SAMPLE QUESTION PAPER (BASIC) - 02

Class 10 - Mathematics

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

General Instructions:

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

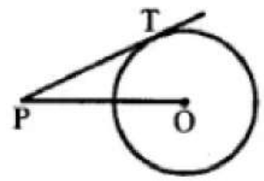
Section A

1. 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

2. In the given figure, point P is 26 cm away from the centre O of a circle and the length PT of the tangent drawn from P to the circle is 24 cm. Then, the radius of the circle is **[1]**



   a) 13 cm b) 10 cm

   c) 15 cm d) 12 cm

3. If an event cannot occur then its probability is **[1]**

   a) $\frac{3}{4}$ b) $\frac{1}{2}$

   c) 0 d) 1

4. The ratio in which the x-axis divides the segment joining (3, 6) and (12,-3) is **[1]**

   a) 1 : -2 b) 2 : 1

c) 1 : 2

d) -2 : 1

5. 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

6. The centroid of a triangle whose vertices are (3, -7), (-8, 6) and (5, 10) is **[1]**

a) (0, 3)

b) (1, 3)

c) (3, 3)

d) (0, 9)

7. From a well shuffled pack of 52 cards, one card is drawn at random. The probability of getting a red queen is **[1]**

a) $\frac{1}{13}$

b) $\frac{3}{26}$

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

d) $\frac{1}{26}$

8. The ratio of the total surface area to the lateral surface area of a cylinder with base radius 80 cm and height 20 cm is **[1]**

a) 5 : 1

b) 4 : 1

c) 2 : 1

d) 3 : 1

9. If two different dice are rolled together, the probability of getting an even number **[1]**

a) $\frac{1}{2}$

b) $\frac{1}{4}$

c) $\frac{1}{36}$

d) $\frac{1}{6}$

10. Which of the following equations has the sum of its roots as 3? **[1]**

a) $-x^2 + 3x - 3 = 0$

b) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + 1 = 0$

c) $2x^2 - 3x + 6 = 0$

d) $3x^2 - 3x + 3 = 0$

11. If the equation $9x^2 + 6kx + 4 = 0$ has equal roots, then the roots are both equal to **[1]**

a) $\pm\frac{3}{2}$

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

c) 0

d) ± 3

12. $\frac{1+\tan^2\theta}{\sec^2\theta} =$ **[1]**

a) $\sec^2\theta$

b) 1

c) $\frac{1}{\sin^2\theta - \cos^2\theta}$

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

13. If a = $(2^2 \times 3^3 \times 5^4)$ and b = $(2^3 \times 3^2 \times 5)$ then HCF (a, b) = ? **[1]**

a) 360

b) 90

c) 180

d) 540

14. The coordinates of the mid-point of the line segment joining the points (-2, 3) and (4, -5) are **[1]**

a) (0, 0)

b) (-1, 1)

c) (1, -1)

d) (-2, 4)

15. If the altitude of the sun is 60°, the height of a tower which casts a shadow of length 90 m is **[1]**

a) 60 m

b) $90\sqrt{3}$ m

c) 90 m

d) $60\sqrt{3}$ m

16. In the formula $\bar{X} = \text{a} + \frac{\Sigma fidi}{\Sigma fi}$, for finding the mean of grouped data, $d_i's$ are deviations from the of: **[1]**

a) mid-points of classes

b) lower limits of classes

c) frequency of the class marks

d) upper limits of classes

17. The number $\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}-\sqrt{2}}$ is **[1]**

a) an irrational number

b) an integer

c) not a real number

d) a rational number

18. The system of equations 2x + 3y - 7 = 0 and 6x + 5y - 11 = 0 has **[1]**

a) unique solution

b) infinite many solutions

c) no solution

d) non zero solution

19. **Assertion (A):** 2 is a rational number. **[1]**

Reason (R): The square roots of all positive integers are irrationals.

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.

20. **Assertion (A):** If a line intersects sides AB and AC of a $\triangle$ABC at D and E respectively and is parallel to BC, then $\frac{AD}{AB} = \frac{AE}{AC}$ **[1]**

Reason (R): If a line is parallel to one side of a triangle then it divides the other two sides in the same ratio.

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. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be a black ball? If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was before. Find x. **[2]**

22. On comparing the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}$ and $\frac{c_1}{c_2}$, find out whether the lines representing the pair of linear equations intersect at a point, are parallel or coincide: $6x - 3y + 10 = 0$; $2x - y + 9 = 0$. **[2]**

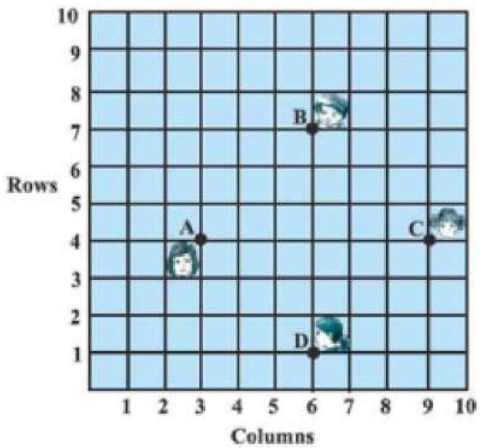
OR

Show that x = 5, y = 2 is a solution of the system of linear equations 2x + 3y = 16 ,x -2 y = 1.

23. Find a quadratic polynomial, the sum and product of whose zeroes are $0, \sqrt{5}$ respectively. **[2]**

24. In a classroom, 4 friends are seated at the four points A, B, C and D as shown in Fig. Champa and Chameli walk into the class and after observing for a few minutes Champa asks Chameli, Don't you think ABCD is a square? **[2]**

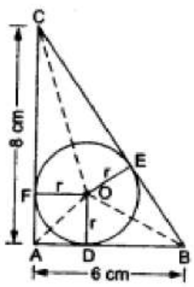
Chameli disagrees. Using distance formula, find which of them is correct.



