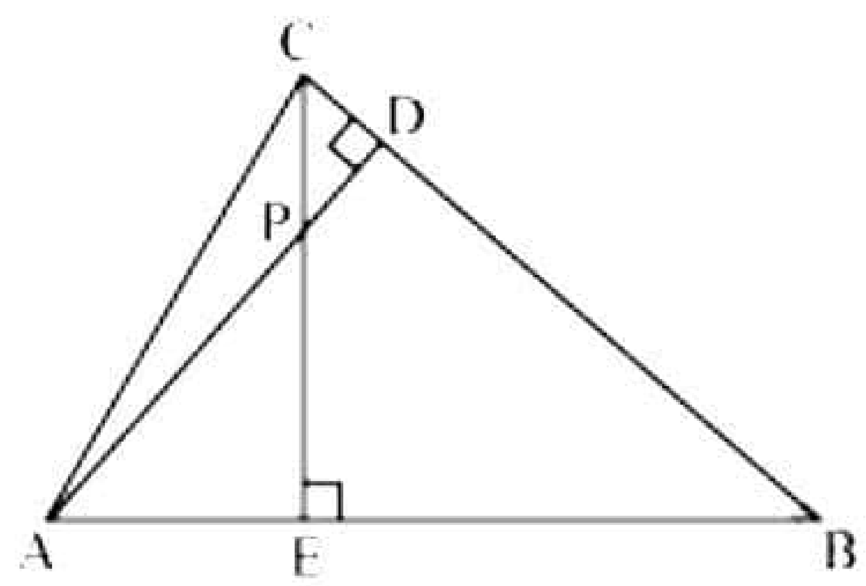
**Section D consists of 4 questions of 5 marks each.**

**32.** The sum of the reciprocals of Rehman's ages, (in years) 3 years ago and 5 years from now is $\frac{1}{3}$. Find his present age. [5]

**OR**

A rectangular field is 16 m long and 10 m wide. There is a path of uniform width all around it with an area of 120 $m^2$. Find the width of the path. [5]

**33.** In the figure, altitudes AD and CE of ΔABC intersect each other at the point P. Show that [5]




i. $\Delta AEP \sim \Delta CDP$
ii. $\Delta ABD \sim \Delta CBE$
iii. $\Delta AEP \sim \Delta ADB$
iv. $\Delta PDC \sim \Delta BEC$

**34.** A tent is in the shape of a right circular cylinder up to a height of 3 m and conical above it. The total height of the tent is 13.5 m, and the radius of its base is 14 m. Find the cost of cloth required to make the tent at the rate of Rs. 80 per square metre. Take $\pi = 22/7$. [5]

**OR**

A solid iron pole consists of a cylinder of height 220 cm and base diameter 24 cm, which is surmounted by another cylinder of height 60 cm and radius 8 cm. Find the mass of the pole, given that 1 $cm^3$ of iron has approximately 8 g mass. (Use π = 3.14)

**35.** The following distribution shows the daily pocket allowance of children of a locality. The mean pocket allowance is Rs. 18. Find the missing frequency f. [5]

| Daily pocket allowance (in Rs.) | 11 – 13 | 13 – 15 | 15 –17 | 17 – 19 | 19 – 21 | 21 – 23 | 23 – 25 |
|---|---|---|---|---|---|---|---|
| Number of children | 7 | 6 | 9 | 13 | f | 5 | 4 |

## Section E

**Case study based questions are compulsory.**

**36.** Rakesh is much worried about his upcoming assessment on A.P. He was vigorously practicing for the exam but unable to solve some questions. One of these questions is as shown below. If the $3^{rd}$ and the $9^{th}$ terms of an A.P. are 4 and −8 respectively, then help Rakesh in solving the problem.

i. What is the common difference? [1]

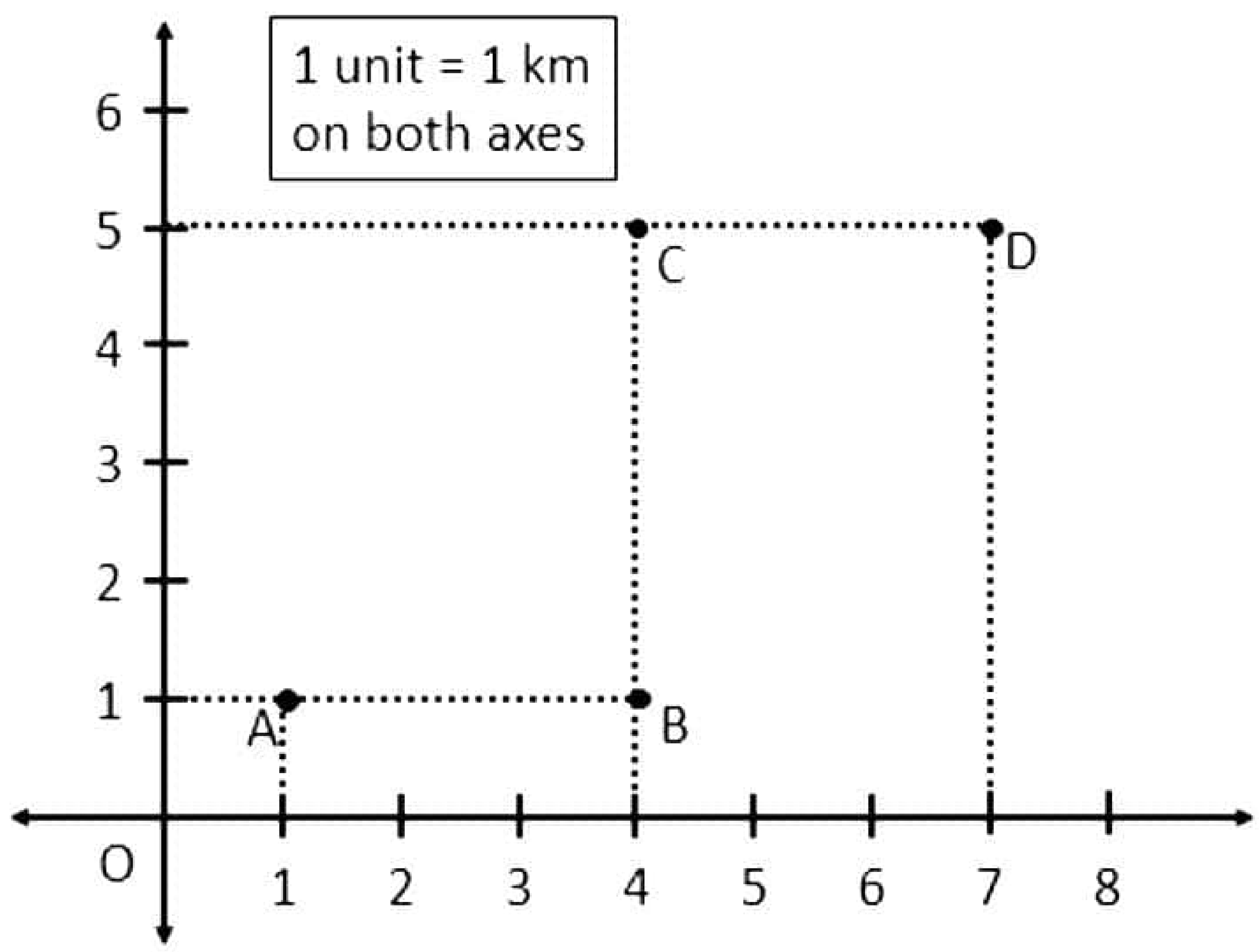
ii. What is the first term? [1]

iii. Which term of the A.P. is −160? [2]

