

CBSE Class 10th Mathematics
Standard Sample Paper - 02

Maximum Marks:

Time Allowed: 3 hours

General Instructions:

- i. All the questions are compulsory.
 - ii. The question paper consists of 40 questions divided into 4 sections A, B, C, and D.
 - iii. Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 8 questions of 3 marks each. Section D comprises of 6 questions of 4 marks each.
 - iv. There is no overall choice. However, an internal choice has been provided in two questions of 1 mark each, two questions of 2 marks each, three questions of 3 marks each, and three questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.
 - v. Use of calculators is not permitted.
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Section A

1. If two numbers do not have common factor (other than 1), then they are called
 - a. prime numbers
 - b. co-prime numbers
 - c. composite numbers
 - d. twin primes
 2. If a is a non-zero rational and \sqrt{b} is irrational, then $a\sqrt{b}$ is:
 - a. an integer
-

-
- b. a natural number
- c. an irrational number
- d. a rational number
3. In the given data if $n = 230$, $l = 40$, $cf = 76$, $h = 10$, $f = 65$, then its median is
- a. 48
- b. 40
- c. 47
- d. 46
4. The perimeter of a right triangle is 70cm and its hypotenuse is 29cm. The area of the triangle is
- a. 210 sq.cm
- b. 200 sq.cm
- c. 180 sq.cm
- d. 250 sq.cm
5. The value of $\tan 15^\circ \tan 20^\circ \tan 70^\circ \tan 75^\circ$ is
- a. 2
- b. 0
- c. 1
- d. -1
6. Which of the following is true:
- a. $\sin A + \operatorname{cosec} A = 1$
- b. $\sin A + \cos A = 1$

-
- c. $\cos A \sec A = 1$
- d. $\sin A \cot A = 1$
7. The angle of elevation of the top of a tower from two points P and Q at distances of 'a' and 'b' respectively from the base and in the same straight line with it are complementary. The height of the tower is
- a. $2\sqrt{ab}$
- b. None of these
- c. ab
- d. \sqrt{ab}
8. The distance of a point from the x – axis is called
- a. None of these
- b. origin
- c. abscissa
- d. ordinate
9. If the point P(2, 4) lies on a circle, whose centre is C(5, 8), then the radius of the circle is
- a. 25 units
- b. 4 units
- c. 8 units
- d. 5 units
10. A letter of English alphabets is chosen at random. The probability that the letter chosen is a vowel is
- a. $\frac{2}{26}$

b. $\frac{4}{26}$

c. $\frac{1}{26}$

d. $\frac{5}{26}$

11. Fill in the blanks:

The ratio of the volume of a cube to that of a sphere, which will exactly fit inside the cube is _____.

12. Fill in the blanks:

Value of K, if K is a zero of $p(x) = 5x + 3$ is _____.

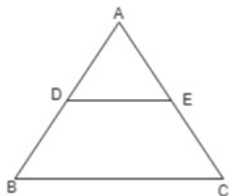
OR

Fill in the blanks:

The product of the zeroes of $-2x^2 + kx + 6$ is _____.

13. Fill in the blanks:

In the given figure, if $\frac{AD}{DB} = \frac{3}{5}$ and $AC = 4.8\text{cm}$, then the value of AE is _____.



14. Fill in the blanks:

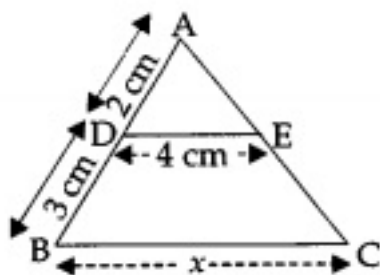
The sum of the AP, $1 + 2 + 3 + 4 + 5 + 6 + \dots + 10$ is _____.

15. Fill in the blanks:

Area of triangle = $\frac{1}{2} \times$ _____.

16. In what form of decimals can irrational numbers be represented?

17. In the adjoining figure, $DE \parallel BC$, then find x.

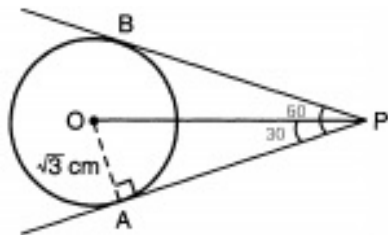


18. For the following APs, write the first term and the common difference : 3, 1, -1, -3,

OR

If they form an AP, find the common difference d and write three more terms. 0.2, 0.22, 0.222, 0.2222,

19. Two tangents making an angle of 60° between them are drawn to a circle of radius $\sqrt{3}$ cm then find the length of each tangent.



20. Find the values of p for which the quadratic equation $4x^2 + px + 3 = 0$ has equal roots.

Section B

21. A number x is chosen from the numbers - 4, - 3, - 2, - 1, 0, 1, 2, 3, 4. Find the probability that $|x| < 3$.
22. Find the roots of the equation, if they exist, by applying the quadratic formula:
 $2\sqrt{3}x^2 - 5x + \sqrt{3} = 0$
23. ABC is a right triangle right-angled at C. Let $BC = a$, $CA = b$, $AB = c$ and let p be the length of perpendicular from C on AB, Prove that $cp = ab$.

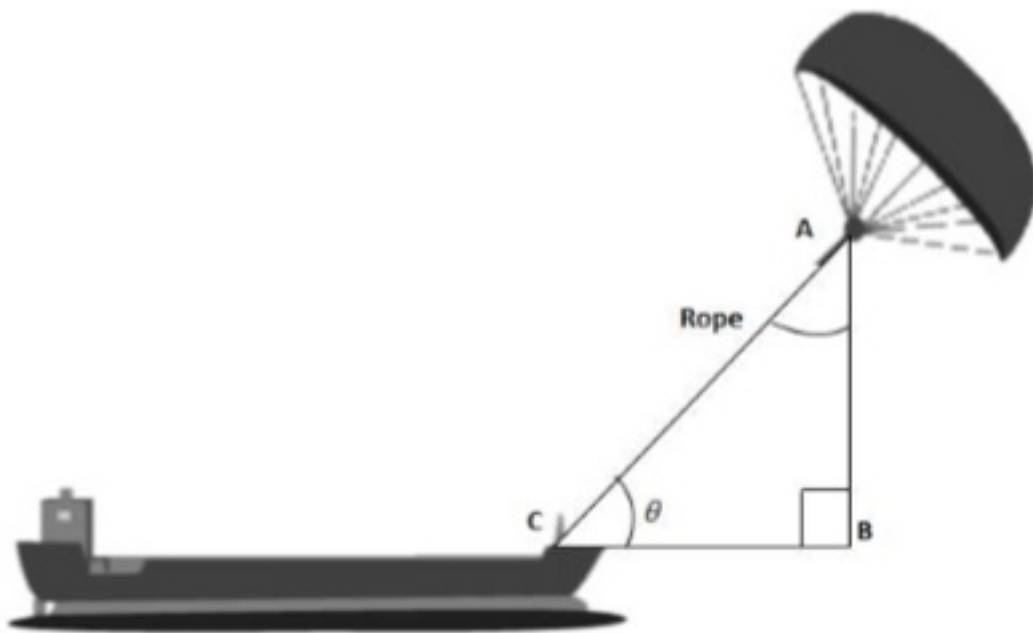
OR

D, E and F are the points on sides BC, CA and AB respectively of $\triangle ABC$ such that AD bisects $\angle A$, BE bisects $\angle B$ and CF bisects $\angle C$. If $AB = 5$ cm, $BC = 8$ cm and $CA = 4$ cm,

determine AF, CE and BD.

