Class- X Session- 2022-23

Subject- Mathematics (Basic)

Sample Question Paper - 5

with Solution

Time Allowed: 3 Hrs. **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 sub-parts 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.

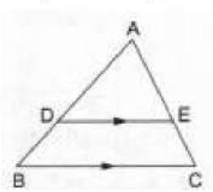
Section A

1. Given that one of the zeroes of the quadratic polynomial $ax^2 + bx + c$ is zero, then the other zero is **[1]**

a) $\frac{-b}{a}$ b) $\frac{c}{a}$

c) $\frac{-c}{a}$ d) $\frac{b}{a}$

2. In a $\triangle ABC$, if DE is drawn parallel to BC, cutting AB and AC at D and E respectively such that AB = 7.2 cm, AC = 6.4 cm and AD = 4.5 cm. Then, AE = ? **[1]**



a) 4 cm b) 5.4 cm

c) 3.2 cm d) 3.6 cm

3. If x - y = 2 and $\frac{2}{x+y} = \frac{1}{5}$ then **[1]**

a) x = 6, y = 4 b) x = 7, y = 5

c) x = 5, y = 3 d) x = 4, y = 2

4. Form the pair of linear equations in the problem, and find its solution graphically.: 5 pencils and 7 pens together cost Rs.50 whereas 7 pencils and 5 pens together cost Rs.46. The cost of 1 pen is **[1]**

a) Rs.5 b) Rs.6

c) Rs.3

d) Rs.4

5. In a family of 3 children, the probability of having at least one boy is **[1]**

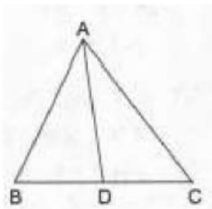
a) $\frac{1}{8}$

b) $\frac{7}{8}$

c) $\frac{3}{4}$

d) $\frac{5}{8}$

6. In △ABC it is given that $\frac{AB}{AC} = \frac{BD}{DC}$. If $\angle B = 70^\circ$ and ∠C = 50° then ∠BAD = ? **[1]**



a) 30°

b) 50°

c) 45°

d) 40°

7. The mean of the first 10 natural odd numbers is **[1]**

a) 9

b) 12

c) 11

d) 10

8. A vertical stick 1.8 m long casts a shadow 45 cm long on the ground. At the same time, what is the length of the shadow of a pole 6 m high? **[1]**

a) 13.5 m

b) 1.35 m

c) 1.5 m

d) 2.4 m

9. $\frac{1+\tan^2 A}{1+\cot^2 A} =$ **[1]**

a) 1

b) $\cot^2$A

c) $\tan^2$A

d) $\sec^2$A

10. Which of the following is not a quadratic equation? **[1]**

a) $x = x^2 + 3 + 4x^2$

b) $2(x-1)^2 = 4x^2 - 2x + 1$

c) $\left(\sqrt{2}x + \sqrt{3}\right)^2 + x^2 = 3x^2 - 5x$

d) $2x - x^2 = x^2 + 5$

11. $\sqrt{2}$ is **[1]**

a) a non-terminating repeating decimal

b) a rational number

c) a terminating decimal

d) an irrational number

12. If the point R(x, y) divides the join of $P(x_1, y_1)$ and $Q(x_2, y_2)$ internally in the given ratio $m_1 : m_2$, then the coordinates of the point R are **[1]**

a) $\left(\frac{m_2x_1-m_1x_2}{m_1+m_2}, \frac{m_2y_1-m_1y_2}{m_1+m_2}\right)$

b) $\left(\frac{m_2x_1-m_1x_2}{m_1-m_2}, \frac{m_2y_1-m_1y_2}{m_1-m_2}\right)$

c) $\left(\frac{m_2x_1+m_1x_2}{m_1+m_2}, \frac{m_2y_1+m_1y_2}{m_1+m_2}\right)$

d) None of these

13. $\frac{2\tan 30^\circ}{1+\tan^2 30^\circ} =$ **[1]**

a) $cos60^\circ$

b) None of these

c) $tan60^\circ$

d) $sin60^\circ$

14. Look at the frequency distribution table given below: **[1]**

Class interval	**35-45**	**45-55**	**55-65**	**65-75**
Frequency	**8**	**12**	**20**	**10**

The median of the above distribution is

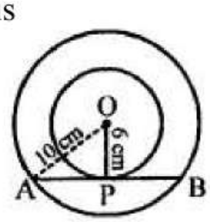
a) 59

b) 58.5

c) 57.5

d) 56.5

15. In the given figure, O is the centre of two concentric circles of radii 6 cm and 10 cm. AB is a chord of outer circle which touches the inner circle. The length of chord AB is **[1]**



a) 16 cm

b) $\sqrt{136}$ cm

c) 8 cm

d) 14 cm

16. If the height of a tower and the distance of the point of observation from its foot, both, are increased by 10%, then the angle of elevation of its top **[1]**

a) decreases

b) none of these

c) remains unchanged

d) increases

17. In △ABC, it is given that AB = 9 cm, BC = 6 cm and CA = 7.5 cm. Also, △DEF is given such that EF = 8 cm and △DEF ~ △ABC. Then, perimeter of △DEF is **[1]**

a) 30 cm

b) 22.5 cm

c) 27 cm

d) 25 cm

18. **Assertion:** $x^3 + x$ has only one real zero. **[1]**

Reason: A polynomial of nth degree must have n real zeroes.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

19. The common root of $2x^2 + x - 6 = 0$ and $x^2 - 3x - 10 = 0$ is **[1]**

a) -2

b) $\frac{3}{2}$

c) 5

d) 2

20. **Assertion (A):** Two identical solid cubes of side 5 cm are joined end to end. The total surface area of the resulting cuboid is 350 cm^2. **[1]**
Reason (R): Total surface area of a cuboid is 2(lb + bh + hl)

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. Find the distance of the point P(6, -6) from the origin. **[2]**

OR

Find the perimeter of a triangle with vertices (0,0),(1,0) and (0,1).