25. Draw a circle and two lines parallel to a given line such that one is a tangent and the other, a secant to the circle. **[2]**

OR

In the given figure, ABC is a right-angled triangle with AB = 6 cm and AC = 8 cm. A circle with centre O has been inscribed inside the triangle. Calculate the value of the radius of the inscribed circle.



Section C

26. In $\triangle ABC$, right angled at B, AB = 24 cm, BC = 7 cm. Determine: **[3]**

i. Sin A cos A

ii. Sin C cos C

27. Given the linear equation 2x + 3y - 8 = 0, write another linear equation in two variables such that the geometrical representation of the pair so formed is: **[3]**

i. intersecting lines

ii. parallel lines

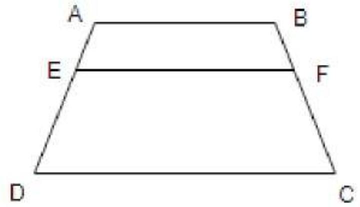
iii. coincident lines.

28. 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]**

OR

If the HCF of 657 and 963 is expressible in the form of 657x + 963$\times$(-15), find the value of x.

29. ABCD is a trapezium with AB || DC. E and F are two points on non-parallel sides AD and BC respectively, such that EF is parallel to AB. Show that $\frac{AE}{ED} = \frac{BF}{FC}$ **[3]**



30. If radii of the two circles are equal, prove that AB = CD where AB and CD are common tangents. **[3]**

OR

Prove that the angle between the two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the centre.

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]**

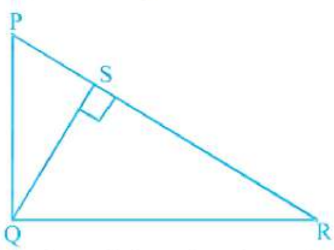
Section D

32. The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers. **[5]**

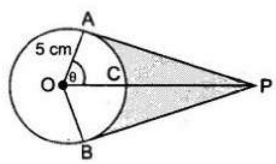
OR

The product of Tanay's age (in years) five years ago and his age ten years later is 16. Determine Tanay's present age.

33. In the given figure, PQR is a right triangle right angled at Q and QS ⊥ PR. If PQ = 6 cm and PS = 4 cm, find QS, RS and QR. **[5]**



34. An elastic belt is placed round the rim of a pulley of radius 5 cm. One point on the belt is pulled directly away from the centre O of the pulley until it is at P, 10 cm from O. Find the length of the belt that is in contact with the rim of the pulley. Also, find the shaded area. **[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.

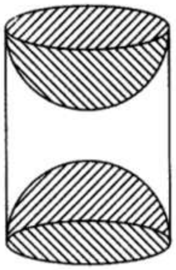
35. The following is the cummulative frequency distribution (of less than type) of 1000 persons each of age 20 years and above. Determine the mean age. **[5]**

Age below (in years)	30	40	50	60	70	80
Number of persons	100	220	350	750	950	1000

Section E

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

A carpenter used to make different kinds and different shapes of a toy of wooden material. One day a man came to his shop to purchase an article that has values as per his requirement. He instructed the carpenter to make the toy by taking a wooden block of rectangular shape with height 12 cm and width 9 cm, then shaping this block as a solid cylinder and then scooping out a hemisphere from each end, as shown in the given figure. The difference between the length of rectangle and height of the cylinder is 2 cm (Rectangle length > Cylinder height), and the difference between the breadth of rectangle and the base of cylinder is also 2 cm (Rectangle breadth > Cylinder base(diameter)).



(i) Find the volume of the cylindrical block before the carpenter started scooping the hemisphere from it.

(ii) Find the volume of wood scooped out?

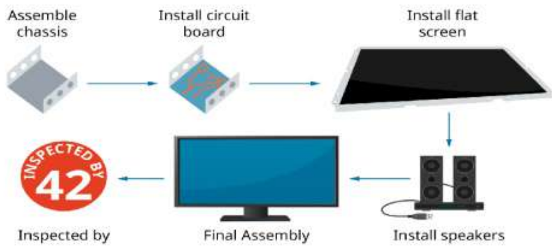
(iii) Find the total surface area of the article?

OR

Find the total surface area of cylinder before scooping out hemisphere?

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

Elpis Technology is a laptop manufacturer. The company works for many branded laptop companies and also provides them with spare parts. Elpis Technology produced 6000 units in 3rd year and 7000 units in the 7th year.



Assuming that production increases uniformly by a fixed number every year.

(i) Find the production in the 1st year.

(ii) Find the production in the 5th year.

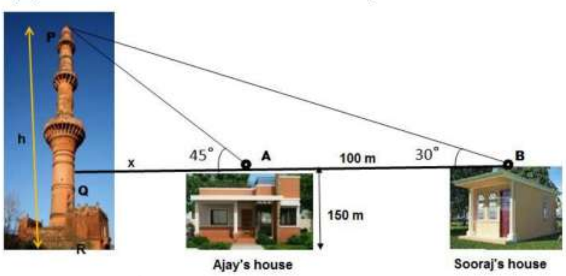
(iii) Find the total production in 7 years.

OR

Find in which year 10000 units are produced?

38. **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?

Solution

SAMPLE QUESTION PAPER (BASIC) - 02

Class 10 - Mathematics

Section A

1. **(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

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

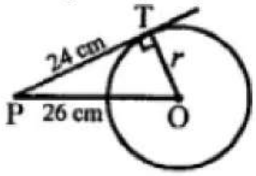
   $\Rightarrow p^2 = 25 - 9 = 16$

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

2. **(b)** 10 cm

   Explanation:

   In the given figure, point P is 26 cm away from the centre O of the circle.

