Class - X Session 2022-23
Subject - Mathematics (Basic)
Sample Question Paper - 29

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 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 2 marks, 2 Qs of 3 marks and 2 Questions of 5 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.

Section A

1. The number of zeroes of a cubic polynomial is **[1]**

a) 3 b) 2

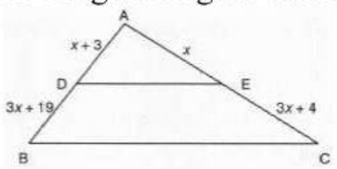
c) 4 d) 1

2. For what value of k, do the equations kx - 2y = 3 and 3x + y = 5 represent two lines intersecting at a unique point? **[1]**

a) all real values except -6 b) k = 3

c) k = 6 d) k = -3

3. In the given figure value of x for which DE || BC is **[1]**



a) 3 b) 2

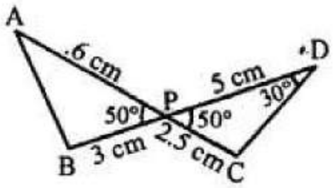
c) 4 d) 1

4. Aruna has only Re 1 and Rs 2 coins with her. If the total number of coins that she has is 50 and the amount of money with her is Rs 75, then the number of Rs 1 and Rs 2 coins are, respectively **[1]**

a) 35 and 15 b) 35 and 20

c) 15 and 35 | d) 25 and 25

5. In the given figure, two line segments AC and BD intersect each other at the point P such that PA = 6 cm, PB = 3 cm, PC = 2.5 cm, PD = 5 cm, ∠APB = 50° and ∠CDP = 30°, ∠PBA = ? **[1]**



a) 60°
b) 100°
c) 50°
d) 30°

6. If in a $\Delta ABC, \angle C = 90^\circ$ and $\angle B = 45^\circ$, then state which of the following is true? **[1]**

a) Perpendicular = Hypotenuse
b) Base = Hypotenuse
c) Base = Hypotenuse + Perpendicular
d) Base = Perpendicular

7. The probability of getting an even, number, when a die is thrown once is **[1]**

a) $\frac{5}{6}$
b) $\frac{1}{3}$
c) $\frac{1}{2}$
d) $\frac{1}{6}$

8. The mode of 4, 5, 6, 8, 5, 4, 6, 5, 6, x, 8 is 6. The value of x is **[1]**

a) 8
b) 6
c) 5
d) 4

9. △ ABC ~ △ DEF such that AB = 9.1 cm and DE = 6.5 cm. If. the perimeter of △ DEF is 25 cm, what is the perimeter of △ABC? **[1]**

a) 40 cm
b) 28 cm
c) 35 cm
d) 42 cm

10. If the equation $x^2 - kx + 1 = 0$ has no real roots then **[1]**

a) $-2 < k < 2$
b) None of these
c) $k < -2$
d) $k > 2$

11. If p is a prime number, then $\sqrt{p}$ is **[1]**

a) Prime number
b) Rational

c) Integer | d) Irrational

12. $\frac{\text{Upper class limit} + \text{Lower class limit}}{2} =$ **[1]**

a) frequency
b) class mark
c) None of these
d) class size

13. If the distance between the points (4, p) and (1,0) is 5, then the value of p is **[1]**

a) 0
b) 4 only
c) -4 only
d) ± 4

14. $\sec^4 A - \sec^2 A$ is equal to **[1]**

a) $\tan^2 A - \tan^4 A$
b) $\tan^4 A - \tan^2 A$
c) $\tan^2 A + \tan^3 A$
d) $\tan^4 A + \tan^2 A$

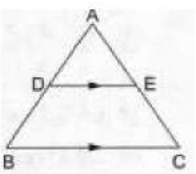
15. The chord of a circle of radius 10 cm subtends a right angle at its centre. The length of the chord (in cm) is **[1]**

a) $\frac{5}{\sqrt{2}}$
b) $10\sqrt{3}$
c) $5\sqrt{2}$
d) $10\sqrt{2}$

16. A pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then the sun's elevation is **[1]**

a) 30°
b) 60°
c) 45°
d) 90°

17. In $\triangle ABC$, DE || BC so that AD = 2.4 cm, AE = 3.2 cm and EC = 4.8 cm. Then, AB = ? **[1]**



a) 6.4 cm
b) 7.2 cm
c) 3.6 cm
d) 6 cm

18. Which of the following equations has two distinct real roots? **[1]**

a) $x^2 + x - 5 = 0$
b) $5x^2 - 3x + 1 = 0$
c) None of these
d) $x^2 + x + 5 = 0$

19. **Assertion:** If α, β, γ are the zeroes of $x^3 - 2x^2 + qx - r$ and $\alpha + \beta = 0$, then 2q = r. **[1]**

Reason: If α, β, γ are the zeroes of $ax^3 + bx^2 + cx + d$,
then, $\alpha + \beta + \gamma = -\frac{b}{a}$
$\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$
$\alpha\beta\gamma = -\frac{d}{a}$

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.

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 300 cm^2. **[1]**

Reason (R): Total surface area of a cuboid is 2(lb + bh + lh)

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 roots of the quadratic equation by using the quadratic formula: **[2]**
$2x^2 - 3x - 5 = 0$

22. Find the distance of C(-4, -6) points from the origin. **[2]**

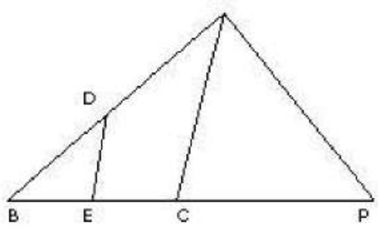
OR

AOBC is a rectangle whose three vertices are A(0,3), 0(0, 0) and B(5, 0). Find the length of its diagonal.

23. In a ΔABC right angled at B, if AB = 4 and BC = 3, find all the six trigonometric ratios of $\angle A$ **[2]**

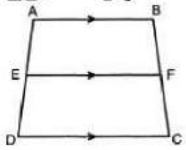
24. Explain why 7 × 11 × 13 + 13 is a composite number. **[2]**

25. In the figure, DE || AC and, $\frac{BE}{EC} = \frac{BC}{CP}$ prove that **[2]**



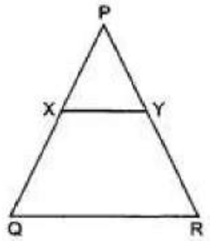
OR

In the given figure, if ABCD is a trapezium in which AB || CD || EF, then prove that $\frac{AE}{ED} = \frac{BF}{FC}$.