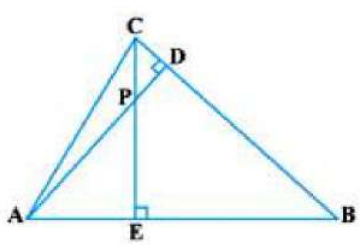
22. Solve: $4x^2 - 12x + 9 = 0$. **[2]**

23. Find the HCF of 1001 and 385. **[2]**

24. S and T are points on sides PR and QR of $\triangle PQR$ such that $\angle P = \angle RTS$. Show that $\triangle RPQ \sim \triangle RTS$. **[2]**

OR

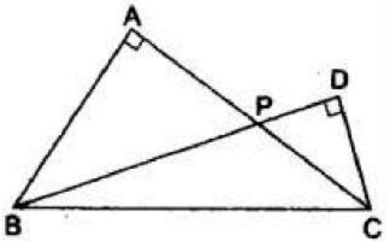
In the figure, altitudes AD and CE of $\triangle$ABC intersect each other at the point P. Show that: $\triangle\ PDC \sim \triangle\ BEC$



25. Evaluate $\operatorname{cosec}^2 30^\circ \sin^2 45^\circ - \sec^2 60^\circ$ **[2]**

Section C

26. Two right triangles ABC and DBC are drawn on the same hypotenuse BC and on the same side of BC. If AC and BD intersect at P, Prove that $AP \times PC = BP \times PD$. **[3]**



27. Find the value of k for which the roots are real and equal of equation: **[3]**
$kx^2 + kx + 1 = -4x^2 - x$

28. If the point C (-1, 2) divides the line segment AB in the ratio 3 : 4, where the coordinates of A are (2, 5), find the coordinates of B **[3]**

OR

Write the coordinates of a point on X-axis which is equidistant from the points (-3, 4) and (2, 5).

29. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers. **[3]**

30. Find the mean, median and mode of the following data: **[3]**

Classes:	0 - 50	50 - 100	100 - 150	150 - 200	200 - 250	250 - 300	300 - 350
Frequency:	2	3	5	6	5	3	1

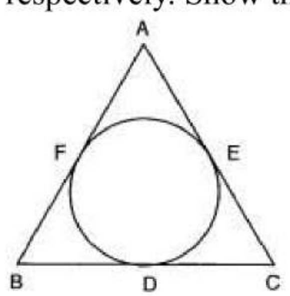
31. The shadow of a tower standing on a level ground is found to be 30m longer when the sun's altitude is 30°, than when it was 60°. Find the height of the tower. [Take V3 = 1.732.] **[3]**

OR

A kite is flying, attached to a thread which is 165 m long. The thread makes an angle of 30° with the ground. Find the height of the kite from the ground, assuming that there is no slack in the thread.

Section D

32. In figure the incircle of ΔABC touches the sides BC, CA and AB at D, E and F respectively. Show that AF + BD + CE = AE + BF + CD = $\frac{1}{2}$(Perimeter of ΔABC) **[5]**



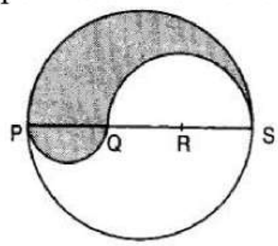
33. A fraction becomes $\frac{1}{3}$ if 1 is subtracted from both its numerator and denominator. If **[5]**

1 is added to both the numerator and denominator, it becomes $\frac{1}{2}$. Find the fraction.

OR

The sum of a two-digit number and the number formed by reversing the order of digits is 66. If the two digits differ by 2, find the number. How many such numbers are there?

34. PQRS is a diameter of a circle of radius 6 cm. The lengths PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS as diameters as shown in Fig. Find the perimeter and area of the shaded region **[5]**



OR

Four equal circles are described at the four corners of a square so that each touches two of the others. The shaded area enclosed between the circles is $\frac{24}{7}\text{cm}^2$. Find the radius of each circle.

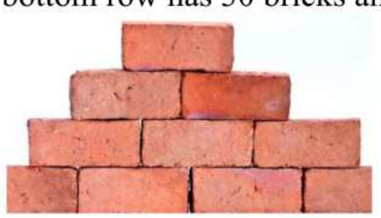
35. A bag contains 5 white balls, 7 red balls, 4 black balls and 2 blue balls. One ball is drawn at random from the bag. What is the probability that the ball drawn is **[5]**

i. white or blue
ii. red or black
iii. not white
iv. neither white nor black.

Section E

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

Akshat's father is planning some construction work in his terrace area. He ordered 360 bricks and instructed the supplier to keep the bricks in such as way that the bottom row has 30 bricks and next is one less than that and so on.



The supplier stacked these 360 bricks in the following manner, 30 bricks in the bottom row, 29 bricks in the next row, 28 bricks in the row next to it, and so on.

(i) In how many rows, 360 bricks are placed?

(ii) How many bricks are there in the top row?

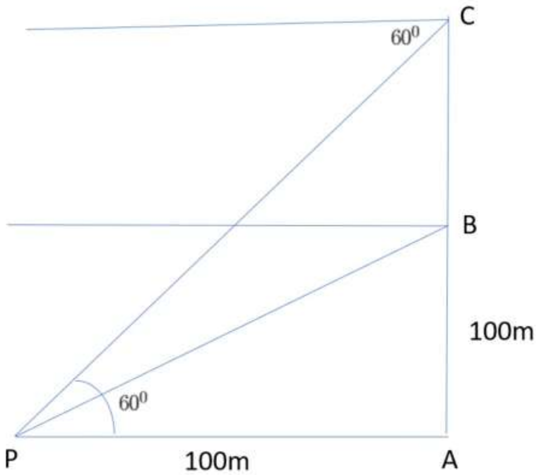
(iii) How many bricks are there in 10^{th} row?

OR

If which row 26 bricks are there?

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

A hot air balloon is rising vertically from a point A on the ground which is at distance of 100m from a car parked at a point P on the ground. Amar, who is riding the balloon, observes that it took him 15 seconds to reach a point B which he estimated to be equal to the horizontal distance of his starting point from the car parked at P.



(i) Find the angle of depression from the balloon at a point B to the car at point P.

(ii) Find the speed of the balloon?

(iii) After certain time Amar observes that the angle of depression is 60^{o}. Find the vertical distance travelled by the balloon during this time.

OR

Find the total time taken by the balloon to reach the point C from ground?

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

Ashish is a Class IX student. His class teacher Mrs Verma arranged a historical trip to great Stupa of Sanchi. She explained that Stupa of Sanchi is great example of architecture in India. Its base part is cylindrical in shape. The dome of this stupa is hemispherical in shape, known as Anda. It also contains a cubical shape part called Hermika at the top. Path around Anda is known as Pradakshina Path.

(i) Find the volume of the Hermika, if the side of cubical part is 10 m.

(ii) Find the volume of cylindrical base part whose diameter and height 48 m and 14 m.

(iii) If the volume of each brick used is 0.01 m^3, then find the number of bricks used to make the cylindrical base.

OR

If the diameter of the Anda is 42 m, then find the volume of the Anda.

Solution

Section A

1. **(a)** $\frac{-b}{a}$

   Explanation: Let α, β are the zeroes of the given polynomial.