**OR**

What is the $75^{th}$ term of the A.P.? [2]

**37.** Amey runs a grocery store that offers home delivery of fresh groceries to its customers. His store is located at location A as indicated in the graph below. Now, he receives regular orders from the families living in the colonies located at B, C and D. Now, using the data given, answer the following questions.




i. Find the shortest distance between locations A and C. [2]

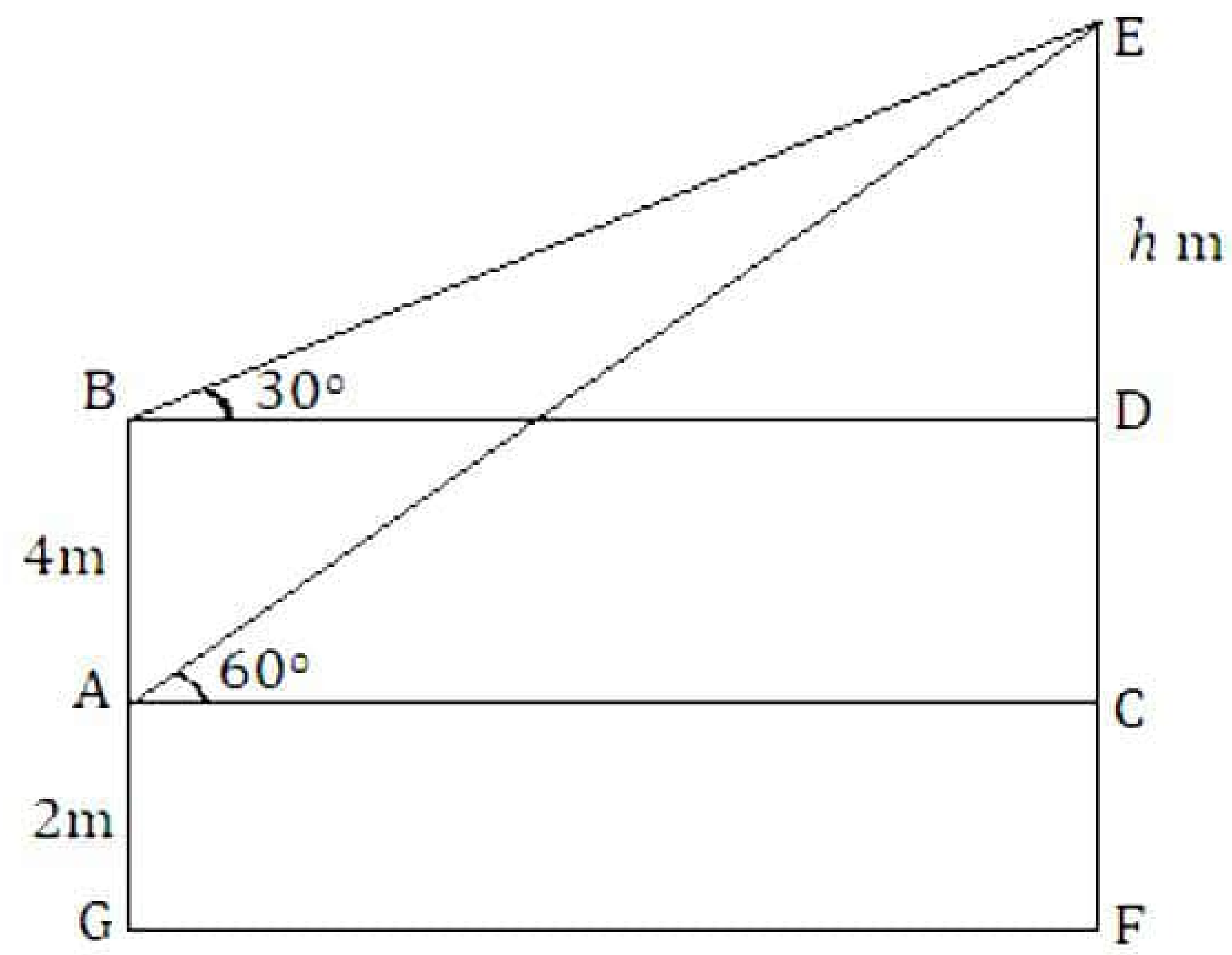
**OR**

Find the shortest distance between locations B and D. [2]

ii. Find the shortest distance between locations B and A. [1]

iii. Find the shortest distance between locations C and B. [1]

**38.** Reema's house has two windows. First is at the height of 2 m above the ground and the second is at the height of 4 m above the first window. Reema and her brother Rishabh are watching outside from the two windows at points A and B respectively. Now, the angles of elevation of an airplane from these windows are observed to be 60° and 30° as shown below.




Based on the above information, answer the following questions.

i. Who is more far from the airplane? [1]

ii. Find the length of BD in terms of h. [2]

**OR**

The value of h is ____. [2]

iii. Find the distance between the airplane and the ground. [1]

# Solution

## Section A

**1.** Correct option: A
Explanation:
Each rational number can be represented as p/q, such that p and q are co-prime, which means their HCF is 1, and q is not equal to zero.

**2.** Correct option: B
Explanation:
$x^2 - 2x - 8 = 0$
$\Rightarrow x - 4 = 0$ or $x + 2 = 0$
$\Rightarrow x = 4$ or $x = -2$
So, the zeroes of $x^2 - 2x - 8$ are 4 and $-2$.

**3.** Correct option: C
Explanation:
$x^2 - 5x + 6=0$
$x^2 - 3x - 2x + 6=0$
$(x - 3)(x - 2)=0$
$x = 3$ or 2
sum = 3 + 2 = 5

**4.** Correct Option: D
Explanation:
Let the two numbers be x and y, hence
$x + y = 18$ ..... (i)
$x - y = 2$ ..... (ii)
Alternate even numbers have difference 2.
From (i) and (ii), we get
$2x = 20 \Rightarrow x = 10$
Substituting $x = 10$ in equation (i), we get
$x + y = 18 \Rightarrow y = 18 - 10 = 8$

**5.** Correct Option: A
Explanation:
The lines represented by system of equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are not parallel if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, that is $a_1b_2 \neq a_2b_1$.

**6.** Correct Option: C
Explanation:
Any point on x axis will have y coordinate zero

**7.** Correct Option: C

Explanation:

Using the graph, we get the coordinates as

H(-2, -2), G(2, -2) and P(2, 2)

Hence, by using distance formula

$$d(HG) = \sqrt{(-2-2)^2 + (-2+2)^2} = \sqrt{16} = 4 \text{ km}$$

$$d(HP) = \sqrt{(-2-2)^2 + (-2-2)^2} = \sqrt{16+16} = 4\sqrt{2} \text{ km}$$

$$d(GP) = \sqrt{(2-2)^2 + (-2-2)^2} = \sqrt{16} = 4 \text{ km}$$

Hence,

d(HP) > d(GP)

d(HP) > d(HG)

d(GP) = d(HG)

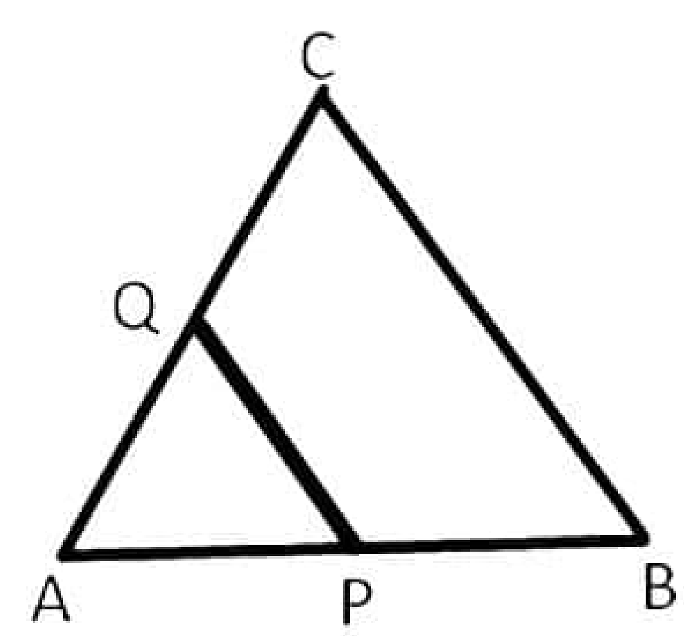
So, the incorrect option is d(HP) < d(GP).