Section C

26. In the given figure, $\triangle$PQR in which XY || QR, PX = 1 cm, XQ = 3 cm, YR = 4.5 cm, QR = 9 cm, find PY and XY. Further if the area of $\triangle$PXY is 'A' cm^2, find in terms of A, the area of $\triangle$PQR and area of trapezium XYRQ. **[3]**



27. The sum of two natural numbers is 28 and their product is 192. Find the numbers. **[3]**

28. If P(2,-1), Q(3,4), R(-2,3) and S (-3,-2) be four points in a plane, show that PQRS is a rhombus but not a square. Find the area of the rhombus. **[3]**

OR

If A (-1, 3), B (1, -1) and C (5,1) are the vertices of a triangle ABC, find the length of the median through A.

29. A mason has to fit a bathroom with square marble tiles of the largest possible size. The size of the bathroom is 10 ft. by 8 ft. What would be the size (in inches) of the tile required that has to be cut and how many such tiles are required? **[3]**

30. If a 1.5-m-tall girl stands at a distance of 3m from a lamp-post and casts a shadow of length 4.5m on the ground then find the height of the lamp-post. **[3]**

OR

From the top of hill, the angles of depression of two consecutive kilometer stones due East are found to be 30^o and 45^o. Find the height of the hill.

31. Following is the distribution of marks obtained by 60 students in Economics test: **[3]**

Marks	Number of students
More than 0	60
More than 10	56
More than 20	40
More than 30	20
More than 40	10
More than 50	3

Calculate the arithmetic mean.

Section D

32. Ten years ago, father was twelve times as old as his son and ten years hence, he will be twice as old as his son will be. Find their present ages. **[5]**

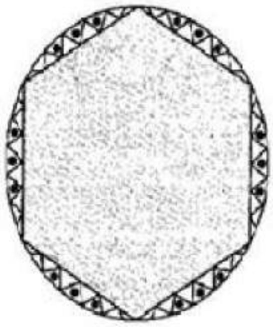
OR

Solve the following pair of linear equations by the elimination method and the substitution method: $x + y = 5$ and $2x - 3y = 4$

33. Find the difference of the areas of two segments of a circle formed by a chord of length 5 cm subtending angle of 90° at the centre. **[5]**

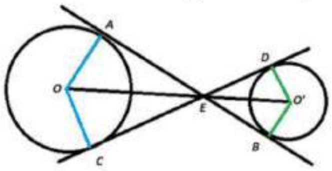
OR

A round table cover has six equal designs as shown in figure. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of Rs. 0.35 per cm^2. (use $\sqrt{3} = 1.7$)



34. A circular target of radius 11 cm consists of an inner circle of radius 5 cm and 3 concentric circles of radii 7 cm, 9 cm and 10 cm dividing the target into 4 regions. If a shot hits the target, find the probabilities of hitting each region. If you shoot the target 121 times, what is your expectation? How will you improve your performance? **[5]**

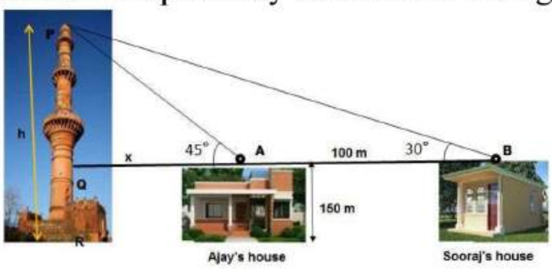
35. The common tangents AB and CD to two circles with centres O and O' intersect at E. Prove that points O, E and O' are collinear **[5]**



Section E

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

The houses of Ajay and Sooraj are at 100 m distance and the height of their houses is the same as approx 150 m. One big tower was situated near their house. Once both friends decided to measure the height of the tower. They measure the angle of elevation of the top of the tower from the roof of their houses. The angle of elevation of ajay's house to the tower and sooraj's house to the tower are 45^{o} and 30^{o} respectively as shown in the figure.



(i) Find the height of the tower.

(ii) What is the distance between the tower and the house of Sooraj?

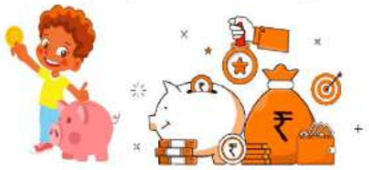
(iii) Find the distance between top of the tower and top of Sooraj's house?

OR

Find the distance between top of tower and top of Ajay's house?

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

Saving money is a good habit and it should be inculcated in children from the beginning. Mrs. Pushpa brought a piggy bank for her child Akshar. He puts one five-rupee coin of his savings in the piggy bank on the first day. He increases his savings by one five-rupee coin daily.



(i) If the piggy bank can hold 190 coins of five rupees in all, find the number of days he can contribute to put the five-rupee coins into it

(ii) Find the total money he saved.

(iii) How much money Akshar saves in 10 days?

OR

How many coins are there in piggy bank on 15th day?

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)** 3

   Explanation: The number of zeroes of a cubic polynomial is at most 3 because the highest power of the variable in cubic polynomial is 3, i.e. $ax^3 + bx^2 + cx + d$
2. **(a)** all real values except -6

   Explanation: For a unique intersecting point, we have $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

   $\therefore \frac{k}{3} \neq \frac{-2}{1} \Rightarrow k \neq -6$
3. **(b)** 2

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

   $\therefore \frac{\mathrm{AD}}{\mathrm{DB}} = \frac{\mathrm{AE}}{\mathrm{EC}}$

   $\Rightarrow \frac{x+3}{3x+19} = \frac{x}{3x+4}$

   $\Rightarrow (x + 3)(3x + 4) = x(3x + 19)$

   $\Rightarrow 3x^2 + 4x + 9x + 12 = 3x^2 + 19x$

   $\Rightarrow 3x^2 + 13x + 12 = 3x^2 + 19x$

   $\Rightarrow 12 = 3x^2 + 19x - 3x^2 - 13x$

   $\Rightarrow 12 = 6x \Rightarrow x = \frac{12}{6} = 2$

   $\therefore x = 2$
4. **(d)** 25 and 25

   Explanation: Let number of Rs 1 coins = x

   and number of Rs 2 coins = y

   Now, by given conditions:

   Total number of coins = x + y = 50 ...(i)

   Also, Amount of money with her = (Number of Rs 1 $\times$ 1) + (Number of Rs 2 $\times$ coin 2)

   = x(1) + y(2) = 75

   = x + 2y = 75 ...(ii)

   On subtracting Eq. (i) from Eq. (ii), we get

   (x + 2y) - (x + y) = (75 - 50)

   So, y = 25

   Putting y = 25 we get x = 25.