   Given: $\alpha = 0 \ \therefore \alpha + \beta = \frac{-b}{a} \Rightarrow 0 + \beta = \frac{-b}{a} \Rightarrow \beta = \frac{-b}{a}$

   Therefore the other zero is $\frac{-b}{a}$.

2. **(a)** 4 cm

   Explanation: In $\triangle$ABC, DE || BC

   AB = 7.2 cm, AC = 6.4 cm, AD = 4.5 cm

   Let AE = x cm

   DE || BC

   $\triangle ADE \sim \triangle ABC$

   $\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{4.5}{7.2} = \frac{AE}{6.4}$

   $\Rightarrow AE = \frac{4.5 \times 6.4}{7.2} = 4.0 = 4cm$

3. **(a)** x = 6, y = 4

   Explanation: We have:

   x - y = 2 …(i)

   x + y = 10 …(ii)

   Now, adding (i) and (ii) we get:

   2x = 12

   $x = \frac{12}{2}$

   x = 6

   Putting the value of x in (ii), we get

   6 + y = 10

   y = 10 - 6

   y = 4

4. **(a)** Rs.5

   Explanation: Let, cost(in RS) of one pencil = x

   and cost (in RS) of one pen = y

   Therefore , according to question

   5x+7y = 50 .... (1)

   7x + 5y = 46 ....(2)

   Multiply equation (1) by 7 and equation (2) by 5 we get

   7(5x+7y)= 7 × 50

   35x +49y = 350 ....(3)

   and

   5(7x +5y) = 5 × 46

   35x +25y = 230 .... (4)

   Subtract equation (4) from equation 3 , we get

$35x + 49y - 35x - 25y = 350 - 230$

$49y - 25y = 120$

$24y = 120$

$y = \frac{120}{24}$

y= 5

Substitute y = 5 in equation 1 , we get

$5x + 7 \times 5 = 50$

$5x + 35 = 50$

$5x = 50 - 35$

$5x = 15$

$x = \frac{15}{5}$

x=3

Hence, Cost of One Pen = y =5

5. **(b)** $\frac{7}{8}$

Explanation: All possible outcomes are BBB, BBG, BGB, GBB, BGG, GBG, GGB, GGG.

Number of all possible outcomes = 8.

Let E be the event of having at least one boy.

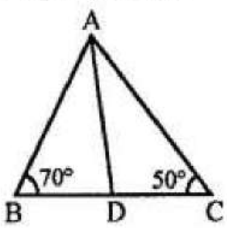
Then, E contains GGB, GBG, BGG, BBG, BGB, GBB, BBB.

Number of cases favourable to E = 7.

Therefore,required probability = P(E) $= \frac{7}{8}$

6. **(a)** 30°

Explanation:



$\frac{AB}{AC} = \frac{BD}{DC}$

$\angle B = 70^\circ$ $\angle C = 50^\circ$

But $\angle A + \angle B + \angle C = 180^\circ$ (Angles of a triangle)

$\angle A = 180^\circ - (\angle B + \angle C)$

$= 180^\circ - (70^\circ + 50^\circ)$

$= 180^\circ - 120^\circ = 60^\circ$

$\frac{AB}{AC} = \frac{BD}{DC}$

AD is the bisector of ∠A

$\angle BAD = \frac{60}{2} = 30^\circ$

7. **(d)** 10

Explanation: The first 10 natural odd numbers are 1, 3, 5, 7, 9, 11, 13, 15, 17, 19

$$\therefore \text{ Mean} = \frac{\text{Sum of first 10 natural odd numbers}}{10}$$

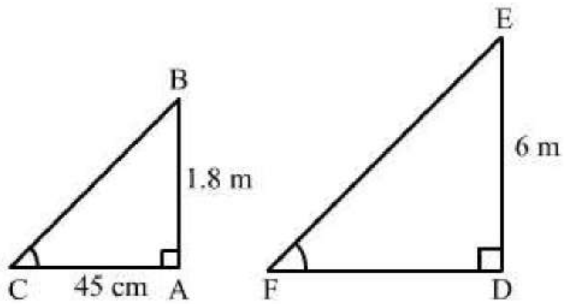
$$= \frac{1+3+5+7+9+11+13+15+17+19}{10}$$

$$= \frac{100}{10}$$

$= 10$

8. **(c)** 1.5 m

Explanation:



Let AB and AC be the vertical stick and its shadow, respectively.
According to the question:
AB = 1.8 m
AC = 45 cm = 0.45 m
Again, let DE and DF be the pole and its shadow, respectively.
According to the question:
DE = 6 m
DF = ?
Now, in right-angled triangles ABC and DEF, we have:
$\angle BAC = \angle EDF = 90°$
$\angle ACB = \angle DFE$ (Angular elevation of the Sun at the same time)
Therefore, by AA similarity theorem,
we get: $\triangle ABC \sim \triangle DEF$

$$\Rightarrow \frac{AB}{AC} = \frac{DE}{DF} \Rightarrow \frac{1.8}{0.45} = \frac{6}{DF} \Rightarrow DF = \frac{6 \times 0.45}{1.8} = 1.5\text{m}$$

9. **(c)** $\tan^2 A$

Explanation: $\dfrac{1+\tan^2 A}{1+\cot^2 A} = \dfrac{1+\tan^2 A}{1+\dfrac{1}{\tan^2 A}}$

$$= \frac{1+\tan^2 A}{\dfrac{\tan^2 A+1}{\tan^2 A}}$$

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

Hence, the correct choice is $\tan^2$A.

10. **(c)** $\left(\sqrt{2}x + \sqrt{3}\right)^2 + x^2 = 3x^2 - 5x$

Explanation: In equation $\left(\sqrt{2}x + \sqrt{3}\right)^2 + x^2 = 3x^2 - 5x$

$\Rightarrow 2x^2 + 3 + 2\sqrt{6}x + x^2 = 3x^2 - 5x$

$\Rightarrow 3x^2 - 3x^2 + 5x + 2\sqrt{6}x + 3 = 0$

$\Rightarrow \left(5 + 2\sqrt{6}\right)x + 3 = 0$

It is not the quadratic equation because its degree is not 2.

11. **(d)** an irrational number

Explanation: Let $\sqrt{2}$ is a rational number.

$\therefore \sqrt{2} = \frac{p}{q}$, where p and q are some integers and HCF(p, q) = 1 .... (1)

$\Rightarrow \sqrt{2}q = p$

$\Rightarrow (\sqrt{2}q)^2 = p^2$

$\Rightarrow 2q^2 = p^2$

$\Rightarrow p^2$ is divisible by 2

$\Rightarrow$ p is divisible by 2 .... (2)

Let p = 2m, where m is some integer.