**8.** Correct option: B

Explanation:

AB = AP + PB = 9 cm

AC = AQ + QC = 15 cm




$$\frac{AP}{AB} = \frac{3}{9} = \frac{1}{3}$$

$$\frac{AQ}{AC} = \frac{5}{15} = \frac{1}{3}$$

$$\frac{AP}{AB} = \frac{AQ}{AC}$$

$\angle A = \angle A$

So $\Delta APQ \sim \Delta ABC$ by SAS test.

$$\frac{AP}{AB} = \frac{AQ}{AC} = \frac{PQ}{BC} = \frac{1}{3}$$

$\Rightarrow BC = 3PQ$

**9.** Correct option: A

Explanation:

$\Delta ABC \sim \Delta DEF$

$$\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$$

$$\Rightarrow \frac{3}{DE} = \frac{2.5}{DF} = \frac{2}{4}$$

$\Rightarrow DE = 6 \text{ cm}, DF = 5 \text{ cm}$

$\text{Perimeter} = 4 + 5 + 6 = 15 \text{ cm}$

**10.** Correct Option: B

Explanation:

Let AB = x cm

As $\Delta ABC$ and $\Delta PQR$ are similar triangles, so the corresponding sides of both triangles are proportional.

$$\Rightarrow \frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta PQR} = \frac{AB}{PQ}$$

$$\Rightarrow \frac{x}{12} = \frac{32}{24}$$

$$\Rightarrow x = \frac{32 \times 12}{24} = 16 \text{ cm}$$

Hence, AB = 16 cm.

**11.** Correct option: C

Explanation:

$\tan A = \sqrt{3}$

Now, $\sec^2 A = 1 + \tan^2 A$

$$\Rightarrow \sec^2 A = 1 + \left(\sqrt{3}\right)^2 = 1 + 3 = 4$$

$$\Rightarrow \sec A = \pm 2$$

**12.** Correct Option: A

Explanation:

Consider $A = 30°$, hence $2A = 60°$

$$\Rightarrow \sin 2A = \sin 60° = \frac{\sqrt{3}}{2} \quad \text{.... (i)}$$

$$\sqrt{3}\sin A = \sqrt{3}\sin 30° = \frac{\sqrt{3}}{2} \quad \text{....(ii)}$$

From (i) and (ii),

$\sin 2A = \sqrt{3}\sin A$ for $A = 30°$

**13.** Correct Option: A

Explanation:

$\Delta ABC$ is right angled at C.

Now, $\angle A + \angle B + \angle C = 180°$

$$\Rightarrow A + B + C = 180° \Rightarrow A + B + 90° = 180° \Rightarrow A + B = 90°$$

$$\therefore \cos(A + B) = \cos 90° = 0$$

**14.** Correct option: A

Explanation:

The total surface area of a right circular cylinder is given by $2\pi rh + 2\pi r^2$

$= 2\pi r(r + h)$

**15.** Correct option: D
Explanation:
Let the radius of the park be r metres.

Thus, $\pi r + 2r = 90 \Rightarrow \frac{22r}{7} + 2r = 90$

$\Rightarrow \frac{36r}{7} = 90 \Rightarrow r = \frac{90 \times 7}{36}$

$r = 17.5 \text{ m}$

Area of semicircle $= \frac{1}{2}\pi r^2 = \left(\frac{1}{2} \times \frac{22}{7} \times 17.5 \times 17.5\right) m^2$

$= 481.25 \text{ m}^2$

**16.** Correct Option: C
Explanation:
The marks with the highest frequency will be the mode, hence mode is 26.

**17.** Correct option: A
Explanation:
Number of lottery tickets = 250, Number of prize tickets = 5

So, the probability $= \frac{5}{250} = \frac{1}{50}$

**18.** Correct Option: A
Explanation:
The median is the middle value of a variable of a distribution which divides it into two equal parts. It is the value of the variable such that the number of observations above it is equal to the number of observations below it.

**19.** Correct Option: C
Explanation:
AO and OB are radii of the same circle
$\Rightarrow$ AO = OB
$\therefore \sqrt{(4-2)^2 + (3-3)^2} = \sqrt{(x-2)^2 + (5-3)^2}$
$\therefore$ x = 2
So, the assertion is true.
And, centre of a circle is not always the mid-point of each chord of the circle.
So, the reason is false.

**20.** Correct Option: A
Explanation:
$\frac{4}{5}$, a, 2 are in A.P.
We know that, if p, q and r are in A.P then q – p = r – q.
So, the reason is true.

$\therefore\ a - \frac{4}{5} = 2 - a$

$\Rightarrow 2a = 2 + \frac{4}{5} = \frac{14}{5}$

$\Rightarrow a = \frac{7}{5}$

Hence, the assertion is true and reason is the correct explanation of assertion.

## Section B

21. According to the question,

HCF (185, 25) = 5

HCF × LCM = Product of numbers

$\Rightarrow$ LCM = $\frac{185 \times 25}{5}$ $\Rightarrow$ LCM = 925

22. Given, AB = 5.7 cm, BD = 3.8 cm and CD = 5.4 cm.

In $\Delta CBA$ and $\Delta CDB$,

$\angle CBA = \angle CDB = 90^\circ$

And $\angle C = \angle C$ (Common)

$\Delta CBA \sim \Delta CDB$ (by AA similarity)

$\Rightarrow \frac{BC}{5.4} = \frac{5.7}{3.8}$

$\Rightarrow \frac{CB}{CD} = \frac{BA}{DB}$

$\Rightarrow BC = \frac{5.7 \times 5.4}{3.8} = 8.1$ cm

Hence, BC = 8.1 cm.

23. A circle is inscribed in a triangle ABC touching AB, BC and CA at P, Q and R, respectively.

Also, AB = 10 cm, AR = 7 cm, CR = 5 cm

AR and AP are the tangents to the circle.

$\therefore$ AP = AR = 7 cm

AB = 10 cm

$\therefore$ BP = AB − AP = (10 − 7) = 3 cm

Also, BP and BQ are tangents to the circle.

$\therefore$ BP = BQ = 3 cm

Further, CQ and CR are tangents to the circle.

