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.

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 + 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 ________.

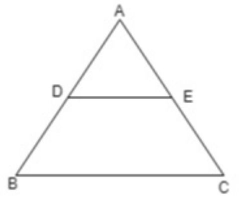
OR

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 = 4.8cm, then the value of AE is ________.



14. Fill in the blanks:

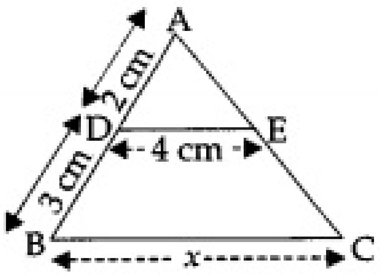
    The sum of the AP, 1 + 2 + 3 + 4 + 5 + 6 + ---- 10 is ________.

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 || BC, then find x.

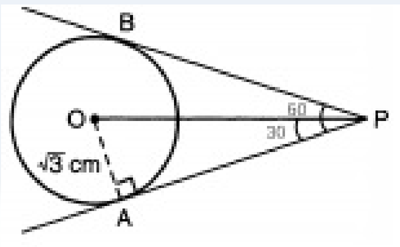


18. For the following APs, write the first term and the common difference : 3, 1, –1, –3, ...

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.

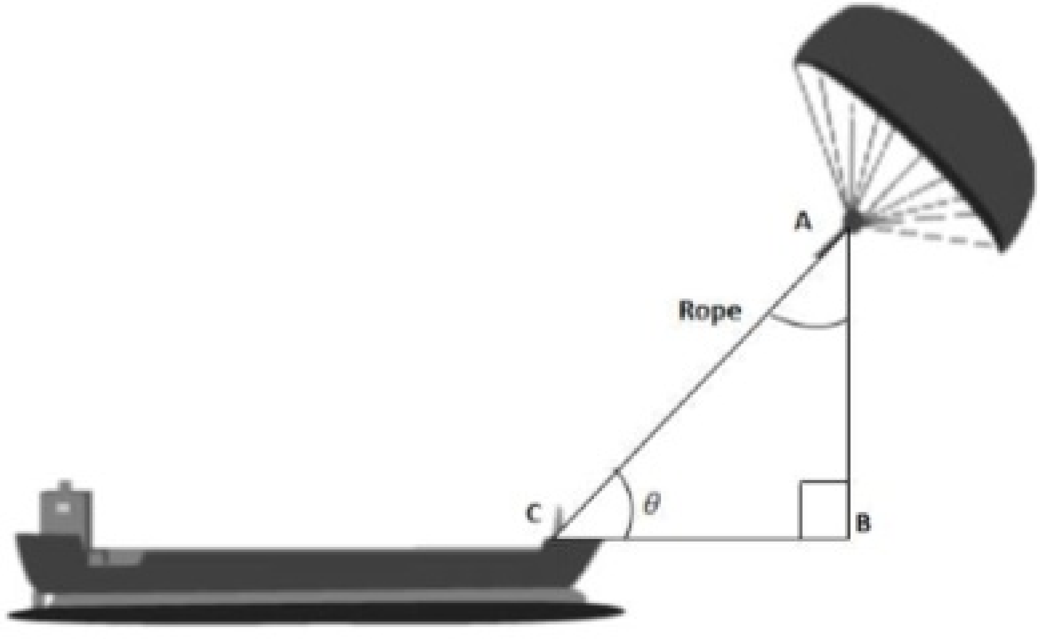
22. Find the roots of the equation, if they exist, by applying the quadratic formula:
$2\sqrt{3}x^2 - 5x + \sqrt{3} = 0$

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 ΔABC 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:



i. In the given figure, if sin θ = cos(θ - 30°), where θ and θ - 30° are acute angles, then find the value of θ.
ii. 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?

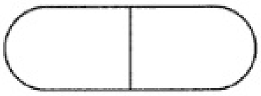
25. The length of a tangent from a point A at distance 5 cm from the centre of the circle is 4 cm. Find the radius of the circle.

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 LCM $\times$ HCF = 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.

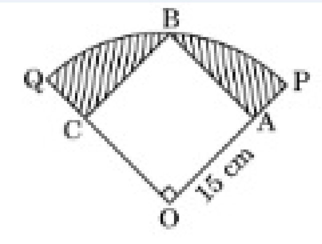
32. If 1 + $\sin^2\theta$ = 3$\sin\theta$ $\cos\theta$, then prove that $\tan\theta$ = 1 or $\frac{1}{2}$.