$\therefore \sqrt{2} = p$

$\Rightarrow \sqrt{2}q = 2m$

$\Rightarrow (\sqrt{2}q)^2 = (2m)^2$

$\Rightarrow 2q^2 = 4m^2$

$\Rightarrow q^2 = 2m^2$

$\Rightarrow q^2$ is divisible by 2

$\Rightarrow$ q is divisible by 2 .... (3)

From (2) and (3), 2 is a common factor of both p and q, which contradicts (1).

Hence, our assumption is wrong.

Thus, $\sqrt{2}$ is an irrational number.

12. **(c)** $\left(\frac{m_2x_1+m_1x_2}{m_1+m_2}, \frac{m_2y_1+m_1y_2}{m_1+m_2}\right)$

Explanation: If the point R(x, y) divides the join of $P(x_1, y_2)$ and $Q(x_2, y_2)$ internally in the given ratio $m_1 : m_2$,

then the coordinates of the point R are $\left(\frac{m_2x_1+m_1x_2}{m_1+m_2}, \frac{m_2y_1+m_1y_2}{m_1+m_2}\right)$

13. **(d)** $sin60^\circ$

Explanation: Given: $\frac{2\tan 30^\circ}{1+\tan^2 30^\circ}$

$$= \frac{2 \times \frac{1}{\sqrt{3}}}{1 + \left(\frac{1}{\sqrt{3}}\right)^2}$$

$$= \frac{2}{\sqrt{3}\left(\frac{3+1}{3}\right)}$$

$$= \frac{6}{4\sqrt{3}} = \frac{3}{2\sqrt{3}}$$

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

$= \sin 60^\circ$

14. **(c)** 57.5

Explanation:

Class interval	Frequency	Cumulative frequency
35-45	8	8
45-55	12	20
55-65	20	40
65-75	10	50

Here, $N = 50 \Rightarrow \frac{N}{2} = 25$

The cumulative frequency just greater than 25 is 40.
Hence, median class is 55-65.

$$\text{Now, Median } = l + \left\{h \times \frac{\left(\frac{N}{2} - cf\right)}{f}\right\}$$

$$= 55 + \left\{10 \times \frac{(25-20)}{20}\right\}$$

$= 55 + 2.5$
$= 57.5$

15. **(a)** 16 cm

Explanation: In the given figure, O is the centre of the two concentric circles of radii 6 cm and 10 cm.
AB is a chord of the outer circle and touches the inner circle at P.
OP = 6 cm, OA = 10 cm
OP is radius and APB is tangent to the inner circle.
OP $\perp$ AB and P is the mid point of AB.

In right $\triangle OPA$,

$OA^2 = OP^2 + AP^2$

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

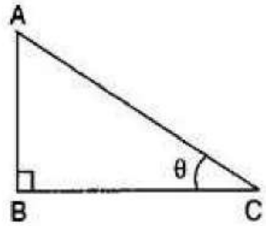
$\Rightarrow 100 = 36 + AP^2$

$\Rightarrow AP^2 = 100 - 36 = 64 = (8)^2$

AP = 8 cm

and AB = 2 × AP = 2 × 8 = 16 cm

16. **(c)** remains unchanged

Explanation: 

Let height of the tower be $h$meters and distance of the point of observation from its foot be x meters and angle of elevation be θ $\therefore \tan\theta = \frac{h}{x}$ ....(i)

Now, new height = h + 10% of h = $h + \frac{10}{100}h = \frac{11h}{10}$ And new distance = x + 10% of x = $x + \frac{10}{100}x = \frac{11x}{10}$ $\therefore \tan\theta = \frac{\frac{11h}{10}}{\frac{11x}{10}} = \frac{h}{x}$..........(ii)

From eq. (i) and (ii), it is clear that the angle of elevation is same i.e., angle of elevation remains unchanged.

17. **(a)** 30 cm

Explanation: $\triangle DEF \sim \triangle ABC$

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

$\Rightarrow \frac{DE}{9} = \frac{8}{6} = \frac{DF}{7.5}$

$\frac{DE}{9} = \frac{8}{6} \Rightarrow DE = \frac{8 \times 9}{6} = 12cm$

$\frac{DF}{7.5} = \frac{8}{6} \Rightarrow DF = \frac{7.5 \times 8}{6} = 10cm$

Perimeter of $\triangle DEF$ = DE + EF + DF

= 12 + 8 + 10 = 30 cm

18. **(c)** Assertion is correct statement but reason is wrong statement.

Explanation: Again, $x^3 + x = x(x^2 + 1)$

which has only one real zero

(x = 0) $[x^2 + 1 \neq 0$ for all $\in R]$

19. **(a)** -2

Explanation: Given: Putting x = -2 in given equations

$p(x) = 2x^2 + x - 6 = 0$ and $q(x) = x^2 - 3x - 10 = 0$

$\therefore$ p(-2) = $2(-2)^2 + (-2) - 6 = 0$
= 8 - 2 - 6 = 8 - 8 = 0
$\therefore$ q(-2) = $(-2)^2 - 3(-2) - 10 = 0$
= 4 + 6 - 10
= 10 - 10 = 0
Since, p(-2) = 0 and q(-2) = 0
therefore, -2 is the common root of $2x^2 + x - 6 = 0$ and $x^2 - 3x - 10 = 0$

20. **(d)** A is false but R is true.
Explanation: A is false but R is true.

Section B

21. Let P(6, -6) be the given point and O(0, 0) be the origin.
Then, $OP = \sqrt{(6-0)^2 + (-6-0)^2} = \sqrt{6^2 + (-6)^2}$
$= \sqrt{36+36} = \sqrt{72} = \sqrt{36 \times 2} = 6\sqrt{2}\ units.$

OR

A = (x, y) = (0,0),
B = (x_1,y_1) = (1,0) and C = (x_2,y_2) = (0,1)
The perimeter is sum of length of three sides, so first find the length of three sides and add them.
First side= AB= $\sqrt{(x_1 - x)^2 + (y_1 - y)^2} = \sqrt{(1-0)^2 + (0-0)^2} = 1$

Second side = BC = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(0-1)^2 + (1-0)^2} = \sqrt{2}$

Third side = AC = $\sqrt{(x_2 - x)^2 + (y_2 - y)^2} = \sqrt{(0-0)^2 + (1-0)^2} = 1$

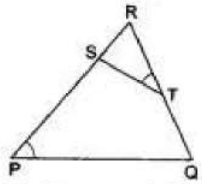
Adding lengths of three sides $= 1 + 1 + \sqrt{2} = (2 + \sqrt{2})\ units$

22. We have,
$4x^2 - 12x + 9 = 0$
Here, 4 $\times$ 9 = 36 so to factor the middle term in given equation we have (-6) $\times$ (-6) = 36, and (-6) + (-6) = -12.
$\Rightarrow$ $4x^2 - 6x - 6x + 9 = 0$ $\Rightarrow$ $2x(2x - 3) - 3(2x - 3) = 0$
$\Rightarrow$ $(2x - 3)(2x - 3) = 0$ $\Rightarrow$ $(2x - 3)^2 = 0$
$\Rightarrow$ $2x - 3 = 0$ $\Rightarrow$ $x = \frac{3}{2}$

Hence, $x = \frac{3}{2}$ is the repeated root of the given equation.