   Length of tangent PT = 24 cm

   Let radius = r

   In right $\triangle$OPT,

   $OP^2 = PT^2 + OT^2$

   $\Rightarrow 26^2 = 24^2 + r^2$

   $\Rightarrow r^2 = 26^2 - 24^2 = 676 - 576 = 100 = (10)^2$

   r = 10

   Radius = 10 cm

3. **(c)** 0

   Explanation: The event which cannot occur is said to be impossible event and probability of impossible event is zero.

4. **(b)** 2 : 1

   Explanation: The point lies on x-axis

   Its ordinate is zero

   Let this point divides the line segment joining the points (3, 6) and (12, -3) in the ratio m : n

   $\therefore 0 = \frac{my_2 + ny_1}{m+n} \Rightarrow 0 = \frac{m(-3) + n \times 6}{m+n}$

   $\Rightarrow -3m + 6n = 0 \Rightarrow 6n = 3m$

   $\Rightarrow \frac{m}{n} = \frac{6}{3} = \frac{2}{1}$

   $\therefore$ Ratio = 2 : 1

5. **(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

6. **(a)** (0, 3)

Explanation: Given: (x_1, y_1) = (3, -7), (x_2, y_2) = (-8, 6) and (x_3, y_3) = (5, 10)

Coordinates of Centroid of triangle

x = $\frac{x_1+x_2+x_3}{3}$ and y = $\frac{y_1+y_2+y_3}{3}$

$\therefore$ x = $\frac{3-8+5}{3} = \frac{8-8}{3}$ = 0

and y = $\frac{-7+6+10}{3} = \frac{9}{3}$ = 3

Therefore, the coordinates of the centroid of the triangle are (0, 3)

7. **(d)** $\frac{1}{26}$

Explanation: Red Queens = Diamond Queen + Heart Queen = 2

Number of possible outcomes = 2

Number of Total outcomes = 52

$\therefore$ Required Probability = $\frac{2}{52} = \frac{1}{26}$

8. **(a)** 5 : 1

Explanation: Ratio of the total surface area to the lateral surface area $= \frac{\text{Total surface area}}{\text{Lateral surfice area}}$

$= \frac{2\pi r(h+r)}{2\pi rh}$

$= \frac{h+r}{h}$

$= \frac{(20+80)}{20}$

$= \frac{100}{20}$

$= \frac{5}{1}$

= 5 : 1

Hence, the required ratio is 5:1

9. **(b)** $\frac{1}{4}$

Explanation: Rolling two different dice, Number of total events = 6 $\times$ 6 = 36

Number of even number on both dice are {(2,2), (2,4), (2,6), (4,2), (4,4), (4,6), (6,2), (6,4), (6,6) }= 9

$\therefore Probability = \frac{9}{36} = \frac{1}{4}$

10. **(a)** $-x^2 + 3x - 3 = 0$

Explanation: Given, $-x^2 + 3x - 3 = 0$

Sum of roots = $\frac{-3}{-1} = 3$

11. **(b)** $\pm\frac{2}{3}$

Explanation: In the equation

$9x^2 + 6kx + 4 = 0$

a = 9, b = 6k, c = 4 then

D = b^2 - 4ac

= $(6k)^2$ - 4 $\times$ 9 $\times$ 4

= 36 k^2 - 144

$\because$ Roots are equal $\therefore$ D = 0

$\Rightarrow$ 36 k^2 - 144=0 $\Rightarrow$ 36 k^2 = 144

$\Rightarrow$ k^2 = $\frac{144}{36}$ = 4 =$(\pm 2)^2$

$\therefore$ k = $\pm$ 2

$\therefore$ Roots are = $\frac{-b}{2a} = \frac{\pm 2\times 6}{2\times 9} = \pm\frac{2}{3}$

12. **(b)** 1

Explanation: Given: $\frac{1+\tan^2\theta}{\sec^2\theta}$

$= \frac{\sec^2\theta}{\sec^2\theta}$ = 1

[$\because \sec^2\theta = 1 + \tan^2\theta$]

13. **(c)** 180

Explanation: It is given that: a = $(2^2 \times 3^3 \times 5^4)$ and b = $(2^3 \times 3^2 \times 5)$

$\therefore$ HCF (a, b) = Product of smallest power of each common prime factor in the numbers = $2^2 \times 3^2 \times 5$ = 180

14. **(c)** (1, -1)

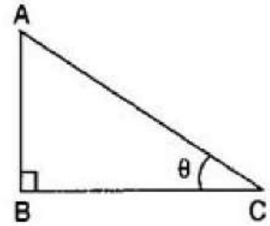
Explanation: Let the coordinates of midpoint C(x, y) of the line segment joining the points A(-2, 3) and B(4, -5)

$\therefore$ x = $\frac{x_1+x_2}{2} = \frac{-2+4}{2} = \frac{2}{2}$ = 1

And y = $\frac{y_1+y_2}{2} = \frac{3-5}{2} = \frac{-2}{2}$ = -1

Therefore, the coordinates of mid-point C are (1, -1)

15. **(b)** $90\sqrt{3}$ m

Explanation: 

Let Height of the tower = AB = h meters,

Length of the shadow = BC = 90 m

And angle of elevation $\theta = 60^\circ$

$\therefore \tan 60^\circ = \frac{\text{AB}}{\text{BC}}$

$\Rightarrow \sqrt{3} = \frac{h}{90}$

$\Rightarrow h = 90\sqrt{3}$ meters

16. **(a)** mid-points of classes

Explanation: We know that $d_i = x_i - a$

i.e. $d_i's$ are the deviations from the mid-points of the classes.