   Hence he has 25 one-rupee coins and 25 2-rupee coins.
5. **(b)** 100°

   Explanation: In the given figure, two line segments AC and BD intersect each other at P such that

   PA = 6 cm, PB = 3 cm, PC = 2.5 cm, PD = 5 cm, $\angle$APB = 50° and $\angle$CDP = 30°

   In $\triangle$ABP and $\triangle$CPD,

   $\angle APB = \angle CPD$ (each = 50°) and vertically)

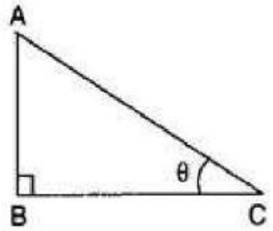
   opposite angles.

   $\frac{AP}{PB} = \frac{6}{5}, \frac{BP}{PC} = \frac{3}{2.5} = \frac{6}{5}$

$\therefore \frac{\mathrm{AP}}{\mathrm{PB}} = \frac{\mathrm{BP}}{\mathrm{PC}}$
$\therefore \Delta\mathrm{ABP} \sim \Delta\mathrm{CPD}$ (SAS axiom)
$\therefore \angle\mathrm{PAB} = \angle\mathrm{CDP} = 30^\circ$
and $\angle\mathrm{ABP} = \angle\mathrm{DCP}$
But $\angle\mathrm{ABP} + \angle\mathrm{APB} + \angle\mathrm{BAP} = 180^\circ$ (sum of angles of a triangles)
$\Rightarrow \angle ABP + 50^\circ + 30^\circ = 180^\circ$
$\Rightarrow \angle\mathrm{ABP} = 180^\circ - 50^\circ - 30^\circ = 100^\circ$

6. **(d)** Base = Perpendicular

Explanation:



Given: in triangle ABC, $\angle C = 45^\circ$, and $\angle B = 90^\circ$,
Since, $\tan\theta = \frac{\text{Perpendicular}}{\text{Base}}$
$\Rightarrow \tan 45^\circ = \frac{\text{Perpendicular}}{\text{Base}}$
$\Rightarrow 1 = \frac{\text{Perpendicular}}{\text{Base}}$
$\Rightarrow$ Base = perpendicular

7. **(c)** $\frac{1}{2}$
Explanation: Even number on a die are 2,4,6.
$\therefore$ Probability P = $\frac{3}{6} = \frac{1}{2}$

8. **(b)** 6
Explanation: Here Observations 5 and 6 has more frequency than those of other numbers that is 3
But here it is given that mode is 6,
$\therefore$ 6 could repeat itself at least once more.
$\Rightarrow$ x should be 6.

9. **(c)** 35 cm
Explanation: $\triangle\mathrm{ABC} \sim \triangle\mathrm{DEF}$
$\therefore \frac{\mathrm{AB}}{\mathrm{DE}} = \frac{\mathrm{BC}}{\mathrm{EF}} = \frac{\mathrm{AC}}{\mathrm{DF}} = \frac{\mathrm{AB+BC+AC}}{\mathrm{DE+EF+DF}}$
$\Rightarrow \frac{9.1}{6.5} = \frac{\text{Perimeter of }\Delta\mathrm{ABC}}{\text{Perimeter of }\Delta\mathrm{DEF}}$
$\Rightarrow \frac{9.1}{6.5} = \frac{\text{Perimeter of }\Delta\mathrm{ABC}}{25}$
$\Rightarrow$ Perimeter of $\triangle\mathrm{ABC} = \frac{9.1\times 25}{6.5} = 35\mathrm{cm}$

10. **(a)** -2 < k < 2

Explanation: For no real roots, we must have: $b^2 - 4ac < 0$.
$k^2 - 4 < 0 \Rightarrow k^2 < 4 \Rightarrow -2 < k < 2$.

11. **(d)** Irrational
Explanation: $\sqrt{p}$ is an irrational number because the square root of every prime number is an irrational number. (for example $\sqrt{3}$ is an irrational number)

12. **(b)** class mark
Explanation: In each class interval of grouped data, there are two limits or

boundaries (upper limit and lower limit) while the mid-value is equal to $\frac{\text{Upper class limit+Lower class limit}}{2}$. These mid-values are also known as Classmark.

13. **(d)** ± 4

Explanation: Distance between (4, p) and (1, 0) = 5

$\Rightarrow \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = 5$

$\Rightarrow \sqrt{(1-4)^2 + (0-p)^2} = 5$

$\sqrt{(-3)^2 + (-p)^2} = 5$

Squaring, both sides

$(-3)^2 + (-p)^2 = (5)^2 \Rightarrow 9 + p^2 = 25$

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

$\therefore p = \pm\sqrt{16} = \pm 4$

14. **(d)** $\tan^4 A + \tan^2 A$

Explanation: We have, $\sec^4 A - \sec^2 A = \sec^2 A (\sec^2 A - 1)$

$= (1 + \tan^2 A) \tan^2 A$

$= \tan^2 A + \tan^4 A$

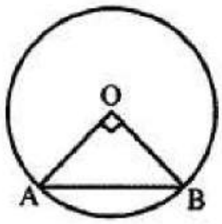
$= \tan^4 A + \tan^2 A$

15. **(d)** $10\sqrt{2}$

Explanation:

A chord subtends a right angle at its centre

Radius of the circle = 10 cm



$\therefore$ Chord AB $= \sqrt{r^2 + r^2}$

$= \sqrt{10^2 + 10^2}$

$= \sqrt{100 + 100} = \sqrt{200}$

$= \sqrt{100 \times 2} = 10\sqrt{2}$cm

16. **(b)** 60°

Explanation: Let height = 6m

length of shadow = $2\sqrt{3m}$

θ is angle of elevation

$\tan\theta$ = (height) / (shadow length)

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

$\theta = \frac{\pi}{3}$

Angle of inclination is = 60°

17. **(d)** 6 cm

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

AD = 2.4 cm, AE = 3.2 cm, EC = 4.8 cm

Let AD = x cm

DE || BC

$\therefore \frac{AD}{DB} = \frac{AE}{EC}$

$\Rightarrow \frac{2.4}{x} = \frac{3.2}{4.8} \Rightarrow x = \frac{2.4 \times 4.8}{3.2}$

$\Rightarrow x = \frac{24 \times 48 \times 10}{32 \times 10 \times 10} = \frac{36}{10} = 3.6$

$\therefore AB = AD + DB = 2.4 + 3.6 = 6.0\text{cm}$

18. **(a)** $x^2 + x - 5 = 0$

Explanation: In equation $x^2 + x - 5 = 0$

$a = 1, b = 1, c = -5$

$\therefore b^2 - 4ac = (1)^2 - 4 \times 1 \times (-5) = 1 + 20 = 21$

Since $b^2 - 4ac > 0$ therefore, $x^2 + x - 5 = 0$ has two distinct roots.