23. Two positive integers are 1001 and 385.
By applying Euclid's division lemma
1001 = 385 $\times$ 2 + 231
385 = 231 $\times$ 1 + 154
231 = 154 $\times$ 1 + 77
154 = 77 $\times$ 2 + 0
HCF = 77
Hence HCF of 1001 and 385 is 77.

24. According to questions it is given that S and T are points on sides PR and QR of $\triangle PQR$ such that $\angle P = \angle RTS$



To Prove $\triangle RPQ \sim \triangle RTS$

Proof In $\triangle RPQ$ and $\triangle RTS$, we have

$\angle P = \angle RTS$ (given)

$\angle R = \angle R$ (common)

$\therefore \quad \triangle RPQ \sim \triangle RTS$ [by AA-similarity].

OR

In $\triangle$PDC and $\triangle$BEC, we have

$\angle$PDC =$\angle$BEC ....(1) [Each equal to 90^0]

$\angle$DCP = $\angle$BEC ....(2) [Common angle]

In view of (1) and (2),

$\triangle$PDC $\sim$ $\triangle$BEC [AA similarity criterion]

25. We have,

$$\operatorname{cosec}30^\circ = 2,\ \sin45^\circ = \frac{1}{\sqrt{2}}\ and\ \sec60^\circ = 2$$

therefore,

$$\operatorname{cosec}^2 30^\circ \sin^2 45^\circ - \sec^2 60^\circ$$

$$= \left(cosec30^\circ\right)^2\left(\sin45^\circ\right)^2 - \left(\sec60^\circ\right)^2 = (2)^2 \times \left(\frac{1}{\sqrt{2}}\right)^2 - (2)^2 = 4 \times \frac{1}{2} - 4 = 2 - 4 = -2$$

Section C

26. Given: Right triangles $\triangle ABC$ and $\triangle DBC$ are drawn on the same hypotenuse BC on the same side of BC.

Also, AC and BD intersect at P.

We have to show: $AP \times PC = BP \times PD$

Now, In $\triangle BAP$ and $\triangle CDP$, we have

$\angle BAP = \angle CDP = 90^\circ$

$\angle BPA = \angle CPD$ (vertically opposite angles)

$\therefore \quad \triangle BAP \sim \triangle CDP$ [by AA-similarity]

$\therefore \quad \frac{AP}{DP} = \frac{BP}{CP}$

$\Rightarrow AP \times CP = BP \times DP$

$\Rightarrow AP \times PC = BP \times PD$

Hence, $AP \times PC = BP \times PD$.

27. We have,

$kx^2 + kx + 1 = -4x^2 - x$

$\Rightarrow kx^2 + 4x^2 + kx + x + 1 = 0$

$\Rightarrow (k + 4)x^2 + (k + 1)x + 1 = 0$

Here, a = k + 4, b = k + 1 and c = 1

$\therefore D = b^2 - 4ac$

$= (k + 1)^2 - 4 \times (k + 4) \times (1)$

$= k^2 + 1 + 2k - 4k - 16$

$= k^2 - 2k - 15$

$\Rightarrow D = k^2 - 2k - 15$

The given equation will have real and equal roots, if

D = 0

$\Rightarrow k^2 - 2k - 15 = 0$

$\Rightarrow k^2 - 5k + 3k - 15 = 0$

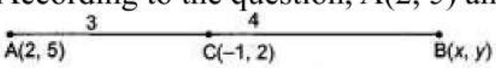
$\Rightarrow k(k - 5) + 3(k - 5) = 0$

$\Rightarrow (k - 5)(k + 3) = 0$

$\Rightarrow k - 5 = 0$ or $k + 3 = 0$

$\Rightarrow k = 5$ or $k = -3$

28. According to the question, A(2, 5) and C(-1, 2).



point C divides the line segment AB in the ratio 3 : 4.

By using section formula,

$$(x, y) = \frac{3 \times x + 4 \times 2}{3 + 4}, \frac{3 \times y + 4 \times 5}{3 + 4}$$

Comparing x , we get

$$\Rightarrow \frac{3 \times x + 4 \times 2}{3 + 4} = -1$$

$$\Rightarrow \frac{3x + 8}{7} = -1$$

$\Rightarrow 3x + 8 = -7$

$\Rightarrow 3x = -15$

$\Rightarrow x = -5$

Comparing y , we get

$$\Rightarrow \frac{3 \times y + 4 \times 5}{3 + 4} = 2$$

$$\Rightarrow \frac{3y + 20}{7} = 2$$

$\Rightarrow 3y + 20 = 14$

$\Rightarrow 3y = 14 - 20$

$\Rightarrow 3y = -6$

$\Rightarrow y = -2$

$\therefore$ Coordinates of B are (-5, -2).

OR

The point is on x-axis

Its ordinates of the point P is (x, 0)

P is equidistant from A(-3, 4) and B(2, 5)

Now $PA = \sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2}$

$= \sqrt{(x + 3)^2 + (0 - 4)^2} = \sqrt{(x + 3)^2 + 16}$

and $PA^2 = (x + 3)^2 + 16$

Similarly $PB^2 = [\sqrt{(x-2)^2 + (0-5)^2}]^2$

$= (x - 2)^2 + 25$

$\because PA = PB \Rightarrow PA^2 = PB^2$

$\therefore (x+3)^2 + 16 = (x-2)^2 + 25$

$x^2 + 6x + 9 + 16 = x^2 - 4x + 4 + 25$

$\Rightarrow x^2 + 6x - x^2 + 4x = 25 + 4 - 9 - 16$

$\Rightarrow 10x = 4 \Rightarrow x = \frac{4}{10} = \frac{2}{5}$

$\therefore$ co-ordinates of point P will be $\left(\frac{2}{5}, 0\right)$

29. Numbers are of two types - prime and composite.
Prime numbers can be divided by 1 and only itself, whereas composite numbers have factors other than 1 and itself.
It can be observed that
$7 \times 11 \times 13 + 13 = 13 \times (7 \times 11 + 1)$
$= 13 \times (77 + 1) = 13 \times 78 = 13 \times 13 \times 6$
The given expression has 6 and 13 as its factors.
Therefore, it is a composite number.
$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$
$= 5 \times (7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1)$
$= 5 \times (1008 + 1) = 5 \times 1009$
1009 cannot be factorized further
Therefore, the given expression has 5 and 1009 as its factors.
Hence, it is a composite number.