17. **(a)** an irrational number

Explanation: $\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}-\sqrt{2}}$

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

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

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

$= \frac{5+2+2\sqrt{10}}{3}$

$= \frac{7+2\sqrt{10}}{3}$

Here $\sqrt{10} = \sqrt{2} \times \sqrt{5}$

Since $\sqrt{2}$ and $\sqrt{5}$ both are an irrational number

Therefore, $\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}-\sqrt{2}}$ is an irrational number.

18. **(a)** unique solution

Explanation: 2x + 3y - 7 = 0

6x + 5y - 11 = 0

By Comparing with $a_1x + b_1y + c = 0$ and $a_2x + b_2y + c = 0$,

Here, $a_1 = 2$, $b_1 = 3$, $c_1 = -7$, and $a_2 = 6$, $b_2 = 5$, $c_2 = -11$

$\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3}$

$\frac{b_1}{b_2} = \frac{3}{5}$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Therefore, the system of equations has a unique solution.

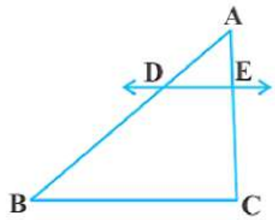
19. **(c)** A is true but R is false.

Explanation: Here reason is not true. $\sqrt{4} = \pm 2$, which is not an irrational number.

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

Explanation:

We know that if a line is parallel to one side of a triangle then it divides the other two sides in the same ratio. This is the Basic Proportionality theorem. So, the Reason is correct.



By Basic Proportionality theorem, we have $\frac{AD}{DB} = \frac{AE}{EC}$

$\Rightarrow \frac{DB}{AD} = \frac{EC}{AE} \Rightarrow \frac{DB}{AD} + 1 = \frac{EC}{AE} + 1$

$\Rightarrow \frac{DB+AD}{AD} = \frac{EC+AE}{AE} \Rightarrow \frac{AB}{AD} = \frac{AC}{AE} \quad \Rightarrow \frac{AD}{AB} = \frac{AE}{AC}$

So, the Assertion is correct.

Section B

21. There are 12 balls in the box.

Therefore, the total number of favourbale outcomes = 12

The number of favourable outcomes = x

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

Therefore P_1 = P (Getting a black ball) $= \frac{x}{12}$

If 6 more balls put in the box, then

Total number of favourable outcomes = 12 + 6 = 18

And Number of favourable outcomes = x + 6

$\therefore$ P_2 = P (Getting a black ball) $= \frac{x+6}{12}$

According to question, $P_2 = 2P_1$

$\frac{x+6}{18} = 2 \times \frac{x}{12}$

$\frac{x+6}{18} \times \frac{12}{x} = 2$

x = 3

22. Given equations are

6x − 3y + 10 = 0

2x – y + 9 = 0

Comparing equation 6x − 3y + 10 = 0 with $a_1x + b_1y + c_1 = 0$

and 2*x* – *y* + 9 = 0 with

$a_2x + b_2y + c_2 = 0$,

We get, $a_1 = 6$, $b_1 = -3$, $c_1 = 10$, $a_2 = 2$, $b_2 = -1$, $c_2 = 9$

We have $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ because $\frac{6}{2} = \frac{-3}{-1} \neq \frac{10}{9} \Rightarrow \frac{3}{1} = \frac{3}{1} \neq \frac{10}{9}$

Hence, lines are parallel to each other.

OR

The given equations are

2x + 3y = 16 ....(i)

x - 2 y = 1 .... (ii)

Putting x = 5 and y = 2 in (i), we get

LHS = 2x + 3y

= (2 × 5 + 3 × 2)

= 10 + 6

= 16

= RHS. .... (iii)

Putting x = 5 and y = 2 in (ii), we get

LHS= x - 2 y

=(5 - 2 × 2)

= 5 - 4

= 1

= RHS. .... (iv)

From (iii) and (iv), x = 5 and y = 2 satisfy both (i) and (ii).

Hence, x = 5, y = 2 is a solution of the given system of equations.

23. Let the polynomial be $ax^2 + bx + c$,

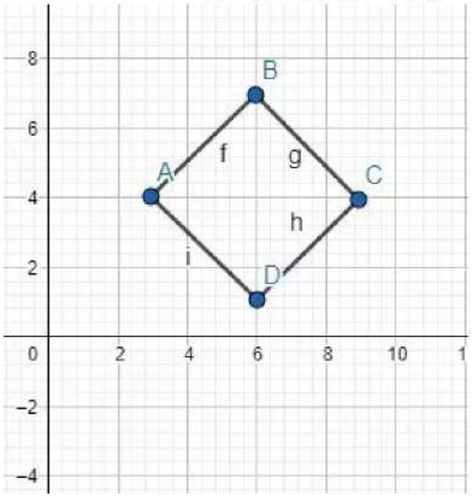
and its zeroes be α and β.

Then, $\alpha + \beta = 0 = -\frac{b}{a}$ and $\alpha\beta = \sqrt{5} = \frac{c}{a}$

If a = 1, then b = 0 and $c = \sqrt{5}$.

So, one quadratic polynomial which fits the given conditions is $x^2 + \sqrt{5}$.