$\therefore$ CQ = CR = 5 cm

BC = BQ + CQ = (3 + 5) cm = 8 cm

Hence, BC = 8 cm

24.

$$\text{L.H.S.} = \frac{\sin\theta}{\operatorname{cosec}\theta} + \frac{\cos\theta}{\sec\theta}$$

$$= \sin\theta\sin\theta + \cos\theta\ \cos\theta$$

$$= \sin^2\theta + \cos^2\theta$$

$$= 1$$

$$= \text{R.H.S.}$$

**OR**

$$\text{L.H.S.} = \cos\ 1^\circ \cos\ 2^\circ \cos 3^\circ \ldots \cos 180^\circ$$

$$= \cos\ 1^\circ \cos\ 2^\circ \cos 3^\circ \ldots \cos 90^\circ \ldots \cos 180^\circ$$

$$= \cos\ 1^\circ \cos\ 2^\circ \cos 3^\circ \ldots . \times 0 \times \ldots \cos 180^\circ$$

$$(\text{Since } \cos 90^\circ = 0)$$

$$= 0$$

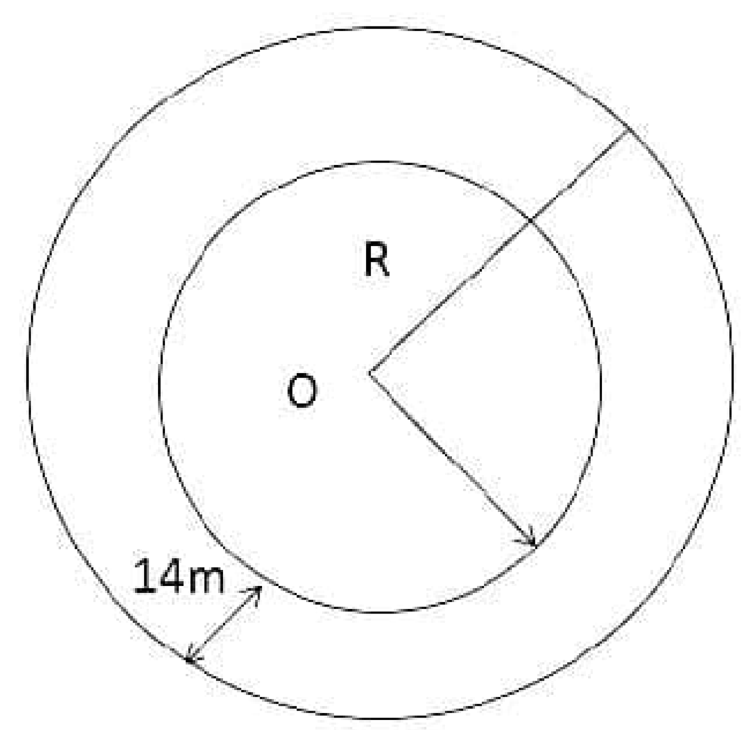
$$= \text{R.H.S.}$$

25. Let the inner and outer radii of the circular tracks be r metres and R metres, respectively.
Now, inner circumference = 440 metres

$\Rightarrow 2\pi r = 440$

$\Rightarrow 2 \times \frac{22}{7} \times r = 440$

$\Rightarrow r = 70$ m




Since the track is 14 m wide everywhere,
Therefore,
Outer radius R = r + 14 m = (70 + 14) m = 84 m
$\therefore$ Outer circumference = $2\pi R$

$= \left(2 \times \frac{22}{7} \times 84\right) m = 528$ m

$\therefore$ Total length of the outer boundary of the track = 528 m.

**OR**

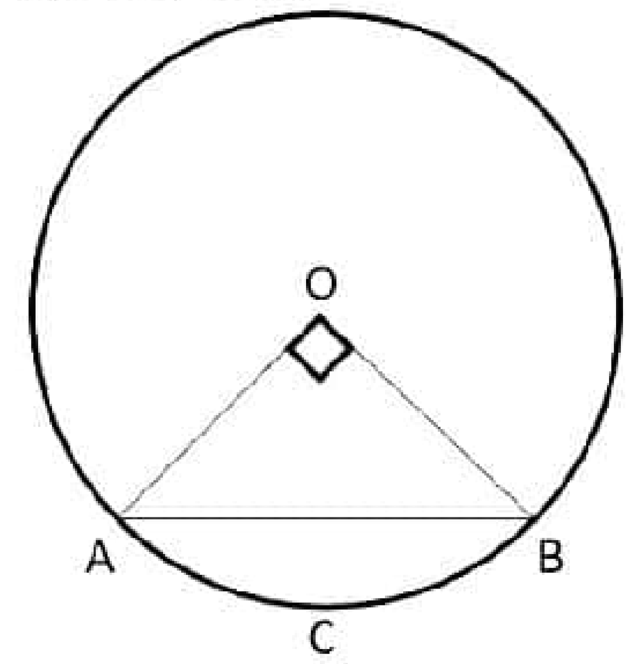
Let AB be the cord of circle subtending 90° angle at centre O of circle.

Area of minor sector OACB $= \frac{90^\circ}{360^\circ} \times \pi r^2$

$$= \frac{1}{4} \times \frac{22}{7} \times 10 \times 10$$

$$= \frac{1100}{14}$$

$$= 78.57 \text{ cm}^2$$



## Section C

**26.** It can be observed that Ravi and Sonia do not take the same amount of time. Ravi takes less time than Sonia to complete 1 round of the circular path.
As they are going in the same direction, they will meet again at the same time when Ravi has completed one round of that circular path with respect to Sonia. i.e., when Sonia completes one round, then Ravi completes 1.5 rounds.
So they will meet first at a time that is a common multiple of the time it takes them to complete one round, i.e., LCM of 18 minutes and 12 minutes.
Now,
$18 = 2 \times 3 \times 3 = 2 \times 3^2$
And, $12 = 2 \times 2 \times 3 = 2^2 \times 3$
LCM of 12 and 18 = product of factors raised to highest exponent = $2^2 \times 3^2 = 36$
Therefore, Ravi and Sonia will meet at the starting point after 36 minutes.

**27.** Let the number of articles produced be $x$.
Therefore, the cost of production of each article = Rs. $(2x + 3)$
It is given that the total cost of production is Rs. 90.

$$\therefore x(2x+3) = 90$$
$$\Rightarrow 2x^2 + 3x - 90 = 0$$
$$\Rightarrow 2x^2 + 15x - 12x - 90 = 0$$
$$\Rightarrow x(2x+15) - 6(2x+15) = 0$$
$$\Rightarrow (2x+15)(x-6) = 0$$

Either $2x + 15 = 0$ or $x - 6 = 0$, i.e., $x = \frac{-15}{2}$ or $x = 6$
As the number of articles produced can only be a positive integer, therefore, $x$ can only be 6.
Hence, number of articles produced = 6
Cost of each article = $2 \times 6 + 3$ = Rs. 15

**28.** Let the cost of a bat and a ball be Rs. x and Rs. y respectively.
According to the given information,

$$7x + 6y = 3800 \quad (1)$$
$$3x + 5y = 1750 \quad (2)$$

From (1), we obtain

$$y = \frac{3800 - 7x}{6} \quad (3)$$

Substituting this value in equation (2), we obtain

$$3x + 5\left(\frac{3800 - 7x}{6}\right) = 1750$$

$$3x + \frac{9500}{3} - \frac{35x}{6} = 1750$$

$$3x - \frac{35x}{6} = 1750 - \frac{9500}{3}$$

$$\frac{18x - 35x}{6} = \frac{5250 - 9500}{3}$$

$$-\frac{17x}{6} = \frac{-4250}{3}$$

$$17x = 8500$$

$$x = 500 \qquad (4)$$

Substituting this in equation (3), we obtain

$$y = \frac{3800 - 7 \times 500}{6} = \frac{300}{6} = 50$$

Hence, the cost of a bat is Rs. 500 and that of a ball is Rs. 50.