OR

Evaluate without using trigonometric tables :

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

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 π = 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 ΔABC, if $AD \perp BC$ and $AD^2 = BD \times DC$, prove that $\angle$BAC = 90°.

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 $\Delta ABC, \angle A = x^\circ, \angle B = (3x-2)^\circ, \angle C = y^\circ$. 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

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-primer 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.

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

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

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

   $\because \frac{p}{aq}$ 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:

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

4. (a) 210 sq.cm

   Explanation:

   Let base of the right triangle be x cm.

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

   Now, using Pythagoras theorem,

   $(29)^2=x^2+(41-x)^2$

   $\Rightarrow 841=1681+x^2-82x+x^2$

   $\Rightarrow 2x^2-82x+840=0$

   $\Rightarrow x^2-41x+420=0$

   $\Rightarrow x^2-20x-21x+420=0$

   $\Rightarrow x(x-20)-21(x-20)=0$

   $\Rightarrow (x-20)(x-21)=0$

   $\Rightarrow x-20=0$ and $x-21=0$

   $\Rightarrow x=20$ and $x=21$

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

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

5. (c) 1

   Explanation:

   Given: $\tan 15^\circ \tan 20^\circ \tan 70^\circ \tan 75^\circ$

   = $\tan 15^\circ \tan 20^\circ \tan(90^\circ-20^\circ)\tan(90^\circ-15^\circ)$

   = $\tan 15^\circ \tan 20^\circ \cot 20^\circ \cot 15^\circ$

   = $(\tan 15^\circ \cot 15^\circ)(\tan 20^\circ \cot 20^\circ)$

= 1 $\times$ 1 = 1

6. (c) cos A sec A = 1

   Explanation:

   $cosAsecA$

   =$cosA \times \frac{1}{cosA}$

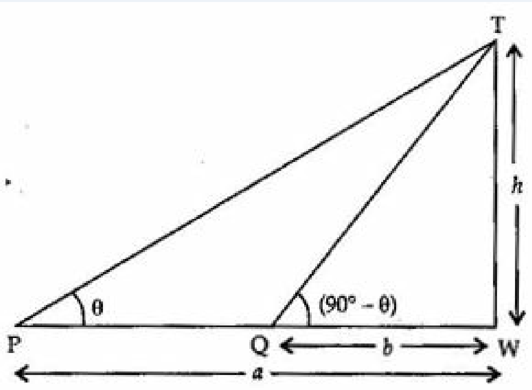
   = 1 $\times$1 = 1

   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 $\angle \mathrm{WPT} = \theta$
And $\angle \mathrm{WQT} = 90^\circ - \theta$
Now, in right angled triangle TWP,
$\tan\theta = \frac{\mathrm{TW}}{\mathrm{PW}}$
$\Rightarrow \tan\theta = \frac{h}{a}$
$\Rightarrow h = a\tan\theta$ ....(i)
Again in right angled triangle TWQ,
$\tan(90^\circ - \theta) = \frac{h}{b}$
$\Rightarrow \cot\theta = \frac{h}{b}$
$\Rightarrow h = b\cot\theta$ ....(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.

   $\therefore PC^2 = (2-5)^2 + (4-8)^2$

   = $\sqrt{9+16}$ = $\sqrt{25}$ = 5 units

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

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

11. 6 : π

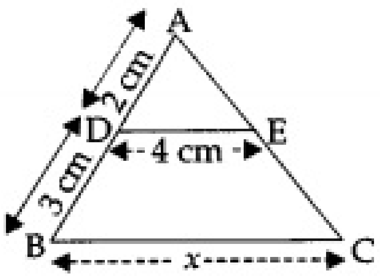
12. $\frac{-3}{5}$ OR -3

13. 1.8cm

14. 55

15. Base $\times$ Altitude

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

17. 

Given: DE || BC

To find: x

We know that,

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

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

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

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

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

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

$\Rightarrow \frac{5\times4}{2} = x$

$\Rightarrow$ x = 10 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, 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.