24. It can be seen that A (3, 4), B (6, 7), C (9, 4), and D (6, 1) are the positions of 4 friends



Distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is given by

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

Hence,

AB = $[(3- 6)^2 + (4 - 7)^2]^{1/2}$

$= \sqrt{9+9} = \sqrt{18}$

$= 3\sqrt{2}$

BC = $[(6 - 9)^2 + (7- 4)^2]^{1/2}$

$= \sqrt{9+9} = \sqrt{18}$

$= 3\sqrt{2}$

CD = $[(9- 6)^2 + (4- 1)^2]^{1/2}$

$= \sqrt{9+9} = \sqrt{18}$

$= 3\sqrt{2}$

AD = $[(3 - 6)^2 + (4 - 1)^2]^{1/2}$

$= \sqrt{9+9} = \sqrt{18}$

$= 3\sqrt{2}$

Diagonal AC = $[(3 - 9)^2 + (4 - 4)^2]^{1/2}$

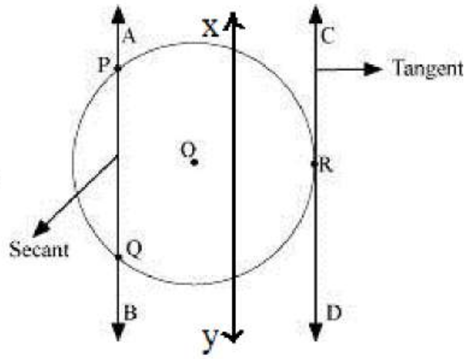
$= \sqrt{36+0} = 6$

Diagonal BD = $[(6- 6)^2 + (7- 1)^2]^{1/2}$

$= \sqrt{36+0} = 6$

It can be seen that all sides of quadrilateral ABCD are of the same length and diagonals are of the same length

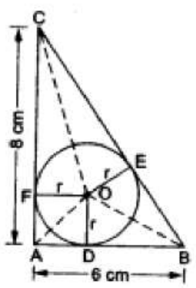
Therefore, ABCD is a square and hence, Champa was correct.

25. 

Steps of Construction:

i. Draw a circle with any radius and center O. Here xy is given line.
ii. Choose any point P on the circumference of the circle, and draw a line passing through P, Let's name it AB.
iii. Draw a line AB parallel to xy, such that AB intersects the circle at two points P and A.Here, AB and xy are two parallel lines. AB intersects the circle at exactly two points, P and Q. Therefore, line AB is the secant of this circle.
iv. CD intersects the circle at exactly one point, R, line CD is the tangent to the circle.

OR



Join OA, OB and OC.

Draw $OD \perp AB, OE \perp BC$

and $OF \perp CA$

Then, OD = OE = OF = r cm.

$\therefore \quad \operatorname{ar}(\Delta ABC) = \frac{1}{2} \times AB \times AC$

$= \left(\frac{1}{2} \times 6 \times 8\right) \mathrm{cm}^2 = 24 \mathrm{cm}^2$

Now, $\operatorname{ar}(\Delta ABC) = \frac{1}{2} \times (\text{ perimeter of } \Delta ABC) \times r$

$\Rightarrow \quad 24 = \frac{1}{2} \times (AB + BC + CA) \times r$

$\Rightarrow \quad 24 = \frac{1}{2} \times (6 + 10 + 8) \times r$

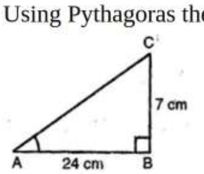
$\Rightarrow r = 2 \left[\because BC^2 = AB^2 + AC^2 \Rightarrow BC = \sqrt{6^2 + 8^2} = 10\right]$

Hence, the radius of the inscribed circle is 2cm.

Section C

26. Let us draw a right angled triangle ABC, right angled at B.

Using Pythagoras theorem,



Given, AB = 24cm and BC = 7cm

Using Pythagoras theorem,

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

$AC^2 = 24^2 + 7^2 = 576 + 49 = 625$

$\therefore$ AC = 25 cm

i. $\sin \mathrm{A} = \frac{\mathrm{P}}{\mathrm{H}} = \frac{\mathrm{BC}}{\mathrm{AC}} = \frac{7}{25}, \ \cos A = \frac{B}{H} = \frac{AB}{AC} = \frac{24}{25}$

$\Rightarrow sin A . cos A = \frac{7}{25} \times \frac{24}{25} = \frac{168}{625}$

ii. $\sin \mathrm{C} = \frac{\mathrm{P}}{\mathrm{H}} = \frac{\mathrm{AB}}{\mathrm{AC}} = \frac{24}{25}, \ \cos C = \frac{B}{H} = \frac{BC}{AC} = \frac{7}{25}$

$\Rightarrow sinC.cosC = \frac{24}{25} \times \frac{7}{25} = \frac{168}{625}$

27. Given, linear equation is 2x + 3y - 8 = 0 ...(i)

Given: 2x + 3y - 8 = 0 ..... (i)

i. For intersecting lines, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\therefore$ Any line intersecting with eq (i) may be taken as 3x + 2y - 9 = 0

or 3x + 2y - 7 = 0

ii. For parallel lines, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\therefore$ Any line parallel with eq(i) may be taken as 6x + 9y + 7 = 0

or 2x +3y - 2 = 0

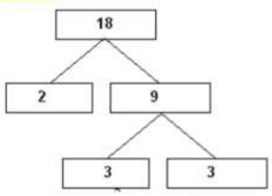
iii. For coincident lines, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$\therefore$ Any line coincident with eq (i) may be taken as 4x + 6y - 16 = 0

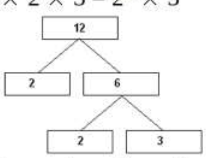
or 6x + 9y - 24 = 0

28. By taking LCM of time taken (in minutes) by Sonia and Ravi, We can get the actual number of minutes after which they meet again at the starting point after both start at the same point and at the same time, and go in the same direction.

$18 = 2 \times 3 \times 3 = 2 \times 3^2$



$12 = 2 \times 2 \times 3 = 2^2 \times 3$



LCM $(18, 12) = 2^2 \times 3^2 = 36$

Therefore, both Sonia and Ravi will meet again at the starting point after 36 minutes.