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

Explanation: Clearly, Reason is true. [Standard Result]

$\alpha + \beta + \gamma = -(-2) = 2$

$0 + \gamma = 2$

$\gamma = 2$

$\alpha\beta\gamma = -(-r) = r$

$\alpha\beta(2) = r$

$\alpha\beta = \frac{r}{2}$

$\alpha\beta + \beta\gamma + \gamma\alpha = q$

$\frac{r}{2} + r(\alpha + \beta) = q$

$\frac{r}{2} + \gamma(0) = q$

r = 2q

Assertion is true. Since, reason gives assertion.

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

Explanation: A is false but R is true.

Section B

21. The quadratic formula for finding the roots of quadratic equation

$ax^2 + bx + c = 0, a \neq 0$ is given by,

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Given, $2x^2 - 3x - 5 = 0$

$\therefore x = \frac{-(-3) \pm \sqrt{3^2 - 4(2)(-5)}}{2(2)}$

$= \frac{3 \pm \sqrt{49}}{4}$

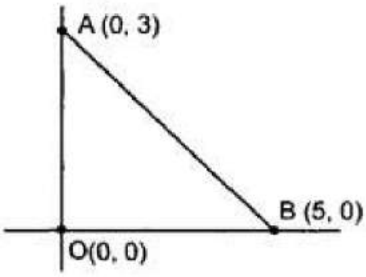
$= \frac{3 \pm 7}{4} = \frac{5}{2}, -1$

22. The given point is C(-4, -6) and let O(0,0) be the origin

Then, $CO = \sqrt{(-4 - 0)^2 + (-6 - 0)^2}$

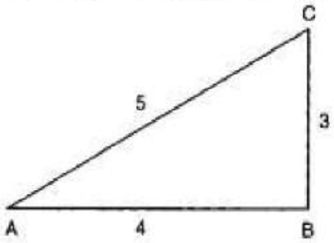
$= \sqrt{16 + 36} = \sqrt{52} = 2\sqrt{13}\ units$

OR



AB = $\sqrt{(5-0)^2+(0-3)^2} = \sqrt{25+9} = \sqrt{34}$

Hence, the length of diagonals is $\sqrt{34}$units.

23. 

We have, $AB = 4$ and $BC = 3$.

Using Pythagoras theorem,

$AC^2 = AB^2 + BC^2$

$\Rightarrow \quad AC = \sqrt{AB^2 + BC^2}$

$\Rightarrow \quad AC = \sqrt{4^2 + 3^2} = \sqrt{25} = 5$

When we consider the t-ratios of $\angle A$, we have

$Base = AB = 4$, $perpendicular = BC = 3$ and, $Hypotenuse = AC = 5$.

$\therefore \quad \sin A = \frac{BC}{AC} = \frac{3}{5}, \cos A = \frac{AB}{AC} = \frac{4}{5}, \tan A = \frac{BC}{AB} = \frac{3}{4}$

$cosecA = \frac{AC}{BC} = \frac{5}{3}, \sec A = \frac{AC}{AB} = \frac{5}{4}$ and , $\cot A = \frac{AB}{BC} = \frac{4}{3}$

24. 7 × 11 × 13 + 13

Take 13 common there we get

= 13(7 x 11 +1)

= 13(77 + 1)

= 13(78)

It is the product of two numbers and both numbers are more than 1. So, it is a composite number.

25. In $\triangle$ABC, DE $\perp$ AC

$\therefore \frac{BD}{DA} = \frac{BE}{CP}$ ....(1)[By Thales's Theorem]

Also

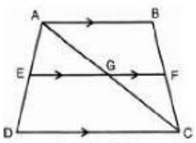
$\frac{BE}{EC} = \frac{BC}{CP}$ (given) ....(ii)

$\therefore$ From (i) and (ii), we get

$\frac{BD}{DA} = \frac{BC}{CP} \therefore DC \perp AP$ [By the converse of Thales Theorem]

OR

Draw AC intersecting EE at G.



In $\triangle$CAB, GF $\parallel$ AB

$\Rightarrow \frac{AG}{CG} = \frac{BF}{FC}$(By BPT) ......(i)

In $\triangle$ADC, EG $\parallel$ DC

$\Rightarrow \frac{AE}{ED} = \frac{AG}{CG}$(By BPT)........(ii)

From equations (i) and (ii),

$\frac{AE}{ED} = \frac{BF}{FC}$

$\therefore$ If ABCD is a trapezium in which AB $\parallel$ CD $\parallel$ EF, then $\frac{AE}{ED} = \frac{BF}{FC}$.

Section C

26. $\because$ XY $\parallel$ QR

$\therefore \quad \frac{\mathrm{PX}}{\mathrm{XQ}} = \frac{\mathrm{PY}}{\mathrm{YR}}$ (using Basic Proportionality Theorem)

$\Rightarrow \quad \frac{1}{3} = \frac{PY}{4.5}$

$\Rightarrow$ PY = 1.5 cm

$\because$ XY $\parallel$ QR

$\therefore \angle$PXY = $\angle$PQR

$\angle$PYX = $\angle$PRO (corresponding angles)

$\therefore \quad \triangle\mathrm{PXY} \sim \triangle\mathrm{PQR}$, By AA Similarity Criteria

$\Rightarrow \quad \frac{\mathrm{PX}}{\mathrm{PQ}} = \frac{\mathrm{XY}}{\mathrm{QR}} \Rightarrow \frac{1}{\mathrm{PX}+\mathrm{XQ}} = \frac{\mathrm{XY}}{9}$(as corresponding sides of similar triangles are in proportion to each other)