30.

Class interval	Mid value (x)	Frequency (f)	fx	Cumulative frequency
0 – 50	25	2	50	2
50 – 100	75	3	225	5
100 – 150	125	5	625	10
150 – 200	175	6	1050	16
200 – 250	225	5	1127	21
250 – 300	275	3	825	24
300 – 350	325	1	325	25
		N = 25	$\Sigma fx = 4225$	

Mean $= \frac{\Sigma fx}{N} = \frac{4225}{25} = 169$

We have,
N = 25

Then, $\frac{N}{2} = \frac{25}{2} = 12.5$

The cumulative frequency just greater than $\frac{N}{2}$ is 16, then the median class is 150 - 200 such that

l = 150, h = 200 – 150 = 50, f = 6, F = 10

$$\text{Median} = l + \frac{\frac{N}{2} - F}{f} \times h$$

$$= 150 + \frac{12.5 - 10}{6} \times 50$$

$$= 150 + \frac{125}{6}$$

= 150 + 20.83

= 170.83

Here the maximum frequency is 6, then the corresponding class 150 - 200 is the modal class

l = 150, h = 200 – 150 = 50, f = 6, f_1 = 5, f_2 = 5

$$\text{Mode} = l + \frac{f - f_1}{2f - f_1 - f_2} \times h$$

$$= 150 + \frac{6 - 5}{2 \times 6 - 5 - 5} \times 50$$

$$= 150 + \frac{50}{2}$$

= 150 + 25

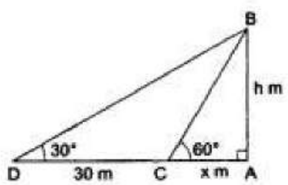
= 175

31. Let AB be the height of the tower, and AC and AD be the lengths of the shadows at the angles 60 and 30 respectively.

Clearly, $\angle ACB = 60^\circ$ and $\angle ADB = 30^\circ$.

Let AB = h m, and

AC = x m.



From right ΔCAB, we have

$$\frac{AC}{AB} = \cot 60^\circ = \frac{1}{\sqrt{3}} \Rightarrow \frac{x}{h} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad x = \left(h \times \frac{1}{\sqrt{3}}\right) = \frac{h}{\sqrt{3}} \text{.......(i)}$$

From right ΔDAB, we have

$$\frac{AD}{AB} = \cot 30^\circ = \sqrt{3} \Rightarrow \frac{x + 30}{h} = \sqrt{3}$$

$$\Rightarrow \quad x = (\sqrt{3}h - 30). \text{ ....(ii)}$$

Equating the values of x from (i) and (ii), we get

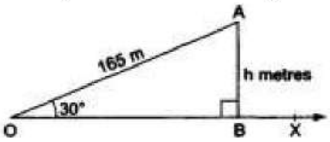
$\frac{h}{\sqrt{3}} = (\sqrt{3}h - 30) \Rightarrow h = 3h - 30\sqrt{3}$

$\Rightarrow 2h = 30\sqrt{3} \Rightarrow h = 15\sqrt{3} = (15 \times 1.732) = 25.98$

OR

Let A be the position of the kite. Let O be the position of the observer and OA be the thread. Draw $AB \perp OX$

Then, $\angle BOA = 30^\circ$, OA = 165m and $\angle OBA = 90^\circ$.

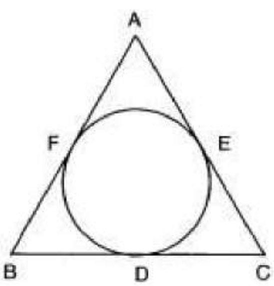


Height of the kite from the ground $= AB$.
Let $AB = h\ m$.
From right ΔOBA, we have

$\frac{AB}{OA} = \sin 30^\circ = \frac{1}{2}$

$\Rightarrow \frac{h}{165} = \frac{1}{2} \Rightarrow h = \frac{165}{2} = 82.5$

Section D

32. 

Since lengths of the tangents from an exterior point to a circle are equal. Therefore,
AF = AE [From A] ...(i)
BD = BF [From B] ...(ii)
and, CE = CD [From C] ...(iii)
Therefore, Adding equations (i), (ii) and (iii), we get,
AF + BD + CE = AE + BF + CD
Now,
Perimeter of ΔABC = AB + BC + AC
$\Rightarrow$ Perimeter of ΔABC = (AF + FB)+(BD + CD)+(AE + EC)
$\Rightarrow$ Perimeter of ΔABC = (AF + AE)+(BF + BD)+(CD + CE)
$\Rightarrow$ Perimeter of ΔABC = 2 AF + 2 BD + 2 CE
$\Rightarrow$ Perimeter of ΔABC = 2(AF + BD + CE) [From (i), (ii) and (iii), we get AE = AF, BD = BF and CD = CE]

$\Rightarrow AF + BD + CE = \frac{1}{2}(\text{ Perimeter of } \Delta ABC)$

Hence, AF + BD + CE = $AE + BF + CD = \frac{1}{2}(\text{ Perimeter of } \Delta ABC)$

33. Suppose the numerator and denominator of the fraction be x and y respectively.

Then the fraction is $\frac{x}{y}$.

If 1 is subtracted from both numerator and the denominator, the fraction becomes $\frac{1}{3}$.

Thus, we have $\frac{x-1}{y-1} = \frac{1}{3}$

$\Rightarrow$ $3(x-1) = (y-1)$

$\Rightarrow$ $3x - 3 = y - 1$

$\Rightarrow$ $3x - y - 2 = 0$

If 1 is added to both numerator and the denominator, the fraction becomes $\frac{1}{2}$.