19. $\tan 30^0 = \frac{OA}{AP}$
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{AP}$
$\Rightarrow AP = 3$
$\therefore AP = BP = 3cm$

20. $4x^2 \ + \ px \ + \ 3 \ = \ 0$
$a = 4, b = p$ and $c = 3$
As the equation has equal roots

$\therefore D = 0$

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

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

or, $p^2 - 48 = 0$

or, $p^2 = 48$

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

Section B

21. Total possible outcomes = 9
$|x| < 3$ for x = -2, -1, 0, 1 and 2

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

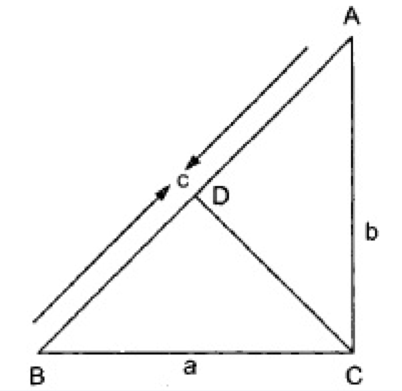
22. The given equation is $2\sqrt{3}x^2 - 5x + \sqrt{3} = 0$
Comparing it with $ax^2 + bx + c = 0$, we get
a = $2\sqrt{3}$, b = -5, and c = $\sqrt{3}$
$\therefore$ D = b^2 - 4ac = $(-5)^2$ - 4$(2\sqrt{3})(\sqrt{3}) = 25 - 24 = 1 > 0$
So, the given equation has real roots, given by
$\alpha = \frac{-b+\sqrt{D}}{2a} = \frac{-(-5)+\sqrt{1}}{2\times2\sqrt{3}} = \frac{5+1}{4\sqrt{3}} = \frac{6}{4\sqrt{3}} = \frac{3}{2\sqrt{3}} = \frac{\sqrt{3}}{2}$
$\beta = \frac{-b-\sqrt{D}}{2a} = \frac{-(-5)-\sqrt{1}}{2\times2\sqrt{3}} = \frac{5-1}{4\sqrt{3}} = \frac{4}{4\sqrt{3}} = \frac{1}{\sqrt{3}}$

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

23. Given: 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.



$\therefore$ Area of $\Delta ABC = \frac{1}{2}$(Base × height)

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

Also,

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

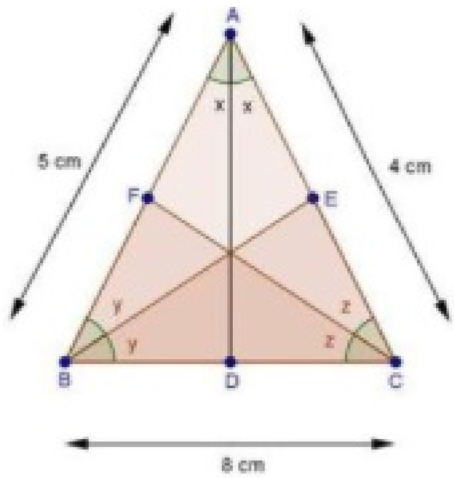
$\therefore \frac{1}{2}cp = \frac{1}{2}ab$

$\Rightarrow$ cp = ab

OR

It is given that D, E and F are the points on sides BC, CA and AB respectively of ΔABC 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

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

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

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

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

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

$\Rightarrow$ 32 - 8CE = 5CE

$\Rightarrow$ 32 = 13CE

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

Similarly,

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

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

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

$\Rightarrow$ 48D = 40 - 58D

$\Rightarrow$ 98D = 40

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

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

$CE = \frac{32}{13}\text{cm}$
and $BD = \frac{40}{9}cm$

24. i. sin θ = cos(θ - 30^o)

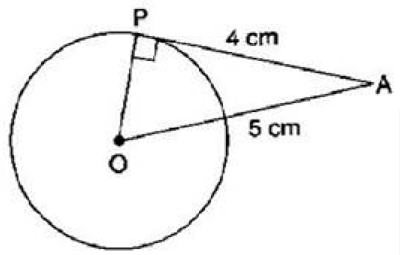
cos(90^o - θ) = cos(θ - 30^o)

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

$\Rightarrow \theta = 60^\circ$

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

$\therefore$ Length of rope, AC = $\frac{AB}{sin60^o}$ = $\frac{200}{\frac{\sqrt{3}}{2}}$ = $\frac{200\times2}{\sqrt{3}}$ = 230.94 m

25. 