**OR**

Let the present age of Jacob be x years and the age of his son be y years.
According to the given information,

$$(x + 5) = 3(y + 5)$$

$$x - 3y = 10 \qquad (1)$$

$$(x - 5) = 7(y - 5)$$

$$x - 7y = -30 \qquad (2)$$

Subtracting (2) from (1),

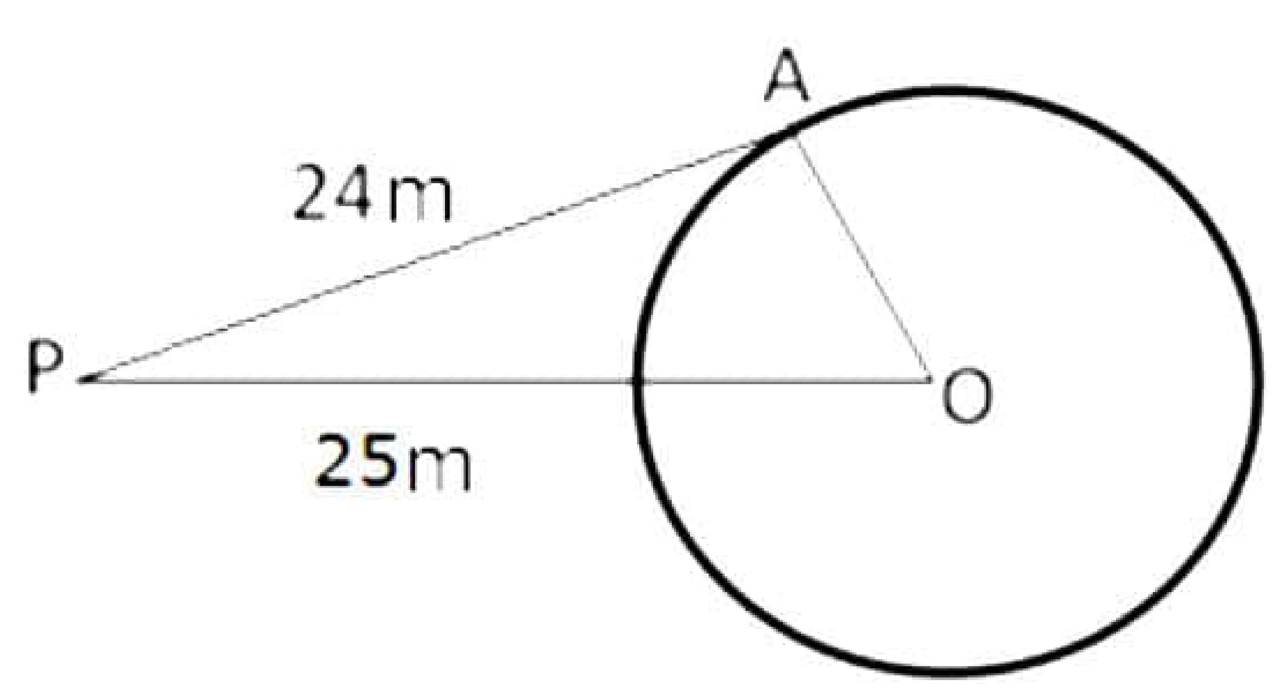
$4y = 40 \Rightarrow y = 10$

Substituting this value in equation (1), we obtain

$x - 3(10) = 10 \Rightarrow x = 40$

Hence, the present age of Jacob is 40 years and that of his son is 10 years.

**29.** PA is the tangent to the circle with centre O, such that PO = 25 m, PA = 24 m.
In $\triangle PAO$, $\angle A = 90^\circ$ (since tangent $\perp$ radius)




By Pythagoras' theorem,

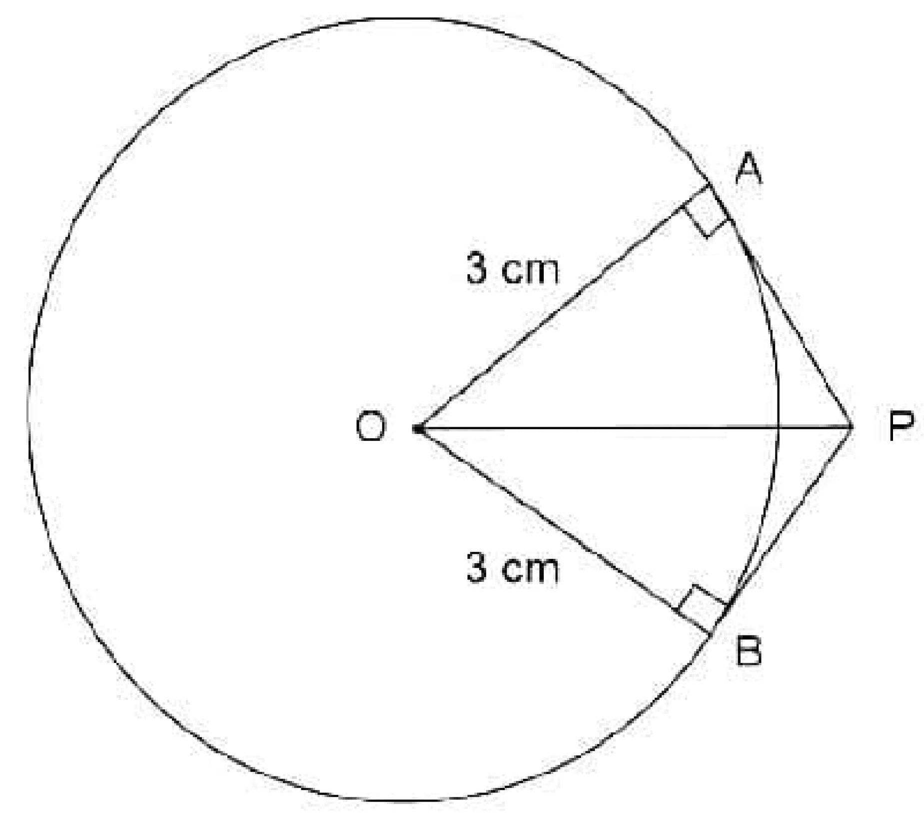
$PO^2 = PA^2 + OA^2$

$OA^2 = PO^2 - PA^2 = 25^2 - 24^2 = (25 - 24)(25 + 24) = 49$ m

So, OA = 7 m

Hence, the distance from the centre of the park to the gate is 7 m.

**OR**




Let P be the external point and PA and PB be the tangents such that,

$\angle APB = 60^{\circ}$.

Now OA and OB are the radii of the circle.

$\therefore$ OA = OB = 3 cm

Also we know that the tangents drawn from an external point are equally inclined to the line joining the point to the centre.

$$\Rightarrow \angle OPA = \angle BPO = \frac{\angle APB}{2} = \frac{60^{\circ}}{2} = 30^{\circ}$$

Now, in $\triangle OAP$

$\angle OPA = 30^{\circ}$

$$\Rightarrow \tan 30^{\circ} = \frac{OA}{AP}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{3}{AP}$$

$$\Rightarrow AP = 3\sqrt{3} \text{ cm} = BP$$

Hence, the length of each tangent is $3\sqrt{3}$ cm.