24. Skysails is the genre of engineering science that uses extensive utilization of wind energy to move a vessel in the seawater. The 'Skysails' technology allows the towing kite to gain a height of anything between 100 metres - 300 metres. The sailing kite is made in such a way that it can be raised to its proper elevation and then brought back with the help of a 'telescopic mast' that enables the kite to be raised properly and effectively.

Based on the following figure related to sky sailing, answer the following questions:



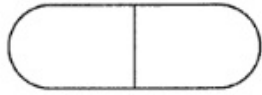
- In the given figure, if $\sin \theta = \cos(\theta - 30^\circ)$, where θ and $\theta - 30^\circ$ are acute angles, then find the value of θ .
 - What should be the length of the rope of the kite sail in order to pull the ship at the angle θ (calculated above) and be at a vertical height of 200m?
25. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle.

OR

Two tangents PA and PB are drawn from an external point P to a circle inclined to each other at an angle of 70° , then what is the value of $\angle PAB$?

26. Seema a class 10th student went to a chemist shop to purchase some medicine for her

mother who was suffering from Dengue. After purchasing the medicine she found that the upcount capsule used to cure platelets has the dimensions as followed: The shape of the upcount capsule was a cylinder with two hemispheres stuck to each of its ends. The length of the entire capsule is 14 mm and the diameter of the capsule is 5 mm.



By reading the above-given information, find the following:

- i. The surface area of the cylinder.
- ii. The surface area of the capsule.

Section C

27. Find the LCM and HCF of the following pairs of integers and verify that $\text{LCM} \times \text{HCF} = \text{product of the two numbers}$.

- i. 510 and 92
- ii. 336 and 54

OR

On morning walk, three persons step off together and their steps measure 40 cm, 42 cm and 45 cm, respectively. What is the minimum distance each should walk so that each can cover the same distance in complete steps?

28. In the following situation, does the list of numbers involved make an arithmetic progression, and why? The amount of money in the account every year, when Rs 10000 is deposited at compound interest at 8% per annum.

29. Solve for x and y: $2x - \frac{3}{y} = 9$; $3x + \frac{7}{y} = 2$.

OR

5 chairs and 4 tables together cost Rs 5600, while 4 chairs and 3 tables together cost Rs 4340. Find the cost of a chair and that of a table.

30. If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + x - 2$, then, find the

value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

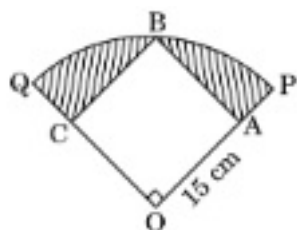
31. In what ratio is the line segment joining the points (-2, -3) and (3, 7) divided by the y-axis? Also, find the coordinates of the point of division.
32. If $1 + \sin^2\theta = 3\sin\theta \cos\theta$, then prove that $\tan\theta = 1$ or $\frac{1}{2}$.

OR

Evaluate without using trigonometric tables :

$$\frac{\operatorname{cosec}^2(90^\circ - \theta) - \tan^2 \theta}{4(\cos^2 48^\circ + \cos^2 42^\circ)} - \frac{2 \tan^2 30^\circ \sec^2 52^\circ \sin^2 38^\circ}{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ}$$

33. In a given figure, a square OABC is inscribed in a quadrant OPBQ. If OA = 15 cm, find the area of the shaded region. (Use $\pi = 3.14$)



34. The following is the distribution of height of students of a certain class in a city:

Heights(exclusive)	160-162	163-165	166-168	169-171	172-174
No of students	15	118	142	127	18

Section D

35. Construct a $\triangle PQR$, in which $PQ = 6$ cm, $QR = 7$ cm and $PR = 8$ cm. Then, construct another triangle whose sides are $\frac{4}{5}$ times the corresponding sides of $\triangle PQR$.

OR

Draw a line segment of length 5 cm and divide it in the ratio 3 : 7.

36. In $\triangle ABC$, if $AD \perp BC$ and $AD^2 = BD \times DC$, prove that $\angle BAC = 90^\circ$.
37. DDA wants to make a rectangular park in the colony. If the length and breadth of the park are decreased by 2 m, then the area will be decreased by 196 sq meters. Its area will be increased by 246 sq meters if its length is increased by 3 m and breadth is

increased by 2 m. Find the length and breadth of the park.

OR

In a $\triangle ABC$, $\angle A = x^\circ$, $\angle B = (3x - 2)^\circ$, $\angle C = y^\circ$. Also, $\angle C - \angle B = 9^\circ$. Find the three angles.

38. An agriculture field is in the form of a rectangle of length 20 m width 14 m. A 10 m deep well of diameter 7m is dug in a corner of the field and the earth taken out of the well is spread evenly over the remaining part of the field. Find the rise in its level.

OR

A well of diameter 4 m is dug 14 m deep. The earth taken out is spread evenly all around the well to form a 40 cm high embankment. Find the width of the embankment.

39. The shadow of a tower, when the angle of elevation of the sun is 45° , is found to be 10 metres longer than when the angle of elevation is 60° . Find the height of the tower.
[Given $\sqrt{3} = 1.732$.]
40. Change the following frequency distribution to less than type distribution and draw its ogive. Hence, obtain the median value.

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60
Frequency	2	5	7	12	8	6

CBSE Class 10th Mathematics Standard
Sample Paper - 04

Solution

Section A

1. (b) co-prime numbers

Explanation:

If two numbers do not have a common factor (other than 1), then they are called co-prime numbers. We know that two numbers are coprime if their common factor (greatest common divisor) is 1. e.g. co-prime of 12 are 11,13.

2. (c) an irrational number

Explanation:

If possible let $a\sqrt{b}$ be rational.

Then $a\sqrt{b} = \frac{p}{q}$, where p and q are non-zero integers, having no common factor other than 1.

$$\text{Now, } a\sqrt{b} = \frac{p}{q}$$

$$\Rightarrow \sqrt{b} = \frac{p}{aq} \dots\dots\dots(i)$$

But, p and aq are both rational and $aq \neq 0$.

$\therefore \frac{p}{aq}$ is rational.

Therefore, from eq. (i), it follows that \sqrt{b} is rational.

The contradiction arises by assuming that $a\sqrt{b}$ is rational.

Hence, $a\sqrt{b}$ is irrational.

3. (d) 46

Explanation:

$$\begin{aligned}
\text{Median} &= l + \frac{\frac{n}{2} - cf}{f} \times h \\
&= 40 + \frac{\frac{230}{2} - 76}{65} \times 10 \\
&= 40 + \frac{115 - 76}{65} \times 10 \\
&= 40 + \frac{39}{65} \times 10 \\
&= 40 + \frac{390}{65} \\
&= 40 + 6 \\
&= 46
\end{aligned}$$

4. (a) 210 sq.cm

Explanation:

Let base of the right triangle be x cm.