Thus, we have $\frac{x+1}{y+1} = \frac{1}{2}$

$\Rightarrow$ $2(x+1) = (y+1)$

$\Rightarrow$ $2x + 2 = y + 1$

$\Rightarrow$ $2x - y + 1 = 0$

We have two equations

$3x - y - 2 = 0$

$2x - y + 1 = 0$

By using cross-multiplication, we have

$$\frac{x}{(-1)\times 1-(-1)\times(-2)} = \frac{-y}{3\times 1-2\times(-2)} = \frac{1}{3\times(-1)-2\times(-1)}$$

$$\Rightarrow \frac{x}{-1-2} = \frac{-y}{3+4} = \frac{1}{-3+2}$$

$$\Rightarrow \frac{x}{-3} = \frac{-y}{7} = \frac{1}{-1}$$

$$\Rightarrow \frac{x}{3} = \frac{y}{7} = 1$$

$\Rightarrow$ x = 3, y = 7

The fraction is $\frac{3}{7}$.

OR

Suppose, the digit at units and tens place of the given number be x and y respectively.

$\therefore$ the number is $10y + x$

After interchanging the digits, the number becomes $10x + y$

Given: The sum of the numbers obtained by interchanging the digits and the original number is 66.

Thus, $(10x + y) + (10y + x) = 66$

$\Rightarrow$ $10x + y + 10y + x = 66$

$\Rightarrow$ $11x + 11y = 66$

$\Rightarrow$ $11(x + y) = 66$

$\Rightarrow x + y = \frac{66}{11}$

$\Rightarrow$ $x + y = 6$ .....(i)

Also given, the two digits of the number are differing by 2.

$\therefore$ we have $x - y = \pm 2$....(ii)

So, we have two systems of simultaneous equations,

$x - y = 2,\ x + y = 6$
$x - y = -2,\ x + y = 6$
Here x and y are unknowns. We have to solve the above systems of equations for x and y.

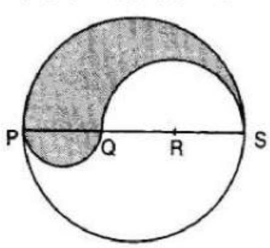
1. First, we solve the system
   $x - y = 2$
   $x + y = 6$
   Adding the two equations,
   $\Rightarrow (x - y) + (x + y) = 2 + 6$
   $\Rightarrow x - y + x + y = 8$
   $\Rightarrow 2x = 8$
   $\Rightarrow x = \frac{8}{2}$
   $\Rightarrow x = 4$
   Substituting the value of x in the first equation, we have
   $4 - y = 2$
   $\Rightarrow y = 4 - 2$
   $\Rightarrow y = 2$
   Hence, the number is $10 \times 2 + 4 = 24$
2. Now, we solve the system
   $x - y = -2$
   $x + y = 6$
   Adding the two equations, we have
   $(x - y) + (x + y) = -2 + 6$
   $\Rightarrow x - y + x + y = 4$
   $\Rightarrow 2x = 4$
   $\Rightarrow x = \frac{4}{2}$
   $\Rightarrow x = 2$
   Substituting the value of x in the first equation,
   $\Rightarrow 2 - y = -2$
   $\Rightarrow y = 2 + 2$
   $\Rightarrow y = 4$
   Hence, the number is $10 \times 4 + 2 = 42$

   Thus, the two numbers are 24 and 42.

34. PS = Diameter of a circle of radius 6 cm = 12 cm

$\therefore\ PQ = QR = RS = \frac{12}{3} = 4\text{cm},\ QS = QR + RS = (4 + 4)\text{cm} = 8\text{ cm}$

Let P be the perimeter and A be the area of the shaded region.
P = Arc of semi-circle of radius 6 cm + Arc of semi-circle of radius 4 cm + Arc of semi-circle of radius 2 cm



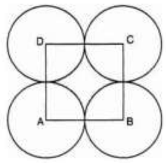
$\Rightarrow P = (\pi \times 6 + \pi \times 4 + \pi \times 2)\text{cm} = 12\pi\text{cm}$

and, A = Area of semi-circle with PS as diameter + Area of semi-circle with PQ as diameter - Area of semi-circle with QS as diameter.

$$\Rightarrow A = \frac{1}{2} \times \frac{22}{7} \times (6)^2 + \frac{1}{2} \times \frac{22}{7} \times 2^2 - \frac{1}{2} \times \frac{22}{7} \times (4)^2$$

$$\Rightarrow A = \frac{1}{2} \times \frac{22}{7}\left(6^2 + 2^2 - 4^2\right) = \frac{1}{2} \times \frac{22}{7} \times 24 = \frac{264}{7}\text{cm}^2 = 37.71 \text{ cm}^2$$

OR



Let r cm be the radius of each circle.

Area of square - Area of 4 sectors = $\frac{24}{7}\text{cm}^2$

$$(\text{side})^2 - 4\left[\frac{\theta}{360}\pi r^2\right] = \frac{24}{7}\text{cm}^2$$

$$\text{or, } (2r)^2 - 4\left(\frac{90°}{360°} \times \pi r^2\right) = \frac{24}{7}$$

$$\text{or, } (2r)^2 - 4\left(\frac{1}{4°} \times \pi r^2\right) = \frac{24}{7}$$

$$\text{or, } (2r)^2 - \left(\pi r^2\right) = \frac{24}{7}$$

$$\text{or, } 4r^2 - \frac{22}{7}r^2 = \frac{24}{7}$$

$$\text{or, } \frac{28r^2 - 22r^2}{7} = \frac{24}{7}$$

or, $6r^2 = 24$

or, $r^2 = 4$

or, $r = \pm 2$

or, Radius of each circle is 2 cm (r cannot be negative)

35. Number of white balls in the bag = 5
Number of red balls in the bag = 7
Number of black balls in the bag = 4
Number of blue balls in the bag = 2
∴ Total number of balls in the bag = 5 + 7 + 4 + 2 = 18
∴ Number of all possible outcomes = 18

$$\textit{Proabibilty of the event} = \frac{\textit{Number of favourble outcomes}}{\textit{Total number of possible outcomes}}$$

i. Let E be the event that the ball drawn is white or blue.
Then, the number of outcomes favourable to E is 5 + 2 = 7.

So, P(E) = P (white or blue) = $\frac{7}{18}$

ii. Let E be the event that the ball drawn is red or black.
Then, the number of outcomes favourable to E is 7 + 4 = 11.

So, P(E) = P (red or black) = $\frac{11}{18}$

iii. Let E be the event not the ball drawn is not white.
Then, the number of outcomes favourable to E is 7 + 4 + 2 = 13.

So, P(E) = P (not white) = $\frac{13}{18}$

iv. Let E be the event that the ball drawn is neither white nor black.
Then, the number of outcomes favourable to E is 7 + 2 = 9

So, P(E) = P (neither white nor black)= $\frac{9}{18} = \frac{1}{2}$

Section E

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

Akshat's father is planning some construction work in his terrace area. He ordered 360 bricks and instructed the supplier to keep the bricks in such as way that the bottom row has 30 bricks and next is one less than that and so on.