$\Rightarrow \quad \frac{1}{4} = \frac{\mathrm{XY}}{9} \Rightarrow \mathrm{XY} = \frac{9}{4} = 2.25\mathrm{cm}$

$\frac{\text{Area }\triangle\mathrm{PXY}}{\text{Area }\triangle\mathrm{PQR}} = \frac{\mathrm{XY}^2}{\mathrm{QR}^2} = \frac{(2.25)^2}{9^2} = \frac{1}{16}$

$\Rightarrow \frac{A}{\text{Area }\triangle PQR} = \frac{1}{16}$

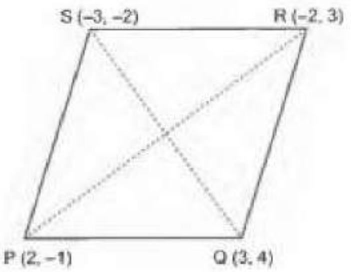
$\Rightarrow$ Area of $\triangle$PQR = 16A cm^2.

Area of trapezium XYRQ = Area $\triangle$PQR - Area $\triangle$PXY

= 16A - A = 15A cm^2

27. Let the 1st natural number is x.
Since, sum of the two natural numbers is 28. Hence, 2nd number will be (28 - x).
According to the question;
x(28 - x) = 192
$\Rightarrow$ 28x - x^2 = 192
$\Rightarrow$ x^2 - 28x + 192 = 0
$\Rightarrow$ x^2 - 16x - 12x + 192 = 0
$\Rightarrow$ x(x - 16) - 12(x - 16) = 0
$\Rightarrow$ x - 16 = 0 or x - 12 = 0
$\Rightarrow$ x = 16 or x = 12
Hence, the required numbers are 16 and 12.

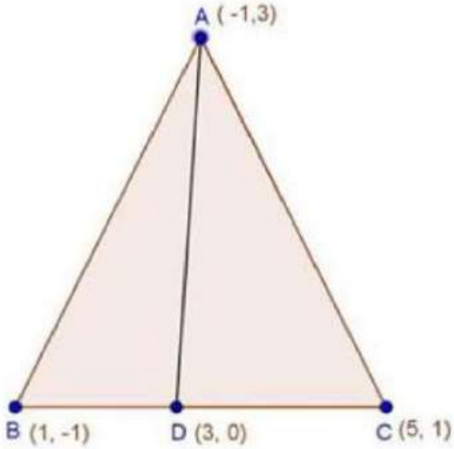
28. The given points are P (2, -1), Q (3,4), R(-2,3) and S (-3, -2).
We have,



$PQ=\sqrt{(3-2)^2+(4+1)^2}=\sqrt{1^2+5^2}=\sqrt{26}$ units
$QR=\sqrt{(-2-3)^2+(3-4)^2}=\sqrt{25+1}=\sqrt{26}$ units
$RS=\sqrt{(-3+2)^2+(-2-3)^2}=\sqrt{1+25}=\sqrt{26}$ units
$SP=\sqrt{(-3-2)^2+(-2+1)^2}=\sqrt{26}$units
and $QS=\sqrt{(-3-3)^2+(-2-4)^2}=\sqrt{36+36}=6\sqrt{2}$ units
$\therefore$ PQ = QR = RS = SP = $\sqrt{26}$ units

$PR=\sqrt{(-2-2)^2+(3+1)^2}=\sqrt{16+16}=\sqrt{32}$
Therefore, $PR \neq QS$
This means that PQRS is a quadrilateral whose sides are equal but diagonals are not equal.
Thus, PQRS is a rhombus but not a square.
Now, Area of rhombus PQRS $=\frac{1}{2}\times$ (Product of lengths of diagonals)
$=\frac{1}{2}\times(PR\times QS)=\left(\frac{1}{2}\times 4\sqrt{2}\times 6\sqrt{2}\right)$ sq. units = 24 sq. units

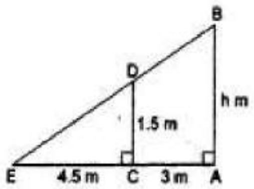
OR



Let A(-1, 3), B(1, -1) and C(5, 1) be the vertices of triangle ABC and let AD be the median through A.
Since, AD is the median, D is the mid-point of BC
Coordinates of mid point are $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$
$\therefore$ Coordinates of D are $\left(\frac{1+5}{2}, \frac{-1+1}{2}\right) = (3,0)$
So, Length of median $AD = \sqrt{(3+1)^2+(0-3)^2}$
$= \sqrt{(4)^2+(-3)^2}$
$= \sqrt{16+9}$
$= \sqrt{25}$
=5 units
Hence, median AD is 5

29. **Given:** Size of bathroom = 10 ft by 8 ft.
= (10 $\times$ 12) inch by (8 × 12) inch
= 120 inch by 96 inch
Area of bathroom = 120 inch by 96 inch
To find the largest size of tile required , we find HCF of 120 and 96.
By applying Euclid's division lemma
120 = 96 $\times$ 1 + 24
96 = 24 $\times$ 4 + 0
Therefore, HCF = 24
Therefore, Largest size of tile required = 24 inches
no.of tiles required $= \frac{\text{area of bathroom}}{\text{area of a tile}} = \frac{120\times96}{24\times24} = 5 \times 4 = 20$ tiles
Hence number of tiles required is 20 and size of tiles is 24 inches.

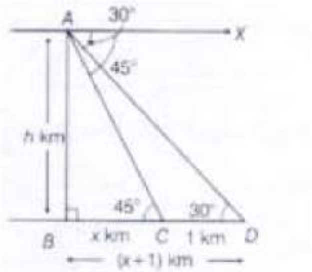
30. Let AB be the lamp-post and CD be the girl.