Given: Perpendicular = $x + 29 = 70 \Rightarrow$ Perpendicular = $(41 - x)$ cm

Now, using Pythagoras theorem,

$$\begin{aligned}
(29)^2 &= x^2 + (41 - x)^2 \\
\Rightarrow 841 &= 1681 + x^2 - 82x + x^2 \\
\Rightarrow 2x^2 - 82x + 840 &= 0 \\
\Rightarrow x^2 - 41x + 420 &= 0 \\
\Rightarrow x^2 - 20x - 21x + 420 &= 0 \\
\Rightarrow x(x - 20) - 21(x - 20) &= 0 \\
\Rightarrow (x - 20)(x - 21) &= 0 \\
\Rightarrow x - 20 = 0 \text{ and } x - 21 &= 0 \\
\Rightarrow x = 20 \text{ and } x = 21
\end{aligned}$$

Therefore, the two sides other than hypotenuse are of 20 cm and 21 cm.

\therefore Area of right triangle = $\frac{1}{2} \times \text{Base} \times \text{Perpendicular} = \frac{1}{2} \times 20 \times 21 = 210 \text{ sq. cm}$

5. (c) 1

Explanation:

$$\begin{aligned}
\text{Given: } &\tan 15^\circ \tan 20^\circ \tan 70^\circ \tan 75^\circ \\
&= \tan 15^\circ \tan 20^\circ \tan(90^\circ - 20^\circ) \tan(90^\circ - 15^\circ) \\
&= \tan 15^\circ \tan 20^\circ \cot 20^\circ \cot 15^\circ \\
&= (\tan 15^\circ \cot 15^\circ) (\tan 20^\circ \cot 20^\circ)
\end{aligned}$$

$$= 1 \times 1 = 1$$

6. (c) $\cos A \sec A = 1$

Explanation:

$$\cos A \sec A$$

$$= \cos A \times \frac{1}{\cos A}$$

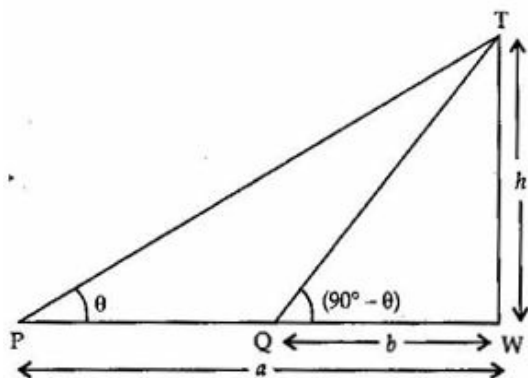
$$= 1 \times 1 = 1$$

Therefore $\cos A \sec A = 1$ is true.

7. (d) \sqrt{ab}

Explanation:

Let TW be the tower of height h meters and P and Q are two points such that PW = a and QW = b .



Let angles of elevation be $\angle WPT = \theta$

And $\angle WQT = 90^\circ - \theta$

Now, in right angled triangle TWP,

$$\tan \theta = \frac{TW}{PW}$$

$$\Rightarrow \tan \theta = \frac{h}{a}$$

$$\Rightarrow h = a \tan \theta \dots(i)$$

Again in right angled triangle TWQ,

$$\tan(90^\circ - \theta) = \frac{h}{b}$$

$$\Rightarrow \cot \theta = \frac{h}{b}$$

$$\Rightarrow h = b \cot \theta \dots(ii)$$

Multiplying eq. (i) and (ii), we get

$$h \times h = (a \tan \theta) (b \cot \theta)$$

$$\Rightarrow h^2 = ab$$

$$\Rightarrow h = \sqrt{ab}$$

Therefore, the height of the tower is \sqrt{ab} .

8. (d) ordinate

Explanation:

The distance of a point from the x – axis is the y (vertical) coordinate of the point and is called ordinate.

9. (d) 5 units

Explanation:

The point P(2, 4) is on the circle and C(5, 8) is its centre

Hence PC will be Radius of circle.

$$\begin{aligned}\therefore PC^2 &= (2 - 5)^2 + (4 - 8)^2 \\ &= \sqrt{9 + 16} = \sqrt{25} = 5 \text{ units}\end{aligned}$$

10. (d) $\frac{5}{26}$

Explanation:

We know that "A , E , I , O , U" are vowels

Number of vowels = 5

Number of possible outcomes = 5

Number of total outcomes = 26

$$\therefore \text{Required Probability} = \frac{5}{26}$$

11. $6 : \pi$

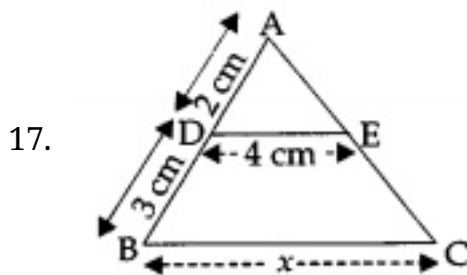
12. $\frac{-3}{5}$ OR -3

13. 1.8cm

14. 55

15. Base \times Altitude

16. Irrational numbers can be represented as non - terminating and non - repeating decimal expansions



Given: $DE \parallel BC$

To find: x

We know that,

$\triangle ABC \sim \triangle ADE$ [AA Similarity]

$$\Rightarrow \frac{AB}{AD} = \frac{AC}{AE} = \frac{BC}{DE}$$

$$\therefore \frac{AB}{AD} = \frac{BC}{DE}$$

$$\text{i.e. } \frac{AD+DB}{AD} = \frac{BC}{DE}$$

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

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

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

$$\Rightarrow x = 10 \text{ cm.}$$

18. 3, 1, -1, -3,

First term (a) = 3

Common difference (d) = $1 - 3 = -2$

OR

0.2, 0.22, 0.222, 0.2222, 0.000

$$a_2 - a_1 = 0.22 - 0.2 = 0.02$$

$$a_3 - a_2 = 0.222 - 0.22 = 0.002$$

As $a_2 - a_1 \neq a_3 - a_2$, the given list of numbers does not form an AP.

$$\begin{aligned}
19. \quad \tan 30^\circ &= \frac{OA}{AP} \\
\Rightarrow \frac{1}{\sqrt{3}} &= \frac{\sqrt{3}}{AP} \\
\Rightarrow AP &= 3 \\
\therefore AP &= BP = 3\text{cm}
\end{aligned}$$

$$\begin{aligned}
20. \quad 4x^2 + px + 3 &= 0 \\
a &= 4, b = p \text{ and } c = 3 \\
\text{As the equation has equal roots}
\end{aligned}$$

$$\therefore D = 0$$

$$D = b^2 - 4ac = 0$$

$$\text{or, } p^2 - 4 \times 4 \times 3 = 0$$

$$\text{or, } p^2 - 48 = 0$$

$$\text{or, } p^2 = 48$$

$$\text{or, } p = \pm 4\sqrt{3}$$

Section B

$$\begin{aligned}
21. \quad \text{Total possible outcomes} &= 9 \\
|x| < 3 \text{ for } x &= -2, -1, 0, 1 \text{ and } 2
\end{aligned}$$

$$\text{Favourable outcomes} = 5$$

$$\therefore P(\text{that } |x| < 3) = \frac{5}{9}$$

$$22. \quad \text{The given equation is } 2\sqrt{3}x^2 - 5x + \sqrt{3} = 0$$

Comparing it with $ax^2 + bx + c = 0$, we get

$$a = 2\sqrt{3}, b = -5, \text{ and } c = \sqrt{3}$$

$$\therefore D = b^2 - 4ac = (-5)^2 - 4(2\sqrt{3})(\sqrt{3}) = 25 - 24 = 1 > 0$$

So, the given equation has real roots, given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-(-5) + \sqrt{1}}{2 \times 2\sqrt{3}} = \frac{5+1}{4\sqrt{3}} = \frac{6}{4\sqrt{3}} = \frac{3}{2\sqrt{3}} = \frac{\sqrt{3}}{2}$$