**30.** We know that

$$\text{cosec}^2 A = 1 + \cot^2 A$$

$$\frac{1}{\text{cosec}^2 A} = \frac{1}{1 + \cot^2 A}$$

$$\sin^2 A = \frac{1}{1 + \cot^2 A}$$

$$\sin A = \pm \frac{1}{\sqrt{1 + \cot^2 A}}$$

But $\sqrt{1 + \cot^2 A}$ will be always positive as we are adding two positive quantities.

$$\text{So, } \sin A = \frac{1}{\sqrt{1 + \cot^2 A}}$$

We know that $\tan A = \dfrac{\sin A}{\cos A}$

But $\cot A = \dfrac{\cos A}{\sin A}$

So, $\tan A = \dfrac{1}{\cot A}$

Also $\sec^2 A = 1 + \tan^2 A$

$$= 1 + \frac{1}{\cot^2 A}$$

$$= \frac{\cot^2 A + 1}{\cot^2 A}$$

$$\sec A = \frac{\sqrt{\cot^2 A + 1}}{\cot A}$$

**31.** Total number of balls = 20

i. Odd numbers are 1, 3, 5, 7, 9, 11, 13, 15, 17, 19.
Total no. of odd numbers = 10

$\therefore$ P(getting an odd number) = $\frac{10}{20} = \frac{1}{2}$

ii. Numbers divisible by 2 or 3 are 2, 3, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20.
Total no. of numbers divisible by 2 or 3 = 13

P(getting a number divisible by 2 or 3) = $\frac{13}{20}$

iii. Prime numbers are 2, 3, 5, 7, 11, 13, 17, 19
Total no. of prime numbers = 8

P(getting a prime number) = $\frac{8}{20} = \frac{2}{5}$

iv. Numbers divisible by 10 are 10, 20.
Total numbers divisible by 10 = 2

$\therefore$ P(getting a number not divisible by 10) = $\left(1 - \frac{2}{20}\right) = \frac{18}{20} = \frac{9}{10}$

## Section D

**32.** Let the present age of Rehman be x years.

Three years ago, his age was (x – 3) years.

Five years hence, his age will be (x + 5) years.

It is given that the sum of the reciprocals of Rehman's ages 3 years ago and 5 years from now is $\frac{1}{3}$.

$$\therefore \frac{1}{x-3}+\frac{1}{x+5}=\frac{1}{3}$$

$$\frac{x+5+x-3}{(x-3)(x+5)}=\frac{1}{3}$$

$$\frac{2x+2}{(x-3)(x+5)}=\frac{1}{3}$$

$$\Rightarrow 3(2x+2)=(x-3)(x+5)$$

$$\Rightarrow 6x+6=x^2+2x-15$$

$$\Rightarrow x^2-4x-21=0$$

$$\Rightarrow x^2-7x+3x-21=0$$

$$\Rightarrow x(x-7)+3(x-7)=0$$

$$\Rightarrow (x-7)(x+3)=0$$

$$\Rightarrow x=7,-3$$

However, age cannot be negative.

Therefore, Rehman's present age is 7 years.

**OR**

Let the width of the path be x metres.

Then, Area of the path = 16 × 10 – (16 – 2x)(10 – 2x) = 120

$\Rightarrow 16 \times 10 - \left(160 - 32x - 20x + 4x^2\right) = 120$

$\Rightarrow 160 - 160 + 32x + 20x - 4x^2 = 120$

$\Rightarrow -4x^2 + 52x - 120 = 0$

$\Rightarrow x^2 - 13x + 30 = 0$

$\Rightarrow x^2 - 10x - 3x + 30 = 0$

$\Rightarrow x(x - 10) - 3(x - 10) = 0$

$\Rightarrow (x - 10)(x - 3) = 0$

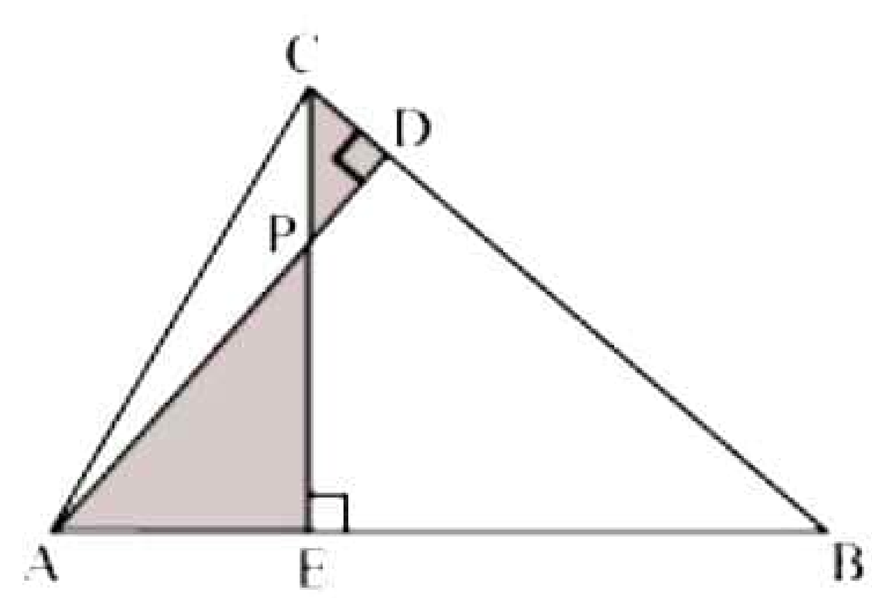
$\Rightarrow x - 10 = 0 \text{ or } x - 3 = 0$

$\Rightarrow x = 10 \text{ or } x = 3$

Hence, the required width is 3 metres as x cannot be 10 m since the width of the path cannot be greater than or equal to the width of the field.

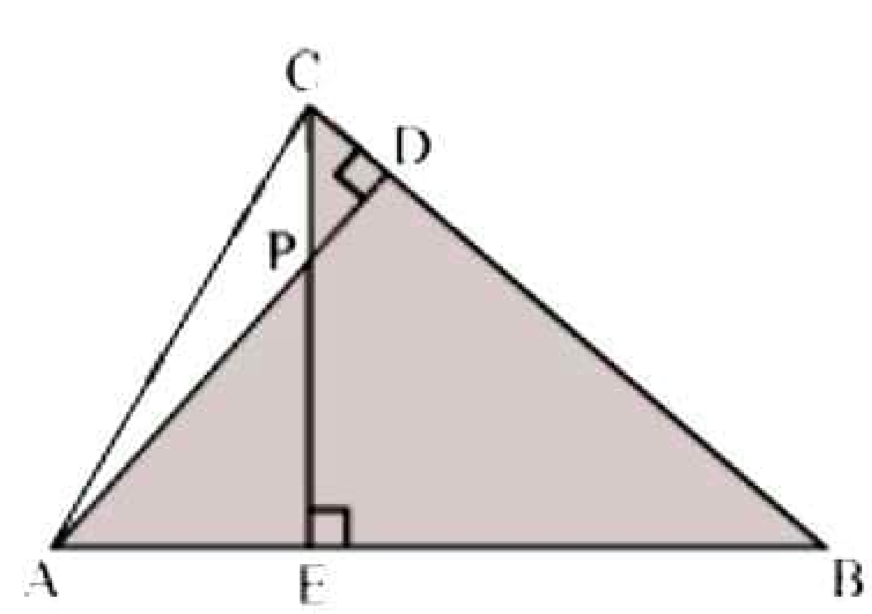
**33.**

i.