30. Let CE be the shadow of CD. Then,
$CD = 1.5m, CE = 4.5m \ and \ AC = 3m.$
Let AB = h m.
Now, ΔAEB and ΔCED are similar.
$\therefore \quad \frac{AB}{AE} = \frac{CD}{CE} \Rightarrow \frac{h}{(3+4.5)} = \frac{1.5}{4.5} = \frac{1}{3}$
$\Rightarrow h = \frac{1}{3} \times 7.5 = 2.5$

OR

Let AB = h km be the height of the hill, and C,D be two consecutive stones such that CD=1 km.
Let BC be x km, then BD = BC + CD = (x + 1) km



Now, $\angle ADB = \angle XAD = 30^o$ [ailternate angles]
and $\angle ACB = \angle XAC = 45^o$ [alternate angles]
In right angled $\triangle ABC$,
$\tan 45^o = \frac{P}{B} = \frac{AB}{BC}$
$\Rightarrow 1 = \frac{h}{x}$
$\Rightarrow x = h$
Now, In right angled $\triangle ABD$, $\tan 30^o = \frac{AB}{BD}$
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+1}$
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h+1}$ [h = x]
$\Rightarrow \boldsymbol{h + 1 = \sqrt{3}h}$
$\Rightarrow \sqrt{3}h - h = 1$
$\Rightarrow (\sqrt{3} - 1)h = 1$
$\Rightarrow h = \frac{1}{\sqrt{3}-1}$
$\Rightarrow \boldsymbol{h = \frac{1}{0.732}}$
$\Rightarrow \boldsymbol{h = \frac{1}{0.732}}$
Therefore, Height of the hill = 1.366k m

31.

Class Interval	Number of students(f)	Mid Value(x_i)	f_ix_i
0 - 10	60 - 56 = 4	5	20
10- 20	56 - 40 = 16	15	240

Class Interval	Number of students(f)	Mid Value(x_i)	f_ix_i
20 - 30	40 - 20 = 20	25	500
30 - 40	20 - 10 = 10	35	350
40 - 50	10 - 3 = 7	45	315
50 - 60	3	55	165
Total	$\Sigma f_i = 60$		$\Sigma f_i x_i = 1590$

Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{1590}{60} = 26.5$

Section D

32. Suppose, the present ages of father and son be x years and y years respectively.
According to the question,
Ten years ago,
Father's age = $(x - 10) years$
Son's age = $(y - 10) years$
$\therefore x - 10 = 12(y - 10)$
$\Rightarrow x - 12y + 110 = 0$ ....(i)
Ten years later,
Father's age = $(x + 10) years.$
Son's age = $(y + 10) years$
$\therefore x + 10 = 2(y + 10)$
$\Rightarrow x - 2y - 10 = 0$ ....(ii)
Subtracting (ii) from (i), we get
-10y + 120 = 0
$\Rightarrow$ 10y = 120
$\Rightarrow$ y = 12
Putting y = 12 in (i), we get
x - 144 + 110 = 0 $\Rightarrow$ x = 34

Thus, present age of father is 34 years and the present age of son is 12 years.

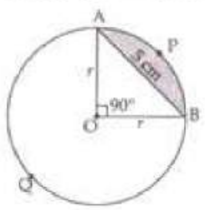
OR

1. By Elimination method,
The given system of equation is:
x + y = 5..................(1)
2x - 3y = 4................(2)
Multiplying equation (1) by 3, we get
3x + 3y = 15..................(3)
Adding equation (2) and equation (3), we get
$5x = 19 \therefore x = \frac{19}{5}$

Substituting this value of x in equation (1), we get
$\frac{19}{5} + y = 5 \Rightarrow \quad y = 5 - \frac{19}{5} \Rightarrow \quad y = \frac{6}{5}$
So, the solution of the given system of equation is
$x = \frac{19}{5}, y = \frac{6}{5}$

2. By Substitution method,
The given system of equation is
x + y = 5......................(1)
2x - 3y = 4...................(2)
From equation(1),
y = 5x........................(3)
Substitute this value of y in equation(2), we get
2x - 3(5 - x) = 4
$\Rightarrow$ 2x - 15 + 3x = 4
$\Rightarrow$ 5x - 15 = 4
$\Rightarrow \quad 5x = 19 \Rightarrow x = \frac{19}{5}$
Substituting this value of x in equation(3), we get
$y = 5 - \frac{19}{5} = \frac{6}{5}$
So, the solution of the given system of equation is
$x = \frac{19}{5}, y = \frac{6}{5}$
Verification: Substituting, $x = \frac{19}{5}, y = \frac{6}{5}$ we find that both the equation(1) and (2) are satisfied shown below:
$x + y = \frac{19}{5} + \frac{6}{5} = \frac{19+6}{5} = \frac{25}{5} = 5$
$2x - 3y = 2\left(\frac{19}{5}\right) - 3\left(\frac{6}{5}\right)$
$= \frac{38}{5} - \frac{18}{5} = \frac{38-18}{5} = \frac{20}{5} = 4$
Hence, the solution is correct

33. Chord AB = 5 cm divides the circle into two segments minor segment APB and major segment AQB. We have to find out the difference in area of major and minor segment.
Here, we are given that $\theta = 90°$
Area of $\triangle$OAB = $\frac{1}{2}$Base × Altitude = $\frac{1}{2}$r × r = $\frac{1}{2}r^2$



Area of minor segment APB
$= \frac{\pi r^2 \theta}{360^\circ} -$ Area of $\triangle$AOB
$= \frac{\pi r^2 90^\circ}{360^\circ} - \frac{1}{2}r^2$
$\Rightarrow$ Area of minor segment = $\left(\frac{\pi r^2}{4} - \frac{r^2}{2}\right)$ …(i)

Area of major segment AQB = Area of circle – Area of minor segment

$= \pi r^2 - \left[\frac{\pi r^2}{4} - \frac{r^2}{2}\right]$

$\Rightarrow$ Area of major segment AQB $= \left[\frac{3}{4}\pi r^2 + \frac{r^2}{2}\right]$ ...(ii)

Difference between areas of major and minor segment

$= \left(\frac{3}{4}\pi r^2 + \frac{r^2}{2}\right) - \left(\frac{\pi r^2}{4} - \frac{r^2}{2}\right)$

$= \frac{3}{4}\pi r^2 + \frac{r^2}{2} - \frac{\pi r^2}{4} + \frac{r^2}{2}$

$\Rightarrow$ Required area $= \frac{2}{4}\pi r^2 + r^2 = \frac{1}{2}\pi r^2 + r^2$

In right $\triangle$OAB,

$r^2 + r^2 = AB^2$

$\Rightarrow 2r^2 = 5^2$

$\Rightarrow r^2 = \frac{25}{2}$

Therefore, required area $= \left[\frac{1}{2}\pi \times \frac{25}{2} + \frac{25}{2}\right] = \left[\frac{25}{4}\pi + \frac{25}{2}\right] cm^2$

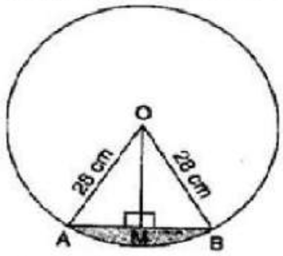
OR

r = 28 cm and $\theta = \frac{360}{6} = 60^\circ$

Area of minor sector $= \frac{\theta}{360}\pi r^2 = \frac{60}{360} \times \frac{22}{7} \times 28 \times 28 = \frac{1232}{3}$

$= 410.67 \ cm^2$

For, Area of $\triangle$AOB,



Draw OM $\perp$ AB.