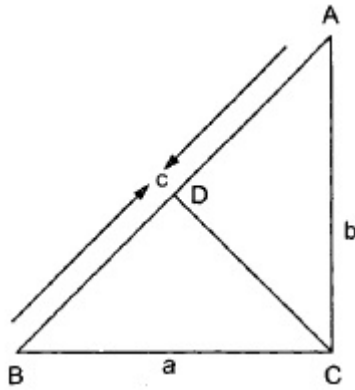
$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-(-5) - \sqrt{1}}{2 \times 2\sqrt{3}} = \frac{5-1}{4\sqrt{3}} = \frac{4}{4\sqrt{3}} = \frac{1}{\sqrt{3}}$$

Hence, $\left(\frac{\sqrt{3}}{2}\right)$ and $\left(\frac{1}{\sqrt{3}}\right)$ are the roots of the given equation.

23. Given: $\triangle ABC$ is a right triangle right-angled at C . Also, $BC = a$, $CA = b$, $AB = c$

To Prove: $cp = ab$.

Proof: Let $CD \perp AB$. Then, $CD = p$.



$$\therefore \text{Area of } \triangle ABC = \frac{1}{2} (\text{Base} \times \text{height})$$

$$\Rightarrow \text{Area of } \triangle ABC = \frac{1}{2} (AB \times CD) = \frac{1}{2} cp$$

Also,

$$\text{Area}(\triangle ABC) = \frac{1}{2} (BC \times AC) = \frac{1}{2} ab$$

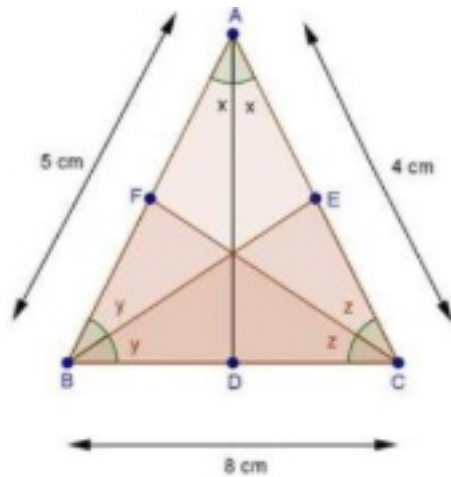
$$\therefore \frac{1}{2} cp = \frac{1}{2} ab$$

$$\Rightarrow cp = ab$$

OR

It is given that D , E and F are the points on sides BC , CA and AB respectively of $\triangle ABC$ such that AD bisects $\angle A$, BE bisects $\angle B$ and CF bisects $\angle C$.

Also $AB = 5$ cm, $BC = 8$ cm and $CA = 4$ cm



We know that the internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the sides containing the angle.

$$\therefore \frac{AF}{FB} = \frac{AC}{BC}$$

$$\Rightarrow \frac{AF}{5-AF} = \frac{4}{8} [\because FB = AB - AF = 5 - AF]$$

$$\Rightarrow \frac{AF}{5-AF} = \frac{1}{2}$$

$$\Rightarrow 2AF = 5 - AF$$

$$\Rightarrow 2AF + AF = 5$$

$$\Rightarrow 3AF = 5$$

$$\Rightarrow AF = \frac{5}{3} \text{ cm}$$

Again, in $\triangle ABC$, BE bisects $\angle B$

$$\therefore \frac{AE}{EC} = \frac{AB}{BC}$$

$$\Rightarrow \frac{4-CE}{CE} = \frac{5}{8} [\because AE = AC - CE = 4 - CE]$$

$$\Rightarrow 8(4 - CE) = 5 \times CE$$

$$\Rightarrow 32 - 8CE = 5CE$$

$$\Rightarrow 32 = 13CE$$

$$\Rightarrow CE = \frac{32}{13} \text{ cm}$$

Similarly,

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

$$\Rightarrow \frac{BD}{8-BD} = \frac{5}{4} [\because DC = BC - BD = 8 - BD]$$

$$\Rightarrow 48D = 5(8 - 8D)$$

$$\Rightarrow 48D = 40 - 58D$$

$$\Rightarrow 98D = 40$$

$$\Rightarrow BD = \frac{40}{9} \text{ cm}$$

$$\text{Hence, } AF = \frac{5}{3} \text{ cm,}$$

$$CE = \frac{32}{13} \text{ cm}$$

and $BD = \frac{40}{9} \text{ cm}$

24. i. $\sin \theta = \cos(\theta - 30^\circ)$

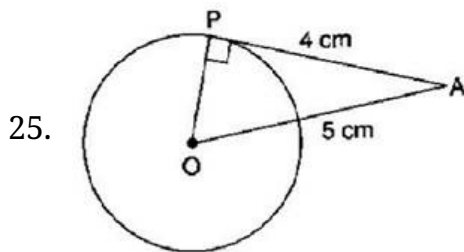
$$\cos(90^\circ - \theta) = \cos(\theta - 30^\circ)$$

$$\Rightarrow 90^\circ - \theta = \theta - 30^\circ$$

$$\Rightarrow \theta = 60^\circ$$

ii. $\frac{AB}{AC} = \sin 60^\circ$

$$\therefore \text{Length of rope, } AC = \frac{AB}{\sin 60^\circ} = \frac{200}{\frac{\sqrt{3}}{2}} = \frac{200 \times 2}{\sqrt{3}} = 230.94 \text{ m}$$



We know that the tangent at any point of a circle is \perp to the radius through the point of contact.

$$\therefore \angle OPA = 90^\circ$$

$$\therefore OA^2 = OP^2 + AP^2 \text{ [By Pythagoras theorem]}$$

$$\Rightarrow (5)^2 = (OP)^2 + (4)^2$$

$$\Rightarrow 25 = (OP)^2 + 16$$

$$\Rightarrow OP^2 = 9$$

$$\Rightarrow OP = 3 \text{ cm}$$

OR

$$\angle OPA = \frac{1}{2} \angle APB$$

$$= \frac{1}{2} \times 70^\circ = 35^\circ$$

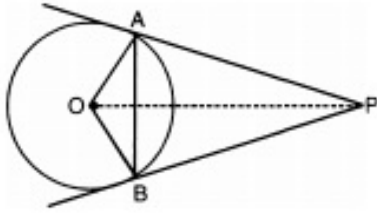
$$\angle OAP = 90^\circ \text{ [radius } \perp \text{ tangent]}$$

$$\therefore \angle AOP = 180^\circ - (90^\circ + 35^\circ) = 55^\circ$$

$$\therefore \angle OAB = 90^\circ - 55^\circ = 35^\circ$$

$$\angle PAB = 90^\circ - 35^\circ$$

$$= 55^\circ$$

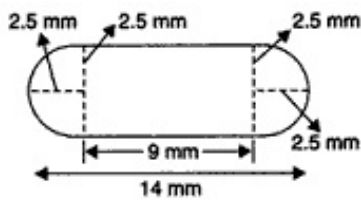


26. Let r = radius, h = cylindrical height

The radius of the hemisphere or cylinder, $r = \frac{5}{2}$ mm

Height of cylinder, h = Total height - $2 \times$ radius of hemisphere

$$h = 14 - 2 \times 2.5 = 9 \text{ mm}$$



i. Surface area of cylinder = $2\pi rh$

$$= 2\pi \left(\frac{5}{2}\right) (9) = 45\pi \text{ mm}^2$$

ii. Surface area of the capsule = curved surface area of cylinder + $2 \times$ surface area of the hemisphere