OR

Using Euclid's Division Lemma,

963 = 657 $\times$ 1 + 306

657 = 306 $\times$ 2 + 45

306 = 45 $\times$ 6 + 36

45 = 36 $\times$ 1 + 9

36 = 9 $\times$ 4 +0

$\therefore HCF(963, 657) = 9$

$Now\ it\ is\ given\ that$

$HCF = 657x + 963(-15)$

$or\ 9 = 657x + 963(-15)$

$657x = 9 + 14445 = 14454$

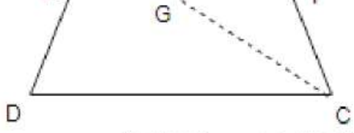
$x = \frac{14454}{657} = 22$

29. Given, In trapezium ABCD,

$AB || DC$ and $EF || DC$

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

Construction: Join AC to intersect EF at G.



Proof Since, $AB || DC$ and $EF || DC$

$EF||AB$ [since, lines parallel to the same line are also parallel to each other]...... (i)

In $\triangle ADC$, $EG||DC$ [$\because EF||DC$]

By using basic proportionality theorem,

$\frac{AE}{ED} = \frac{AG}{GC}$ ....(ii)

In $\triangle ABC$, $GF||AB$ [$\because EF||AB$ from (i)]

By using basic proportionality theorem ,

$\frac{CG}{AG} = \frac{CF}{BF}$ or $\frac{AG}{GC} = \frac{BF}{CF}$ [On taking reciprocal of the terms]............. (iii)

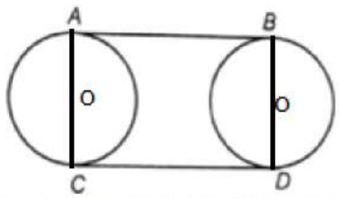
From Equations (ii) and (iii), we get

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

Hence Proved.

30. Given: AB and CD are two common tangents to two circles of equal radii.

To prove



Construction: OA, OC, O'B and O'D proof

Now, ∠OAB = 90° and ∠OCD = 90° as OA ⊥ AB and OC ⊥ CD

A tangent at any point of a circle is perpendicular to radius through the point of contact

Thus, AC is a straight line.

Also, $\angle O'BA = \angle O'DC = 90^{\circ}$

A tangent at a point on the circle is perpendicular to the radius through point of contact

so ABCD is a quadrilateral with four sides as AB, BC, CD and AD

But as $\angle A = \angle B = \angle C = \angle D = 90^{\circ}$

so, ABCD is a rectangle.

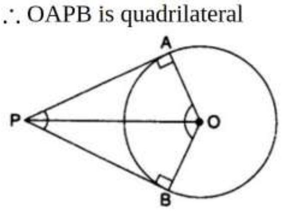
Hence, AB = CD opposite sides of the rectangle are equal.

OR

∠OAP = 90^o ....(1) [Angle between tangent and radius through the point of contact is 90^o]

∠OBP = 90^o ....(2) [Angle between tangent and radius through the point of contact is 90^o]

∴ OAPB is quadrilateral



∴ ∠APB + ∠AOB + ∠OAP + ∠OBP = 360^o [Angle sum property of a quadrilateral]

⇒ ∠APB + ∠AOB + 90^o + 90^o = 360^o [From (1) and (2)]

⇒ ∠APB + ∠AOB = 180^o

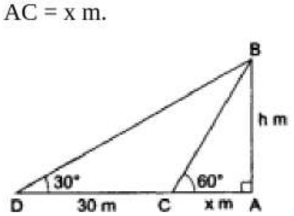
⇒ ∠APB and ∠AOB are supplementary

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

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

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

From right ΔDAB, we have

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

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

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

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

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

Section D

32. Let the larger number be x,

Then, (smaller number)^2 = 8(larger number) = 8x

$\Rightarrow$ smaller number $= \sqrt{8x}$

According to the question, x^2 - 8x = 180

$\Rightarrow x^2 - 8x - 180 = 0$

Using the quadratic formula, $= \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

we get $= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(-180)}}{2(1)}$

$= \frac{8 \pm \sqrt{64+720}}{2} = \frac{8 \pm \sqrt{784}}{2} = \frac{8 \pm 28}{2}$

$= \frac{8+28}{2}, \frac{8-28}{2} \Rightarrow x = 18, -10$

x = -10 is inadmissible

Then smaller number $= \sqrt{8(-10)} = \sqrt{-80}$

which is not possible!

$\therefore x = 18 \therefore \sqrt{8x} = \sqrt{8 \times 18} = \sqrt{144} = \pm 12$

Hence, the two numbers are 18, 12 or 18, -12.

OR

Let the present age of Tanay be x years

By the question,

(x - 5)(x + 10) = 16

or, $x^2 + 5x - 50 = 16$

or, $x^2 + 5x - 66 = 0$

or, $x^2 + 11x - 6x - 66 = -66$

x(x + 1)-16(x - l11) = 0

(x + 11) (x -6) = 0

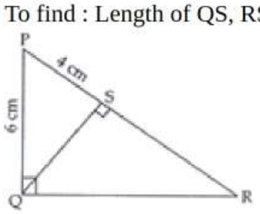
=-11, 6

Rejecting x = - 11, as age cannot be negative.

$\therefore$ Present age of Tanay is 6 years.

33. Given: According to the question, PQR is a right triangle right angled at Q and QS $\perp$ PR. PQ = 6 cm and PS = 4 cm

To find : Length of QS, RS and QR.