In right triangles OMA and OMB,

OA = OB [Radii of same circle]

OM = OM [Common]

$\therefore \triangle$OMA $\cong$ OMB [RHS congruency]

$\therefore$ AM = BM [By CPCT]

$\Rightarrow$ AM = BM = $\frac{1}{2}$AB and $\angle$AOM = $\angle$BOM = $\frac{1}{2}$AOB = $\frac{1}{2} \times 60^\circ = 30^\circ$

In right angled triangle OMA, $\cos 30^\circ = \frac{OM}{OA}$

$\Rightarrow \frac{\sqrt{3}}{2} = \frac{OM}{28}$

$\Rightarrow OM = 14\sqrt{3}$ cm

Also, $\sin 30^\circ = \frac{AM}{OA}$

$\Rightarrow \frac{1}{2} = \frac{AM}{28}$

$\Rightarrow$ AM = 14 cm

$\Rightarrow 2\ AM = 2 \times 14 = 28$ cm

$\Rightarrow$ AB = 28 cm

$\therefore$ Area of $\triangle$AOB $= \frac{1}{2} \times AB \times OM = \frac{1}{2} \times 28 \times 14\sqrt{3} = 196\sqrt{3} = 196 \times 1.7 =$

$333.2\ cm^2$

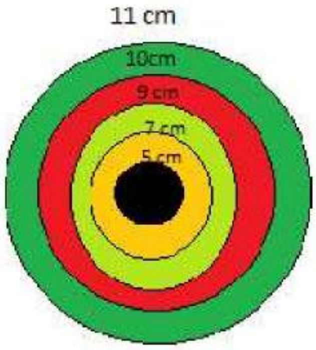
$\therefore$ Area of minor segment = Area of minor sector - Area of $\triangle$AOB

$= 410.67 - 333.2 = 77.47\ cm^2$

$\therefore$ Area of one design = $77.47\ cm^2$

$\therefore$ Area of six designs = $77.47 \times 6 = 464.82\ cm^2$

Cost of making designs = 464.82×0.35 = Rs. 162.68

34. 

Area of circle (with r = 11 cm) = $\pi \times (11)^2 = 121\pi\ cm^2$

Total area of outcome = $121\pi\ cm^2$

Area of region 1 = $\pi \times (11^2 - 10^2) = 21\pi\ cm^2$

Area of region 2 = $\pi \times (10^2 - 9^2) = 19\pi\ cm^2$

Area of region 3 = $\pi \times (9^2 - 7^2) = 32\pi\ cm^2$

Area of region 4 = $\pi \times (7^2 - 5^2) = 24\pi\ cm^2$

Probability of hitting region 1, $P_1 = \frac{21\pi}{121\pi} = \frac{21}{121}$

Probability of hitting region 2, $P_2 = \frac{19\pi}{121\pi} = \frac{19}{121}$

Probability of hitting region 3, $P_3 = \frac{32\pi}{121\pi} = \frac{32}{121}$

Probability of hitting region 4,,$P_4 = \frac{24\pi}{121\pi} = \frac{24}{121}$

If number of shots are 121 then expectation of hitting in the following regions:

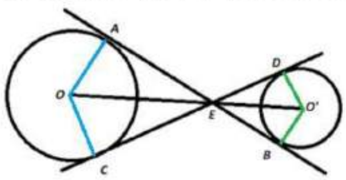
Region 1: $\frac{21}{121} \times 121 = 21$

Region 2: $\frac{19}{121} \times 121 = 19$

Region 3: $\frac{32}{121} \times 121 = 32$

Region 4: $\frac{24}{121} \times 121 = 24$

To improve his performance one needs to practice more.

35. 

Construction:

Join OA and OC.

In $\triangle$OAE and $\triangle$OCE, we have

OA = OC (radii of same circle)

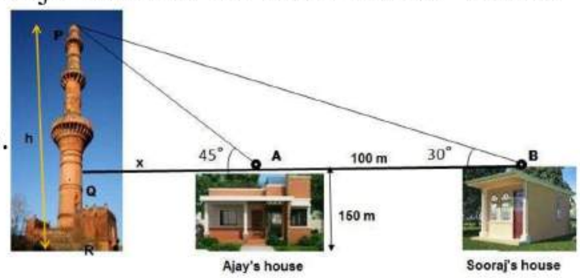
OE = OE (Common side)

$\angle OAE = \angle OCE$(each is 90°)

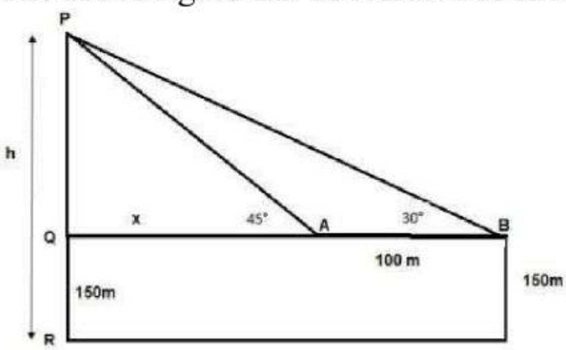
$\Rightarrow \triangle OAE \cong \triangle OCE$(RHS congruence criterion)
$\Rightarrow \angle AEO = \angle CEO$(cpct)
Similarly, $\angle BEO' = \angle DEO'$
$\angle AEC = \angle DEB$[Vertically Opposite Angles]
$\Rightarrow \frac{1}{2}\angle AEC = \frac{1}{2}\angle DEB$
$\Rightarrow \angle AEO = \angle CEO = \angle BEO' = \angle DEO'$
Since, these angles are equal and are bisected by OE and O'E,
O, E and O' are collinear.