$$= 2\pi rh + 2(2\pi r^2)$$

$$= 2\pi \left(\frac{5}{2}\right) (9) + 2 \left[2 \cdot \pi \cdot \left(\frac{5}{2}\right)^2 \right]$$

$$= 45\pi + 25\pi$$

$$= 70\pi = 70 \times \frac{22}{7} = 220 \text{ mm}^2$$

Section C

27. i. 510 and 92

$$510 = 2 \times 3 \times 5 \times 17$$

$$92 = 2 \times 2 \times 23$$

$$\text{HCF}(510, 92) = 2$$

$$\text{LCM}(510, 92) = 2 \times 2 \times 3 \times 5 \times 17 \times 23 = 23460$$

$$\text{Product of two numbers } 510 \text{ and } 92 = 510 \times 92 = 46920$$

$$\text{HCF} \times \text{LCM} = 2 \times 23460 = 46920$$

$$\text{Hence, product of two numbers} = \text{HCF} \times \text{LCM}$$

ii. 336 and 54

$$336 = 2 \times 2 \times 2 \times 2 \times 3 \times 7 = 2^4 \times 3 \times 7$$

$$54 = 2 \times 3 \times 3 \times 3 = 2 \times 3^3$$

$$\text{HCF}(336, 54) = 2 \times 3 = 6$$

$$\text{LCM}(336, 54) = 2^4 \times 3^3 \times 7 = 3024$$

$$\text{Product of two numbers } 336 \text{ and } 54 = 336 \times 54 = 18144$$

$$\text{HCF} \times \text{LCM} = 6 \times 3024 = 18144$$

$$\text{Hence, product of two numbers} = \text{HCF} \times \text{LCM}$$

OR

Since, the three persons start walking together.

\therefore The minimum distance covered by each of them in complete steps = LCM of the measures of their steps

$$40 = 8 \times 5 = 2^3 \times 5$$

$$42 = 6 \times 7 = 2 \times 3 \times 7$$

$$45 = 9 \times 5 = 3^2 \times 5$$

Hence LCM (40, 42, 45)

$$= 2^3 \times 3^2 \times 5 \times 7 = 8 \times 9 \times 5 \times 7 = 2520$$

\therefore The minimum distance each should walk so that each can cover the same distance = 2520 cm = 25.20 meters.

$$28. \text{ Amount of money after 1 year} = Rs10000 \left(1 + \frac{8}{100}\right) = a_1$$

$$\text{Amount of money after 2 year} = Rs10000 \left(1 + \frac{8}{100}\right)^2 = a_2$$

$$\text{Amount of money after 3 year} = Rs10000 \left(1 + \frac{8}{100}\right)^3 = a_3$$

$$\text{Amount of money after 4 year} = Rs10000 \left(1 + \frac{8}{100}\right)^4 = a_4$$

$$a_2 - a_1 = Rs10000 \left(1 + \frac{8}{100}\right)^2 - Rs10000 \left(1 + \frac{8}{100}\right)$$

$$= Rs10000 \left(1 + \frac{8}{100}\right) \left(1 + \frac{8}{100} - 1\right)$$

$$= 10000 \left(1 + \frac{8}{100}\right) \left(\frac{8}{100}\right)$$

$$a_3 - a_2$$

$$= 10000 \left(1 + \frac{8}{100}\right)^2 - 10000 \left(1 + \frac{8}{100}\right)$$

$$= 10000 \left(1 + \frac{8}{100}\right) \left(1 + \frac{8}{100} - 1\right)$$

$$= 10000 \left(1 + \frac{8}{100}\right) \left(\frac{8}{100}\right)$$

Since $a_3 - a_2 \neq a_2 - a_1$. It does not form AP.

29. Putting $\frac{1}{y} = v$, the given equations becomes

$$2x - 3v = 9 \dots\dots(i)$$

$$3x + 7v = 2 \dots\dots(ii)$$

Multiplying (i) by 7 and (ii) by 3, we get

$$14x - 21v = 63 \dots\dots(iii)$$

$$9x + 21v = 6 \dots\dots(iv)$$

Adding (iii) and (iv), we get

$$23x = 69 \Rightarrow x = \frac{69}{23} = 3$$

Putting $x = 3$ in (i), we get

$$2 \times 3 - 3v = 9$$

$$-3v = 9 - 6$$

$$\Rightarrow -3v = 3$$

$$\Rightarrow v = -1$$

$$\Rightarrow \frac{1}{y} = -1 \Rightarrow y = -1$$

\therefore Solution is $x = 3, y = -1$

OR

Let each chair cost Rs x and each table cost Rs y .

According to the first condition,

$$5x + 4y = 5600 \dots\dots(i)$$

According to the second condition,

$$4x + 3y = 4340 \dots\dots(ii)$$

Multiplying (i) by 3 and (ii) by 4, we get

$$15x + 12y = 16800$$

$$\text{and } 16x + 12y = 17360$$

Subtracting the above equations, we get

$$x = 560$$

substituting $x = 560$ in (i), we get $y = 700$

\therefore the cost of each chair is Rs. 560 and the cost each table is Rs. 700.

30. $f(x) = 6x^2 + x - 2$

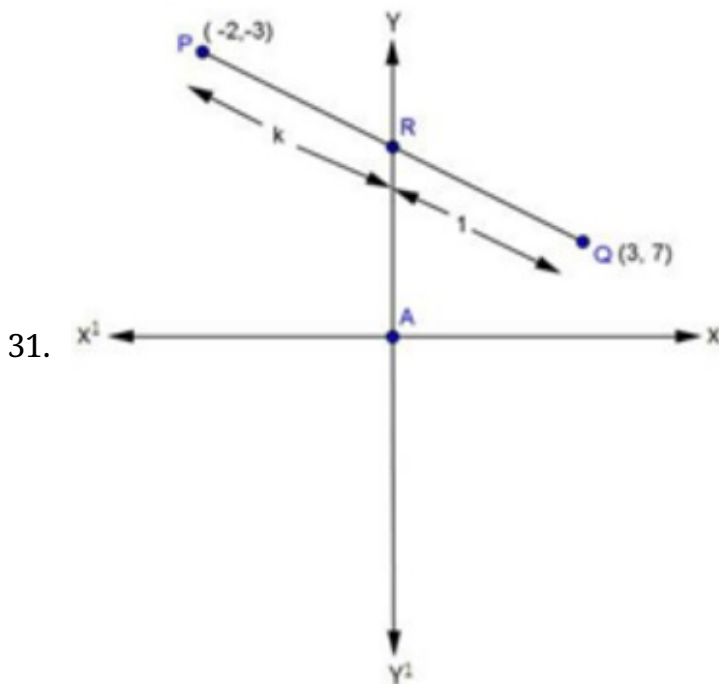
$$a = 6, b = 1, c = -2$$

Let zeroes be α and β . Then

$$\text{Sum of zeroes} = \alpha + \beta = -\frac{b}{a} = -\frac{1}{6}$$

$$\text{Product of zeroes} = \alpha \times \beta = \frac{c}{a} = \frac{-2}{6} = -\frac{1}{3}$$

$$\begin{aligned} \frac{\alpha}{\beta} + \frac{\beta}{\alpha} &= \frac{\alpha^2 + \beta^2}{\alpha\beta} \\ &= \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta} \left[\because (\alpha + \beta)^2 = \alpha^2 + \beta^2 + 2\alpha\beta \right] \\ &= \frac{\left[-\frac{1}{6}\right]^2 - 2\left[-\frac{1}{3}\right]}{\left[-\frac{1}{3}\right]} \\ &= \frac{\frac{1}{36} + \frac{2}{3}}{-\frac{1}{3}} \\ &= \frac{\frac{1+24}{36}}{-\frac{1}{3}} \\ &= \frac{25}{36} \times \frac{-3}{1} \\ &= \frac{-25}{12} \end{aligned}$$