In ΔPQR, $\angle PQR = 90$

and QS $\perp$ PR

So, $\triangle$PSQ ~ $\triangle$PQR (By AA similarity)

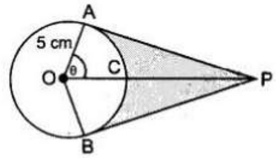
Thus, $\frac{PS}{QS} = \frac{QS}{SR}$

$\therefore$ QS^2 = PS.SR..........(i)

In ΔPQS,

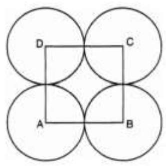
$QS^2 = PQ^2 - PS^2$ [By Pythagoras theorem]
$= 6^2 - 4^2 = 36 - 16$
$\Rightarrow QS^2 = 20$
$\Rightarrow QS = 2\sqrt{5}$ cm

Now $QS^2 = PS.SR$ [From eqn(i)]
$\Rightarrow (2\sqrt{5})^2 = 4 \times SR$
$\Rightarrow \frac{20}{4} = SR$
$\Rightarrow SR = 5$ cm
Now, $QS \perp SR$
$\therefore \angle QSR = 90°$
$\Rightarrow QR^2 = QS^2 + SR^2$ [By Pythagoras theorem]
$\Rightarrow QR^2 = (2\sqrt{5})^2 + 5^2$
$\Rightarrow QR^2 = 20 + 25$
$\Rightarrow QR^2 = 45$
$\Rightarrow QR = 3\sqrt{5}$ cm
Hence, QS = $2\sqrt{5}$ cm, RS = 5 cm and QR = $3\sqrt{5}$ cm.

34. 

$\cos\theta = \frac{1}{2}$ or, $\theta = 60^\circ$
Reflex $\angle AOB = 120^\circ$
$\therefore$ ADB = $\frac{2\times3.14\times5\times240}{360}$ = 20.93 cm
Hence length of elastic in contact = 20.93 cm
Now, AP = $5\sqrt{3}$cm
a ($\triangle$OAP) = $\frac{1}{2}\times$ base $\times$ height = $\frac{1}{2} \times 5 \times 5\sqrt{3} = \frac{25\sqrt{3}}{2}$
Area ($\triangle$OAP + $\triangle$OBP) = 2$\times$ $\frac{25\sqrt{3}}{2} = 25\sqrt{3}$ = 43.25 cm^2
Area of sector OACB = $\frac{\theta}{360} \times \pi r^2$
= $\frac{25\times3.14\times120}{360}$ = 26.16 cm^2
Shaded Area = 43.25 - 26.16 = 17.09 cm^2

OR



Let r cm be the radius of each circle.
Area of square - Area of 4 sectors = $\frac{24}{7}$cm^2
(side)^2 - 4 $\left[\frac{\theta}{360}\pi r^2\right]$ = $\frac{24}{7}$cm^2
or, $(2r)^2 - 4\left(\frac{90^\circ}{360^\circ} \times \pi r^2\right) = \frac{24}{7}$
or, $(2r)^2 - 4\left(\frac{1}{4^\circ} \times \pi r^2\right) = \frac{24}{7}$
or, $(2r)^2 - \left(\pi r^2\right) = \frac{24}{7}$
or, $4r^2 - \frac{22}{7}r^2 = \frac{24}{7}$
or, $\frac{28r^2-22r^2}{7} = \frac{24}{7}$
or, $6r^2 = 24$
or, $r^2 = 4$
or, $r = \pm2$
or, Radius of each circle is 2 cm (r cannot be negative)

35.

Class interval	Frequency f_i	Mid-value X_i	$u_i = \frac{x_i - A}{h} = \frac{x_i - 45}{10}$	f_iu_i
20-30	100	25	-2	-200
30-40	120	35	-1	-120
40-50	130	45=A	0	0
50-60	400	55	1	400
60-70	200	65	2	400
70-80	50	75	3	150
	$\Sigma f_i = 1000$			$\sum f_iu_i = 630$

A = 45, h = 10,

$\Sigma f_i = 1000$, $\sum f_iu_i = 630$

Mean = A + $\left\{h \times \frac{\sum f_iu_i}{\sum f_i}\right\}$

= 45 + $\left\{10 \times \frac{630}{1000}\right\}$

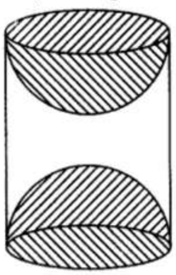
= 45 + 6.3

= 51.3

Section E

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

A carpenter used to make different kinds and different shapes of a toy of wooden material. One day a man came to his shop to purchase an article that has values as per his requirement. He instructed the carpenter to make the toy by taking a wooden block of rectangular shape with height 12 cm and width 9 cm, then shaping this block as a solid cylinder and then scooping out a hemisphere from each end, as shown in the given figure. The difference between the length of rectangle and height of the cylinder is 2 cm (Rectangle length > Cylinder height), and the difference between the breadth of rectangle and the base of cylinder is also 2 cm (Rectangle breadth > Cylinder base(diameter)).



(i) Given:

Length of rectangle = 12 cm

Width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

Height of cylinder = 10 cm

Diameter of base = 7 cm

$\Rightarrow$ Radius of base = 3.5 cm

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

= $\frac{22}{7} \times 3.5^2 \times 10$ = 385 cm^3

(ii) Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

Volume of wood scooped out = 2 $\times$ volume of hemisphere

$\Rightarrow$ Volume of wood scooped-out = $2 \times \frac{2}{3} \times \pi \times r^3$

$\Rightarrow$ Volume of wood scooped out = $\frac{4}{3} \times \frac{22}{7} \times (3.5)^3 = 179.66 \text{ cm}^3$

(iii) Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

Total surface area of the article

$= 2\pi(3.5)(10) + 2\left[2\pi(3.5)^2\right]$

$= 70\pi + 49\pi = 119\pi$

$= 119 \times \frac{22}{7} = 17 \times 22$

= 374 cm^2

OR

Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

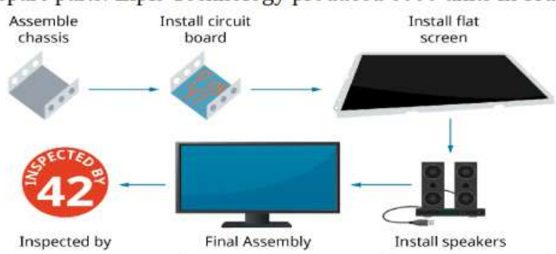
$\Rightarrow$ radius of base = 3.5 cm

T.S.A of cylinder = $2\pi r(r + h)$

$\Rightarrow$ T.S.A of cylinder = $2 \times \frac{22}{7} \times 3.5(3.5 + 10) = 99 \text{ cm}^2$

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

Elpis Technology is a laptop manufacturer. The company works for many branded laptop companies and also provides them with spare parts. Elpis Technology produced 6000 units in 3rd year and 7000 units in the 7th year.