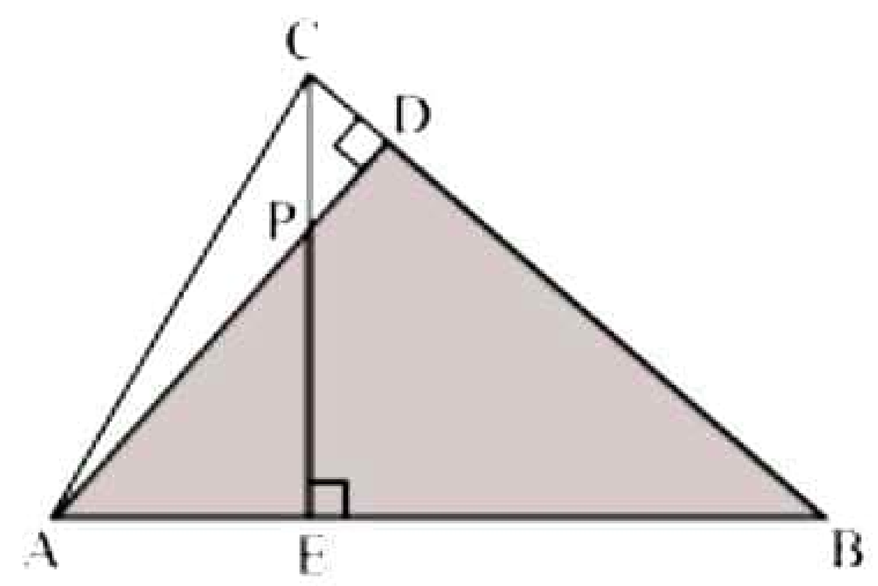

In $\Delta AEP$ and $\Delta CDP$,
$\angle CDP = \angle AEP = 90^\circ$
$\angle CPD = \angle APE$ ... (vertically opposite angles)
$\angle PCD = \angle PAE$ ... (remaining angle)
Therefore by AAA rule,
$\Delta AEP \sim \Delta CDP$

ii.




In $\Delta ABD$ and $\Delta CBE$,
$\angle ADB = \angle CEB = 90^\circ$
$\angle ABD = \angle CBE$ (common angle)
$\angle DAB = \angle ECB$ (remaining angle)
Therefore by AAA rule,
$\Delta ABD \sim \Delta CBE$

iii.




In ΔAEP and ΔADB,

∠AEP = ∠ADB = 90°

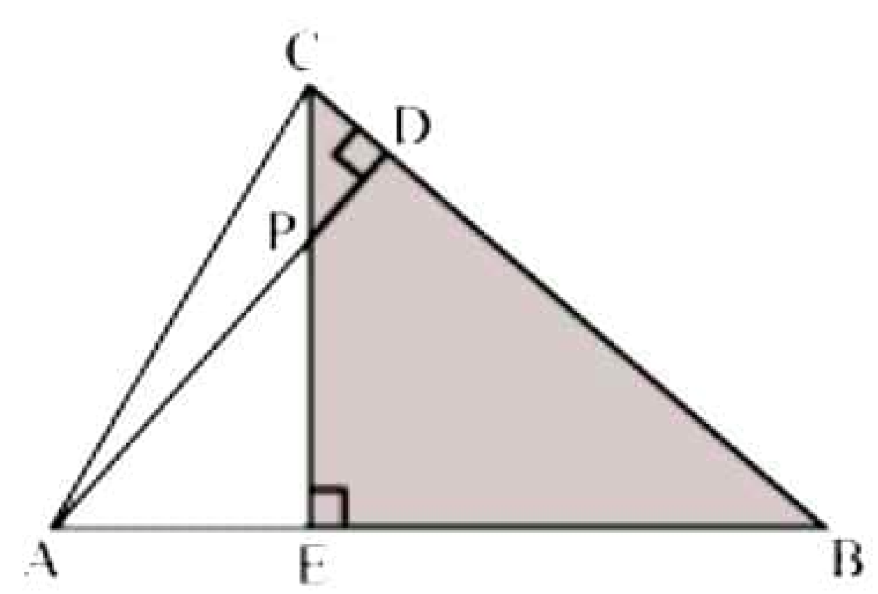
∠PAE = ∠DAB (common angle)

∠APE = ∠ABD (remaining angle)

Therefore, by AAA rule,

ΔAEP ~ ΔADB

iv.




In ΔPDC and ΔBEC

∠PDC = ∠BEC = 90°

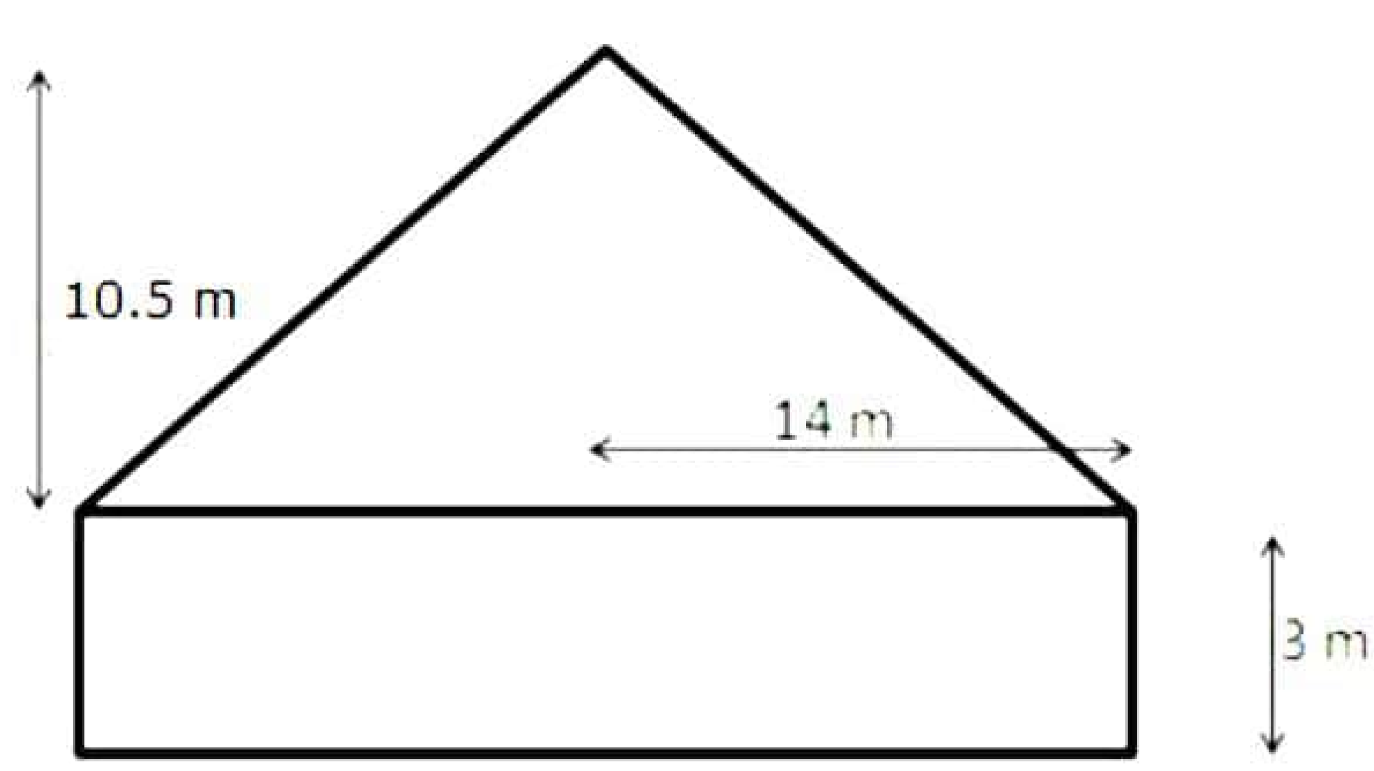
∠PCD = ∠BCE (common angle)

∠CPD = ∠CBE (remaining angle)

Therefore, by AAA rule,

ΔPDC ~ ΔBEC

**34.**




For cylinder: Radius = 14 m and height = 3 m

For cone: Radius = 14 m and height = 10.5 m

Let l be the slant height of the cone.