Suppose y-axis divides PQ in the ratio K:1 at R.

Then, the coordinates of the point of division are:

$$\begin{aligned} R &\left[\frac{3k + (-2) \times 1}{k+1}, \frac{7k + (-3) \times 1}{k+1} \right] \\ &= R \left[\frac{3k-2}{k+1}, \frac{7k-3}{k+1} \right] \end{aligned}$$

Since, R lies on y-axis and x-coordinate of every point on y-axis is zero

$$\therefore \frac{3k-2}{k+1} = 0$$

$$\Rightarrow 3k - 2 = 0$$

$$\Rightarrow 3k = 2$$

$$\Rightarrow k = \frac{2}{3}$$

Hence, the required ratio is $\frac{2}{3} : 1$

i.e., 2:3

Putting $k = \frac{2}{3}$ in the coordinates of R

We get, (0, 1)

32. Given,

$$1 + \sin^2 \theta = 3 \sin \theta \cos \theta$$

$$\Rightarrow \sin^2 \theta + \cos^2 \theta + \sin^2 \theta = 3 \sin \theta \cos \theta$$

$$\Rightarrow 2 \sin^2 \theta + \cos^2 \theta = 3 \sin \theta \cos \theta$$

$$\Rightarrow 2 \sin^2 \theta - 3 \sin \theta \cos \theta + \cos^2 \theta = 0$$

$$\Rightarrow 2 \sin^2 \theta - 2 \sin \theta \cos \theta - \sin \theta + \cos^2 \theta = 0$$

$$\Rightarrow (\sin \theta - \cos \theta)(2 \sin \theta - \cos \theta) = 0$$

either, $\sin \theta - \cos \theta = 0$ or, $2 \sin \theta - \cos \theta = 0$

$$\Rightarrow \sin \theta = \cos \theta \text{ or, } 2 \sin \theta = \cos \theta$$

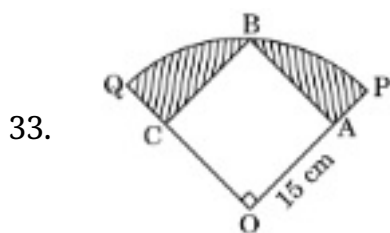
$$\Rightarrow \tan \theta = 1 \text{ or, } \tan \theta = \frac{1}{2} \quad [\because \frac{\sin \theta}{\cos \theta} = \tan \theta]$$

Hence, proved.

OR

$$\begin{aligned} & \frac{\operatorname{cosec}^2(90^\circ - \theta) - \tan^2 \theta}{4(\cos^2 48^\circ + \cos^2 42^\circ)} - \frac{2 \tan^2 30^\circ \sec^2 52^\circ \cdot \sin^2 38^\circ}{\operatorname{cosec}^2 70^\circ - \tan^2 20^\circ} \\ &= \frac{\sec^2 \theta - \tan^2 \theta}{4\{\cos^2 48^\circ + \sin^2(90^\circ - 42^\circ)\}} - \frac{2 \times \left(\frac{1}{\sqrt{3}}\right)^2 \cdot \sec^2 52^\circ \cdot \cos^2(90^\circ - 38^\circ)}{\sec^2(90^\circ - 70^\circ) - \tan^2 20^\circ} \\ &= \frac{1}{4(\cos^2 48^\circ + \sin^2 48^\circ)} - \frac{2 \times \frac{1}{3} \times \frac{1}{\cos^2 52^\circ} \times \cos^2 52^\circ}{\sec^2 20^\circ - \tan^2 20^\circ} \\ &= \frac{1}{4 \times 1} - \frac{\frac{2}{3} \times 1}{1} \\ &= \frac{1}{4} - \frac{2}{3} \\ &= \frac{3-8}{12} \end{aligned}$$

$$= -\frac{5}{12}$$



In the given figure, OB is the radius of quadrant QOBP and OB is diagonal of square OACB. If we join OB, we get right triangle BAO.

Also, given that OA = 15 cm, and OA = AB = BC = CO [\because sides of square]

By Pythagoras theorem in triangle BAO, we get,

$$OB^2 = AB^2 + OA^2$$

$$OB = \sqrt{15^2 + 15^2} = 15\sqrt{2} \text{ cm}$$

\therefore Radius (r) of quadrant = OB = $15\sqrt{2} \text{ cm}$ and side of square = 15 cm

\therefore Shaded area = Area of quadrant - Area of square

$$= \frac{1}{4} \times \pi r^2 - \text{side} \times \text{side}$$

$$= \frac{1}{4} (3.14)(15\sqrt{2})^2 - (15)^2$$

$$= \frac{1}{4} \times 3.14 \times 450 - 225$$

$$= 353.25 - 225 = 128.25 \text{ cm}^2$$

34.

Heights(exclusive)	160-162	163-165	166-168	169-171	172-174
Heights (inclusive)	159.5-162.5	162.5-165.5	165.5-168.5	168.5-171.5	171.5-174.5
No of students	15	118	142	127	18

from table ,the maximum frequency is 142, then the corresponding class 165.5 - 168.5 is the modal class.

$$l = 165.5, h = 168.5 - 165.5 = 3, f = 142, f_1 = 118, f_2 = 127$$

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

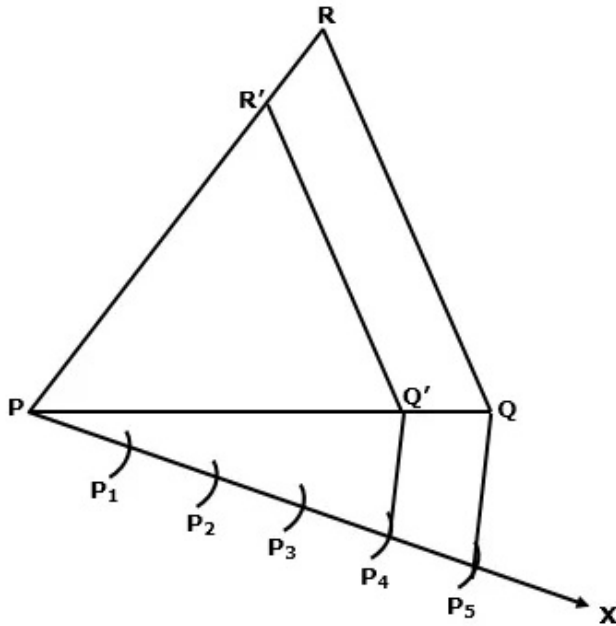
$$= 165.5 + \frac{142 - 118}{2 \times 142 - 118 - 127} \times 3$$

$$= 165.5 + 1.85$$

$$= 167.35 \text{ cm}$$

Section D

35.