Section E

36. **Read the text carefully and answer the questions:**
The houses of Ajay and Sooraj are at 100 m distance and the height of their houses is the same as approx 150 m. One big tower was situated near their house. Once both friends decided to measure the height of the tower. They measure the angle of elevation of the top of the tower from the roof of their houses. The angle of elevation of ajay's house to the tower and sooraj's house to the tower are 45^{O} and 30^{O} respectively as shown in the figure.

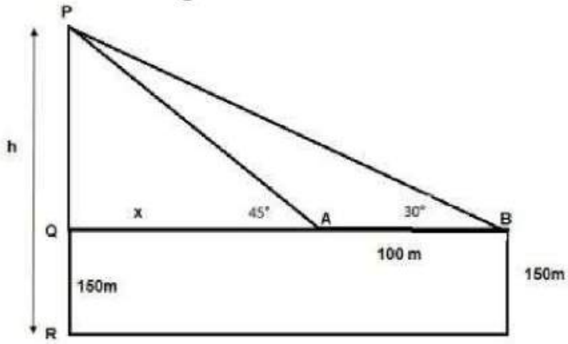


(i) The above figure can be redrawn as shown below:



Let PQ = y
In $\triangle$PQA,
tan 45 = $\frac{PQ}{QA} = \frac{y}{x}$
$1 = \frac{y}{x}$
x = y ...(i)
In $\triangle$PQB,
tan 30 = $\frac{PQ}{QB} = \frac{PQ}{x+100} = \frac{y}{x+100} = \frac{x}{x+100}$
$\frac{1}{\sqrt{3}} = \frac{x}{x+100}$
$x\sqrt{3} = x + 100$
$x = \frac{100}{\sqrt{3}-1} = 136.61$ m
From the figure, height of tower h = PQ + QR
= x + 150 = 136.61 + 150
h = 286.61 m

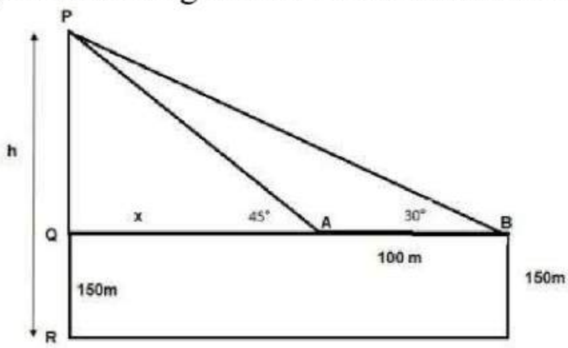
(ii) The above figure can be redrawn as shown below:



Distance of Sooraj's house from tower = QA + AB

= x + 100 = 136.61 + 100 = 236.61 m

(iii)The above figure can be redrawn as shown below:



Distance between top of tower and Top of Sooraj's house is PB

In $\triangle$PQB

$\sin 30^{o} = \frac{PQ}{PB}$

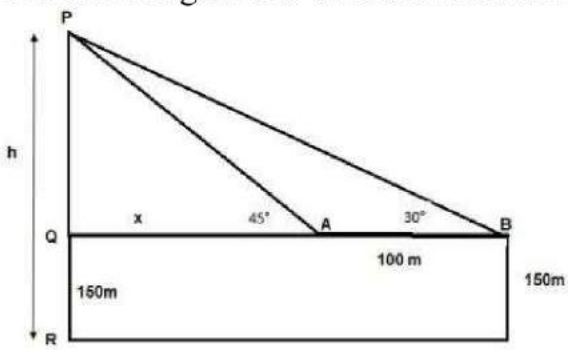
$\Rightarrow PB = \frac{PQ}{\sin 30^{o}}$

$\Rightarrow$ PB = $\frac{y}{\frac{1}{2}} = 2 \times 136.61$

$\Rightarrow$ PB = 273.20 m

OR

The above figure can be redrawn as shown below:



Distance between top of the tower and top of Ajay's house is PA

In $\triangle$PQA

$\sin 45^{o} = \frac{PQ}{PA}$

$\Rightarrow PA = \frac{PQ}{\sin 45^{o}}$

$\Rightarrow$ PA = $\frac{y}{\frac{1}{\sqrt{2}}} = \sqrt{2} \times 136.61$

$\Rightarrow$ PA = 193.20 m

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

Saving money is a good habit and it should be inculcated in children from the beginning. Mrs. Pushpa brought a piggy bank for her child Akshar. He puts one five-rupee coin of his savings in the piggy bank on the first day. He increases his savings by one five-rupee coin daily.

(i) Child's Day wise are,

$\underbrace{5}_{1\ coin}, \underbrace{10}_{2\ coins}, \underbrace{15}_{3\ coins}, \underbrace{20}_{4\ coins}, \underbrace{25}_{5\ coins}$ .... to $\underbrace{n\ days}_{n\ coins}$

We can have at most 190 coins

i.e., 1 + 2 + 3 + 4 + 5 + ... to n term = 190

$\Rightarrow \frac{n}{2}[2 \times 1 + (n - 1)1] = 190$

$\Rightarrow n(n + 1) = 380 \Rightarrow n^2 + n - 380 = 0$

$\Rightarrow (n + 20)(n - 19) = 0 \Rightarrow (n + 20)(n - 19) = 0$

$\Rightarrow n = -20$ or $n = 19 \Rightarrow n = -20$ or $n = 19$

But number of coins cannot be negative

$\therefore n = 19$ (rejecting $n = -20$)

So, number of days = 19

(ii) Total money she saved = 5 + 10 + 15 + 20 + ... = 5 + 10 + 15 + 20 + ... upto 19 terms

$= \frac{19}{2}[2 \times 5 + (19 - 1)5]$

$= \frac{19}{2}[100] = \frac{1900}{2} = 950$

and total money she shaved = ₹950

(iii)Money saved in 10 days

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

$\Rightarrow S_{10} = \frac{10}{2}[2 \times 5 + (10 - 1) \times 5]$

$\Rightarrow S_{10} = 5[10 + 45\}]$

$\Rightarrow S_{10} = 275$

Money saved in 10 days = ₹275

OR

Number of coins in piggy bank on 15th day

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

$\Rightarrow S_{15} = \frac{15}{2}[2 \times 5 + (15 - 1) \times 5]$

$\Rightarrow S_{15} = \frac{15}{2}\ [2 + 14]$

$\Rightarrow S_{15} = 120$

So, there are 120 coins on 15th day.

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 m^3

(iii) Volume of brick = 0.01 m^3

$\Rightarrow$ n = 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 = 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 × 21 × 21 = 19404 m^3