The supplier stacked these 360 bricks in the following manner, 30 bricks in the bottom row, 29 bricks in the next row, 28 bricks in the row next to it, and so on.

(i) Number of bricks in the bottom row = 30. in the next row = 29, and so on.
Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27, ..., which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1
Suppose number of rows is n, then sum of number of bricks in n rows should be 360.
i.e. $S_n = 360$

$\Rightarrow \frac{n}{2}[2 \times 30 + (n-1)(-1)] = 360 \ \{S_n = \frac{n}{2}(2a + (n-1)d)\}$

$\Rightarrow 720 = n(60 - n + 1)$

$\Rightarrow 720 = 60n - n^2 + n$

$\Rightarrow n^2 - 61n + 720 = 0$

$\Rightarrow n^2 - 16n - 45n + 720 = 0$ [by factorization]

$\Rightarrow n(n-16) - 45(n-16) = 0$

$\Rightarrow (n-16)(n-45) = 0$

$\Rightarrow (n-16) = 0$ or $(n-45) = 0$

$\Rightarrow n = 16$ or $n = 45$

Hence, number of rows is either 45 or 16.
n = 45 not possible so n = 16

$a_{45} = 30 + (45-1)(-1) \ \{a_n = a + (n-1)d\}$

$= 30 - 44 = -14$ [$\because$ The number of logs cannot be negative]

Hence the number of rows is 16.

(ii) Number of bricks in the bottom row = 30. in the next row = 29, and so on.

Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27,...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1

Suppose number of rows is n, then sum of number of bricks in n rows should be 360.

Number of bricks on top row are $n = 16$,

$a_{16} = 30 + (16 - 1)(-1)$ $\{a_n = a + (n - 1)d\}$

$= 30 - 15 = 15$

Hence, and number of bricks in the top row is 15.

(iii) Number of bricks in the bottom row = 30. in the next row = 29, and so on.

therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27, ...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1.

Suppose number of rows is n, then sum of number of bricks in n rows should be 360

Number of bricks in 10th row a = 30, d = -1, n = 10

$a_n = a + (n - 1)d$

$\Rightarrow a_{10} = 30 + 9 \times -1$

$\Rightarrow a_{10} = 30 - 9 = 21$

Therefore, number of bricks in 10th row are 21.

OR

Number of bricks in the bottom row = 30. in the next row = 29, and so on.

Therefore, Number of bricks stacked in each row form a sequence 30, 29, 28, 27,...,
which is an AP with first term, a = 30 and common difference, d = 29 - 30 = -1.

Suppose number of rows is n, then sum of number of bricks in n rows should be 360.

$a_n = 26$, a = 30, d = -1

$a_n = a + (n - 1)d$

$\Rightarrow 26 = 30 + (n - 1) \times -1$

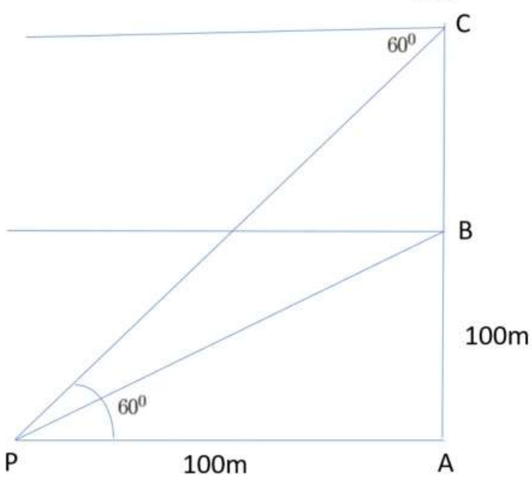
$\Rightarrow 26 - 30 = -n + 1$

$\Rightarrow n = 5$

Hence 26 bricks are in 5th row.

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

A hot air balloon is rising vertically from a point A on the ground which is at distance of 100m from a car parked at a point P on the ground. Amar, who is riding the balloon, observes that it took him 15 seconds to reach a point B which he estimated to be equal to the horizontal distance of his starting point from the car parked at P.



(i) The angle of depression from the balloon at a point B to the car at point P.

In △APB

$$\tan B = \frac{AB}{AP} = \frac{100}{100} = 1$$

$\Rightarrow \tan B = 1$

$\Rightarrow \tan B = \tan 45^o$

$\Rightarrow B = 45^o$

(ii) The speed of the balloon is

$$\text{Speed} = \frac{\text{Distan } ce}{\text{Time}}$$

$$\Rightarrow \text{Speed} = \frac{100}{15} = \frac{25}{3} = 6.6 \text{ m/sec}$$

(iii) The vertical distance travelled by the balloon when angle of depression is 60^o.

In △APC

Let BC = x

$$\tan 60^\circ = \frac{AC}{AP} = \frac{AB+x}{100}$$

$$\Rightarrow \sqrt{3} = \frac{100+x}{100}$$

$\Rightarrow 100\sqrt{3} - 100 = x$

$\Rightarrow x = 100(\sqrt{3} - 1)$

$\Rightarrow x = 73.21$ m

OR

The total time taken by the balloon to reach the point C from ground.

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\Rightarrow T = \frac{100(\sqrt{3}-1)}{\frac{25}{3}}$$

$\Rightarrow T = 12(\sqrt{3} - 1) = 8.78$ sec

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

Ashish is a Class IX student. His class teacher Mrs Verma arranged a historical trip to great Stupa of Sanchi. She explained that Stupa of Sanchi is great example of architecture in India. Its base part is cylindrical in shape. The dome of this stupa is hemispherical in shape, known as Anda. It also contains a cubical shape part called Hermika at the top. Path around Anda is known as Pradakshina Path.

(i) Volume of Hermika = side^3 = 10 × 10 × 10 = 1000 m^3

(ii) r = radius of cylinder = 24, h = height = 16

Volume of cylinder = $\pi r^2 h$

$$\Rightarrow V = \frac{22}{7} \times 24 \times 24 \times 14 = 25344 \text{ m}^3$$

(iii) Volume of brick = 0.01 m^3

$$\Rightarrow n = \text{Number of bricks used for making cylindrical base} = \frac{\text{Volume of cylinder}}{\text{Volume of one brick}}$$

$$\Rightarrow n = \frac{25344}{0.01} = 2534400$$

OR

Since Anda is hespherical in shape r = radius = 21

$$V = \text{Volume of Anda} = \frac{2}{3} \times \pi \times r^3$$

$$\Rightarrow V = \frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$$

$$\Rightarrow V = 44 \times 21 \times 21 = 19404 \text{ m}^3$$