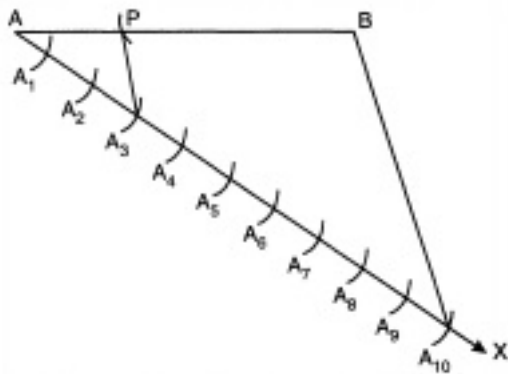


Steps of construction:

1. Draw a line segment $PQ = 6$ cm.
2. With P as centre and radius 8 cm, draw an arc.
3. With Q as centre and radius 7 cm, draw another arc intersecting the previous arc at R.
4. Join PR and QR to obtain $\triangle PQR$.
5. Below PQ, make an acute $\angle QPX$.
6. Along PX, mark off 5 points (greater of 4 and 5 in $\frac{4}{5}$) P_1, P_2, P_3, P_4, P_5 such that $PP_1 = P_1P_2 = P_2P_3 = P_3P_4 = P_4P_5$
7. Join P_5Q .
8. From point P_4 , draw a line parallel to P_5Q intersecting PQ at Q'
9. From point Q' , draw a line parallel to QR intersecting PR at R'

Thus, $\triangle PQ'R'$ is the required triangle.

OR



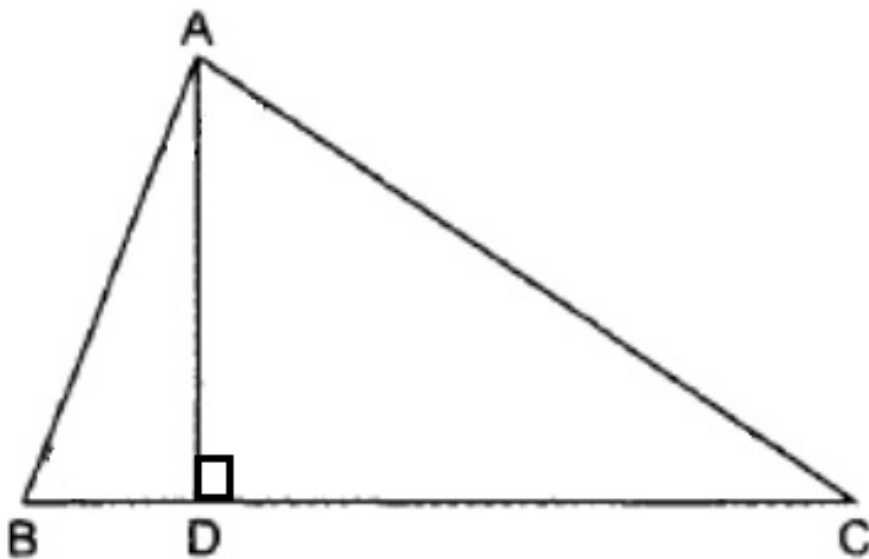
We have to draw a line segment of length 5 cm and divide it in the ratio 3 : 7. We write the steps of construction as follows:

Steps of Construction:

- i. Draw a line segment $AB = 5$ cm.
- ii. Draw any ray AX making an acute angle down ward with AB .
- iii. Mark the points $A_1, A_2, A_3, \dots, A_{10}$ on AX such that $AA_1 = A_1A_2 = \dots = A_9A_{10}$.
- iv. Join BA_{10} .
- v. Through the point A_3 draw a line parallel to BA_{10} . To meet AB at P .

Hence $AP : PB = 3 : 7$

36.



Given: In $\triangle ABC$, $AD \perp BC$ and $AD^2 = BD \times DC$

To prove : $\angle BAC = 90^\circ$

Proof: In right triangles, $\triangle ADB$ and $\triangle ADC$,

Applying Pythagoras theorem we have,

$$AB^2 = AD^2 + BD^2 \dots \dots \dots (i)$$

$$AC^2 = AD^2 + DC^2 \dots\dots\dots(ii)$$

Adding eq. (i) and (ii),

$$\begin{aligned} AB^2 + AC^2 &= 2AD^2 + BD^2 + DC^2 \\ &= 2BD \cdot CD + BD^2 + CD^2 \quad [\because \text{given } AD^2 = BD \cdot CD] \\ &= (BD + CD)^2 = BC^2 \end{aligned}$$

Thus in $\triangle ABC$ we have, $AB^2 + AC^2 = BC^2$

So, by the converse of Pythagoras theorem, triangle ABC is a right triangle, right angled at A.

Hence, $\angle BAC = 90^\circ$

37. Let the length and breadth of the rectangular park be 'L' and 'B' respectively.

Case 1-

If the length and the breadth of the park is decreased by 2 m respectively, its area is decreased by 196 square meter.

Therefore, the area will be $= (L \times B) - 196$

$$(L - 2)(B - 2) = L \times B - 196$$

$$LB - 2B - 2L + 4 = LB - 196$$

$$- 2B - 2L = - 196 - 4$$

$$- 2B - 2L = - 200 \dots(1)$$

Case 2-

If the length of the park is increased by 3 m and breadth is increased by 2 m, then its area is increased by 246 square meter.

Therefore, the area will be $= (L \times B) + 246$

$$(L + 3)(B + 2) = L \times B + 246$$

$$LB + 3B + 2L + 6 = LB + 246$$

$$3B + 2L = 246 - 6$$

$$3B + 2L = 240 \dots(2)$$

Adding equation (1) and (2), we get, $B = 40$

Substituting the value $B = 40$ in equation (2), we get

$$3B + 2L = 240$$

$$3 \times 40 + 2L = 240$$

$$120 + 2L = 240$$

$$2L = 240 - 120$$

$$2L = 120$$

$$L = 60$$

So, the length and breadth of the park is 60 m and 40 m respectively.

OR

It is given that

$$\angle A = x^\circ \dots(i)$$

$$\angle B = (3x - 2)^\circ \dots(ii)$$

$$\angle C = y^\circ \dots(iii)$$

$$\text{And, } \angle C - \angle B = 9^\circ \dots(iv)$$

Putting $\angle C = y^\circ$ and $\angle B = (3x - 2)^\circ$ in equation (iv), we get

$$y - (3x - 2) = 9$$

$$\Rightarrow y - 3x + 2 = 9$$

$$\Rightarrow y - 3x = 9 - 2$$

$$\Rightarrow -3x + y = 7 \dots(v)$$

We know that, the sum of angles of a triangle is 180° .