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^o

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

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

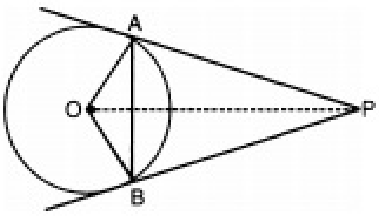
$\Rightarrow$ 25 = (OP)^2 + 16

$\Rightarrow$ OP^2 = 9

$\Rightarrow$ OP = 3 cm

OR

$\angle OPA = \frac{1}{2}\angle APB$
$= \frac{1}{2} \times 70^\circ = 35^\circ$
$\angle OAP = 90^\circ$ [radius $\perp$tangent]
$\therefore \quad \angle AOP = 180^\circ - (90^\circ + 35^\circ) = 55^\circ$
$\therefore \angle OAB = 90^\circ - 55^\circ = 35^\circ$
$\angle PAB = 90^\circ - 35^\circ$
$= 55^\circ$

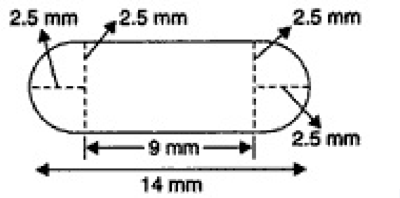


26. Let r = radius, h = cylindrical height

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

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

$h = 14 - 2 \times 2.5 = 9$ 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

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

$92 = 2 \times 2 \times 23$

HCF (510, 92) = 2

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

Product of two numbers 510 and 92 = 510×92 = 46920

HCF $\times$ LCM = 2 $\times$ 23460 = 46920

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

ii. 336 and 54

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

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

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

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

Product of two numbers 336 and 54 = 336×54 = 18144

HCF $\times$ LCM = 6 $\times$ 3024 = 18144

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

OR

Since, the three persons start walking together.

∴ 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)

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

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

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

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

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

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

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

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

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

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
$2x - 3v = 9$........(i)
$3x + 7v = 2$.......(ii)

Multiplying (i) by 7 and (ii) by 3, we get
14x - 21v = 63........(iii)
9x + 21v = 6..........(iv)

Adding (iii) and (iv),we get
$23x = 69 \Rightarrow x = \frac{69}{23} = 3$
Putting x = 3 in (i), we get
$2 \times 3 - 3v = 9$
$-3v = 9 - 6$
$\Rightarrow \quad -3v = 3$
$\Rightarrow \quad v = -1$
$\Rightarrow \frac{1}{y} = -1 \Rightarrow y = -1$
$\therefore$ Solution is $x = 3, y = -1$

OR

Let each chair cost Rs x and each table cost Rs y.
According to the first condition,
$5x + 4y = 5600$......(i)
According to the second condition,
$4x + 3y = 4340$.......(ii)
Multiplying (i) by 3 and (ii) by 4, we get
$15x + 12y = 16800$
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

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

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

$\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta}$

$= \frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}\left[\because (\alpha+\beta)^2 = \alpha^2+\beta^2+2\alpha\beta\right]$

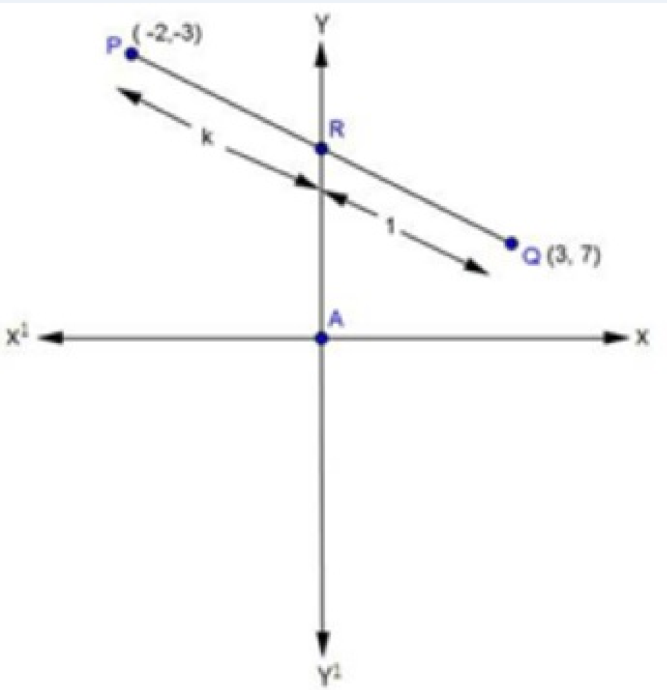
$= \frac{\left[-\frac{1}{6}\right]^2-2\left[-\frac{1}{3}\right]}{\left[-\frac{1}{3}\right]}$

$= \frac{\frac{1}{36}+\frac{2}{3}}{-\frac{1}{3}}$

$= \frac{\frac{1+24}{36}}{-\frac{1}{3}}$

$= \frac{25}{36} \times \frac{-3}{1}$

$= \frac{-25}{12}$

31. 