Assuming that production increases uniformly by a fixed number every year.

(i) Let production in a 1st year be 'a' unit and increase in production (every year) be 'd' units.

Increase in production is constant, therefore unit produced every year forms an AP.

Now, $a_3 = 6000$

$a + 2d = 6000 \Rightarrow a = 6000 - 2d$ ...(i)

and $a_7 = 7000 \Rightarrow a + 6d = 7000$

$\Rightarrow (6000 - 2d) + 6d = 7000 \Rightarrow 4d = 1000$ [using eq. (i)]

$\Rightarrow d = 250$

When d = 250, eq. (i) becomes

a = 6000 - 2(250) = 5500

$\therefore$ Production in 1st year = 5500

(ii) Production in fifth year

$a_5 = a + 4d = 5500 + 4(250) = 6500$

(iii) Total production in 7 years = $\frac{7}{2}(5500 + 7000) = 43750$

OR

$a_n = 1000$ units

$a_n = 1000$

$\Rightarrow 10000 = a + (n - 1)d$

$\Rightarrow 1000 = 5500 + 250n - 250$

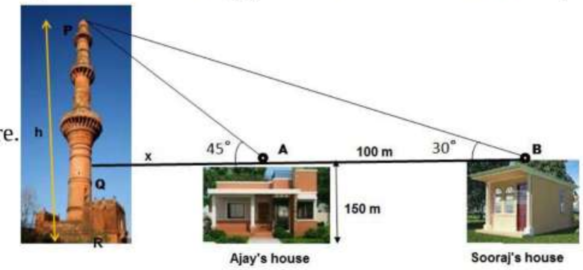
$\Rightarrow 10000 - 5500 + 250 = 250n$

$\Rightarrow 4750 = 250n$

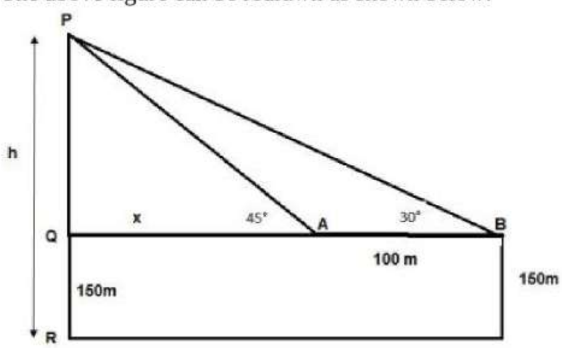
$\Rightarrow n = \frac{4750}{250} = 19$

38. **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 $\triangle PQB$,

$\tan 30 = \frac{PQ}{QB} = \frac{PQ}{x+100} = \frac{y}{x+100} = \frac{x}{x+100}$

$\frac{1}{\sqrt{3}} = \frac{x}{x+100}$

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

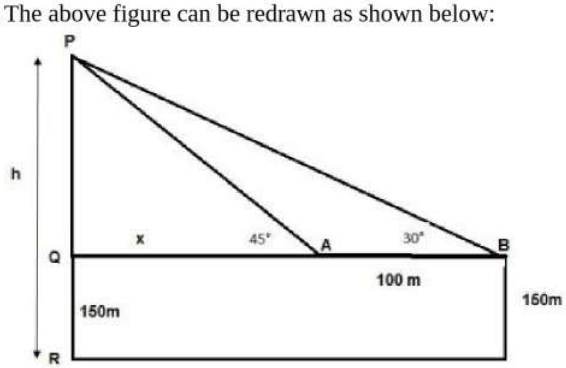
$x = \frac{100}{\sqrt{3}-1} = 136.61$ m

From the figure, height of tower h = PQ + QR

= x + 150 = 136.61 + 150

h = 286.61 m

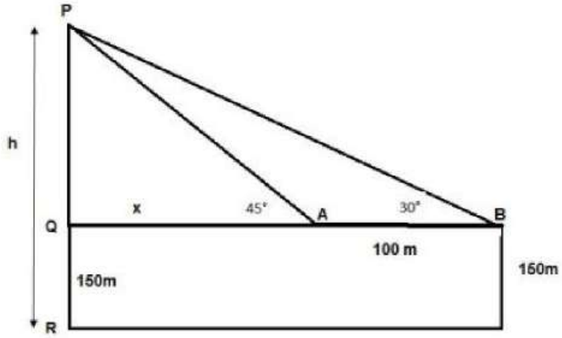
(ii) The above figure can be redrawn as shown below:



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 = $\frac{PQ}{PB}$

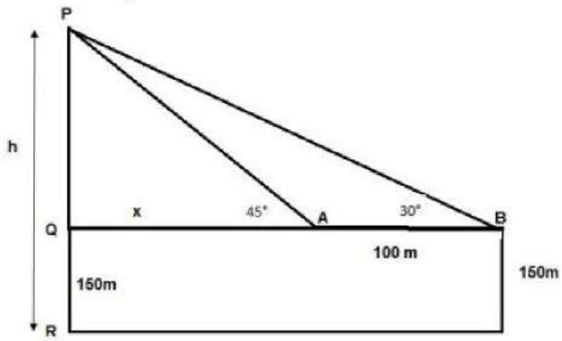
$\Rightarrow PB = \frac{PQ}{\sin 30^o}$

$\Rightarrow$ 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