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

$$\Rightarrow x + 3x - 2 + y = 180$$

$$\Rightarrow 4x + y = 180 + 2$$

$$\Rightarrow 4x + y = 182 \dots(vi)$$

Subtracting equation (v) from equation (vi), we get

$$4x + 3x = 182 - 7$$

$$\Rightarrow 7x = 175$$

$$\Rightarrow x = \frac{175}{7} = 25$$

putting $x = 25$ in equation (v), we get

$$-3 \times 25 + y = 7$$

$$\Rightarrow -75 + y = 7$$

$$\Rightarrow y = 7 + 75$$

$$\Rightarrow y = 82$$

$$\therefore \angle A = x^\circ = 25^\circ$$

$$\angle B = (3x - 2)^\circ = (3 \times 25 - 2)^\circ = (75 - 2) = 73^\circ$$

$$\text{And, } \angle C = y^\circ = 82^\circ$$

38. We have,

Radius of the well = $\frac{7}{2}$, Depth of the well = 10 m

$$\therefore \text{Volume of the earth dug} = \pi \left(\frac{7}{2}\right)^2 \times 10\text{m}^3 = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 10\text{m}^3 = 358\text{m}^3$$

Also, we have

Length of the field = 20 m, Breadth of the field = 14 m

$$\therefore \text{Area of the field} = 20 \times 14\text{m}^2 = 280\text{m}^2$$

$$\text{Area of the base of the well} = \pi \times \left(\frac{7}{2}\right)^2 \text{m}^2 = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \text{m}^2 = \frac{77}{2} \text{m}^2$$

\therefore Area of the remaining part of the field = Area of the field - Area of the base of the field

$$= \left(280 - \frac{77}{2}\right) \text{m}^2 = \left(\frac{560-77}{2}\right) \text{m}^2 = \frac{483}{2} \text{m}^2$$

Let the rise in the level of the field be h metres.

$$\therefore \text{Volume of the raised field} = \text{Area of the base} \times \text{Height} = \left(\frac{483}{2} \times h\right) \text{m}^3$$

But, Volume of the raised field = Volume of the earth dugout

$$\therefore \frac{483}{2} \times h = 385$$

$$\Rightarrow h = \frac{2 \times 385}{483} = \frac{770}{483} = 1.594\text{m}$$

Hence, rise in the level of the field = 1.594 m.

OR

According to the question, the well of diameter 4 metre is dug 14 metre deep.

We are given that, Depth of well = 14 m, radius = 2 m.

$$\text{Volume of earth taken out} = \pi r^2 h$$

$$= \frac{22}{7} \times 2 \times 2 \times 14$$

$$= 176\text{m}^3$$

Let r be the width of embankment, then

the radius of outer circle of embankment = 2 + r

$$\text{Area of upper surface of embankment} = \pi [(2 + r)^2 - (2)^2]$$

Volume of embankment = Volume of earth taken out

$$\text{or, } \pi [(2 + r)^2 - (2)^2] \times 0.4 = 176$$

$$\text{or, } \pi [4 + r^2 + 4r - 4] \times 0.4 = 176$$

$$\text{or, } r^2 + 4r = \frac{176 \times 7}{0.4 \times 22}$$

$$\text{or, } r^2 + 4r = 140$$

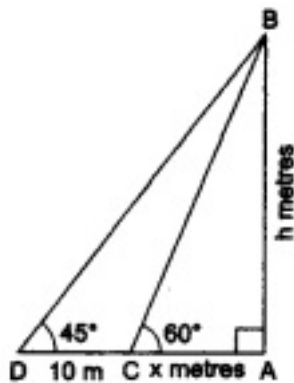
$$\text{or, } r^2 + 4r - 140 = 0$$

$$\text{or, } (r + 14)(r - 10) = 0$$

$$\text{or, } r = 10 \text{ m [as radius can't be negative]}$$

Hence width of embankment = 10 m.

39. Let us suppose that AB is the tower and suppose AC and AD be its shadows when the angles of elevation of the sun are 60° and 45° respectively.



$$\therefore \angle ACB = 60^\circ, \angle ADB = 45^\circ (\text{given})$$

$$\angle DAB = 90^\circ \text{ and also it is given that } CD = 10\text{m}$$

Let us suppose that $AB = h$ metres and $AC = x$ metres.

Now, from right $\triangle CAB$, we have

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

$$\Rightarrow \frac{x}{h} = \frac{1}{\sqrt{3}} \Rightarrow x = \frac{h}{\sqrt{3}} \dots\dots\dots(i)$$

Again from right $\triangle DAB$, we have

$$\frac{AD}{AB} = \cot 45^\circ = 1 \Rightarrow \frac{x+10}{h} = 1$$

$$\Rightarrow x + 10 = h \Rightarrow x = h - 10 \dots\dots\dots(ii)$$

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

$$\frac{h}{\sqrt{3}} = h - 10 \Rightarrow h = \sqrt{3}h - 10\sqrt{3} \Rightarrow (\sqrt{3} - 1)h = 10\sqrt{3}$$

$$\Rightarrow h = \frac{10\sqrt{3}}{(\sqrt{3}-1)} = \left\{ \frac{10\sqrt{3}}{(\sqrt{3}-1)} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)} \right\}$$

$$= 5\sqrt{3}(\sqrt{3} + 1) = 15 + 5\sqrt{3}$$

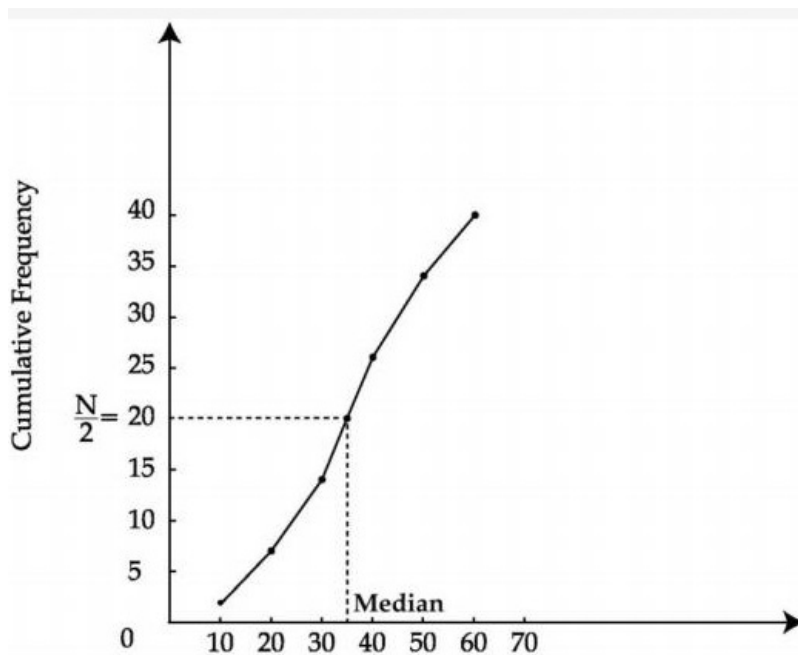
$$\Rightarrow h = (15 + 5 \times 1.732) = (15 + 8.66) = 23.66.$$

Hence, the height of the tower is 23.66m.

40.

Upper class limit	c.f
Less than 10	2
Less than 20	7
Less than 30	14
Less than 40	26
Less than 50	34
Less than 60	40

Plot the points (10, 2), (20, 7), (30, 14), (40, 26), (50, 34), (60, 40) to obtain the required ogive.



$$N = 40$$

$$\frac{N}{2} = 20$$

So, mark the point whose ordinate is 20, its x-coordinate is 32.

\therefore Median = 32