$\therefore\ l^2 = (14)^2 + (10.5)^2$

$l^2 = (196 + 110.25)m^2$

$l^2 = 306.25\ m^2$

$l = \sqrt{306.25}\,m$

$= 17.5\ m$

Curved surface area of the tent

= (curved surface area of the cylinder + curved surface area of the cone)

$= 2\pi rh + \pi rl$

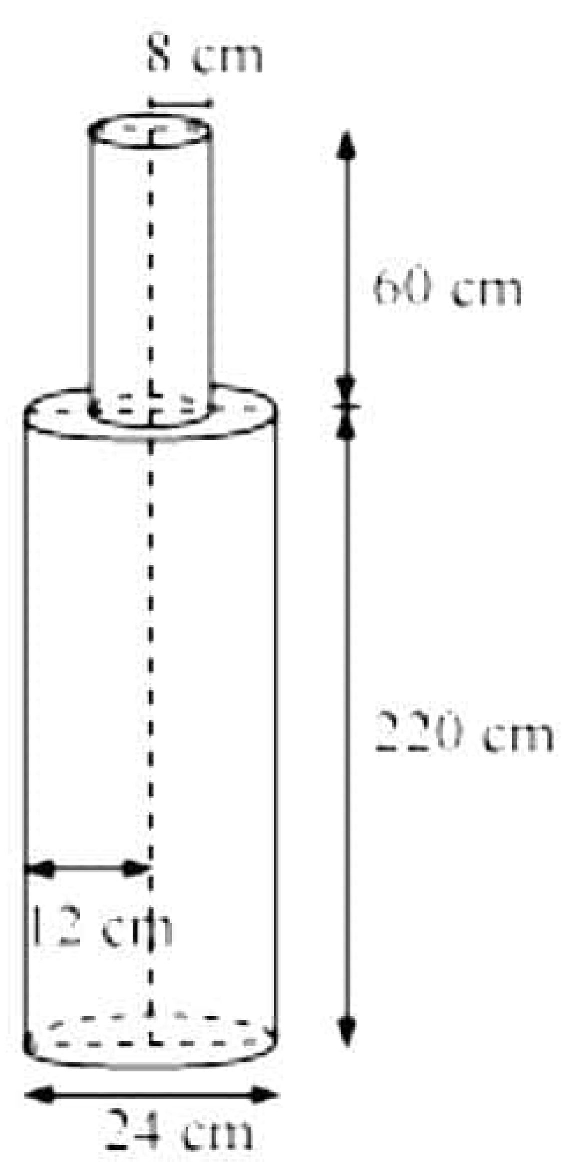
$= \left[\left(2 \times \frac{22}{7} \times 14 \times 3\right) + \left(\frac{22}{7} \times 14 \times 17.5\right)\right] m^2$

$= (264 + 770)m^2 = 1034\ m^2$

Hence, curved surface area of the tent = 1034 $m^2$

Cost of cloth = Rs. (1034 × 80) = Rs. 82720.

**OR**




From the figure we have

Height ($h_1$) of larger cylinder = 220 cm

Radius ($r_1$) of larger cylinder = $\frac{24}{2}$ = 12 cm

Height ($h_2$) of smaller cylinder = 60 cm

Radius ($r_2$) of larger cylinder = 8 cm

Total volume of pole = volume of larger cylinder + volume of smaller cylinder

$= \pi r_1^2 h_1 + \pi r_2^2 h_2$

$= \pi(12)^2 \times 220 + \pi(8)^2 \times 60$

$= \pi[144 \times 220 + 64 \times 60]$

$= 35520 \times 3.14 = 1,11,532.8\ cm^3$

Mass of 1 $cm^3$ iron = 8 gm

Mass of 111532.8 $cm^3$ iron = 111532.8 × 8 = 892262.4 gm = 892.262 kg.

**35.** We may find class mark ($x_i$) for each interval by using the relation.

$$x_i = \frac{\text{upper class limit} + \text{lower class limit}}{2}$$

Given that mean pocket allowance $\bar{x} = \text{Rs.}18$

Now taking 18 as assured mean (a) we may calculate $d_i$ and $f_id_i$ as follows:

| Daily pocket allowance (in Rs.) | Number of children $f_i$ | Class mark $x_i$ | $d_i = x_i - 18$ | $f_id_i$ |
|---|---|---|---|---|
| 11 - 13 | 7 | 12 | −6 | −42 |
| 13 - 15 | 6 | 14 | −4 | −24 |
| 15 - 17 | 9 | 16 | −2 | −18 |
| 17 - 19 | 13 | 18 | 0 | 0 |
| 19 - 21 | f | 20 | 2 | 2f |
| 21 - 23 | 5 | 22 | 4 | 20 |
| 23 - 25 | 4 | 24 | 6 | 24 |
| Total | $\sum f_i = 44 + f$ | | | $\sum f_id_i = 2f - 40$ |

From the table,

$$\bar{x} = a + \frac{\sum f_id_i}{\sum f_i}$$

$$18 = 18 + \left(\frac{2f - 40}{44 + f}\right)$$

$$0 = \left(\frac{2f - 40}{44 + f}\right)$$

$2f - 40 = 0$

$2f = 40$

$f = 20$

Hence, the messing frequency f is 20.

## Section E

**36.**

i. Here,

$a_3 = a + 2d = 4$ ...... (i) and

$a_9 = a + 8d = -8$ ..... (ii)

Subtracting (i) from (ii), we get

$6d = -12 \Rightarrow d = -2$

ii. $d = -2$ and $a_3 = a + 2d = 4$

$\Rightarrow a = 4 - 2(-2) = 4 + 4 = 8$

iii. Here, $a = 8$ and $d = -2$ and $a_n = -160$

$\Rightarrow -160 = 8 + (n - 1)(-2)$

$\Rightarrow -168 = -2n + 2$

$\Rightarrow n = 85$

**OR**

Here, $a = 8$ and $d = -2$

$\Rightarrow a_{75} = a + 74d = 8 + 74(-2) = 8 - 148 = -140$

**37.**

i. A (1, 1) and C(4, 5)

$$d(AC) = \sqrt{(4-1)^2 + (5-1)^2} = 5 \text{ km}$$

**OR**

B(4,1) and D(7,5)

$$d(BD) = \sqrt{(7-4)^2 + (5-1)^2} = 5 \text{ km}$$

ii. B (4, 1) and A(1, 1)

$$d(BA) = \sqrt{(1-4)^2 + (1-1)^2} = 3 \text{ km}$$

iii. C (4, 5) and B(4, 1)

$$d(BC) = \sqrt{(4-4)^2 + (5-1)^2} = 4 \text{ km}$$

**38.**

i. The one who makes small angle of elevation is closer to airplane.
As Rishabh makes an angle of elevation 30° from the airplane, he is closer and Reema is far from the airplane.

ii. In ΔBDE, we have

$$\tan 30^\circ = \frac{DE}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{BD}$$

$$\Rightarrow BD = h\sqrt{3}\ \text{m}$$

**OR**

In ΔACE, we have

$$\tan 60^\circ = \frac{CE}{AC}$$

$$\Rightarrow \sqrt{3} = \frac{h+4}{BD}$$

$$\Rightarrow BD = \frac{h+4}{\sqrt{3}}$$

$$\Rightarrow \sqrt{3} \times h = \frac{h+4}{\sqrt{3}}$$

$$\Rightarrow h = 2$$

iii. Distance between the airplane and the ground = EF
EF = ED + DC + CF = 2 + 4 + 2 = 8 m