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

Then, the coordinates of the point of division are:

$R\left[\frac{3k+(-2)\times1}{k+1}, \frac{7k+(-3)\times1}{k+1}\right]$

$= R\left[\frac{3k-2}{k+1}, \frac{7k-3}{k+1}\right]$

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

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

$\Rightarrow$ 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, $2\sin\theta - \cos\theta = 0$

$\Rightarrow \sin\theta = \cos\theta$. or, $2\sin\theta = \cos\theta$

$\Rightarrow \tan\theta = 1$ or, $\tan\theta = \frac{1}{2}$. $[\because \frac{Sin\theta}{Cos\theta} = \tan\theta]$

Hence, proved.

OR

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

$$= \frac{\sec^2\theta-\tan^2\theta}{4\{\cos^2 48^\circ+\sin^2(90^\circ-42^\circ)\}} - \frac{2\times\left(\frac{1}{\sqrt{3}}\right)^2\cdot\sec^2 52^\circ\cdot\cos^2(90^\circ-38^\circ)}{\sec^2(90^\circ-70^\circ)-\tan^2 20^\circ}$$

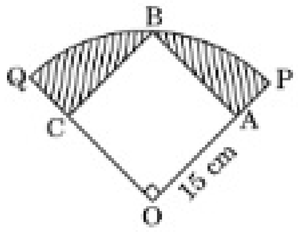
$$= \frac{1}{4(\cos^2 48^\circ+\sin^2 48)} - \frac{2\times\frac{1}{3}\times\frac{1}{\cos^2 52^\circ}\times\cos^2 52^\circ}{\sec^2 20^\circ-\tan^2 20^\circ}$$

$$= \frac{1}{4\times1} - \frac{\frac{2}{3}\times1}{1}$$

$$= \frac{1}{4} - \frac{2}{3}$$

$$= \frac{3-8}{12}$$

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

33. 

In the given figure, OB is the radius of quadrant OQBP and OB is diagonal of square OABC. If we join OB, we get right triangle BAO.
Also, given that OA= 15 cm, and OA= AB = BC = CO [∵ sides of square]

By Pythagoras theorem in triangle BAO, we get,
$OB^2 = AB^2 + OA^2$
OB = $\sqrt{15^2 + 15^2}$ = $15\sqrt{2}$ cm

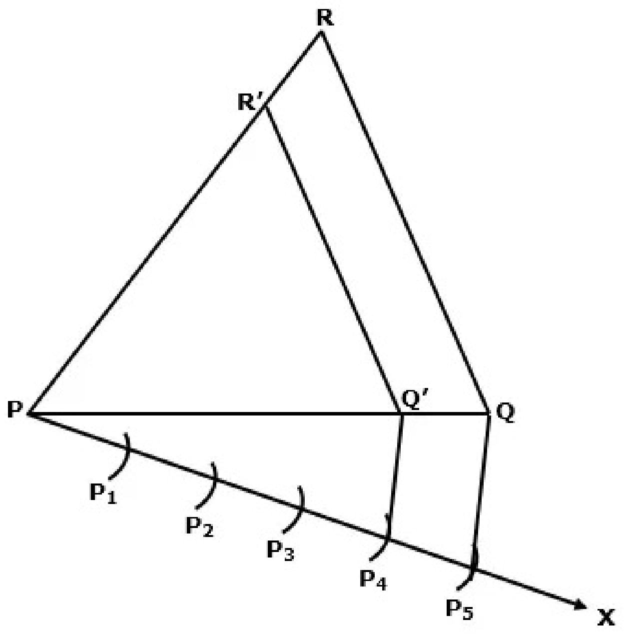
∴ Radius (r) of quadrant = OB = $15\sqrt{2}cm$ and side of square = 15 cm
∴ Shaded area = Area of quadrant - Area of square
= $\frac{1}{4} \times \pi r^2 - side \times side$
= $\frac{1}{4}(3.14)(15\sqrt{2})^2 - (15)^2$
= $\frac{1}{4} \times 3.14 \times 450 - 225$
= 353.25 - 225 = 128.25 cm^2

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.
$l = 165.5, h = 168.5 - 165.5 = 3, f = 142, f_1 = 118, f_2 = 127$
$= l + \frac{f - f_1}{2f - f_1 - f_2} \times h$
$= 165.5 + \frac{142 - 118}{2 \times 142 - 118 - 127} \times 3$
$= 165.5 + 1.85$
$= 167.35cm$

Section D

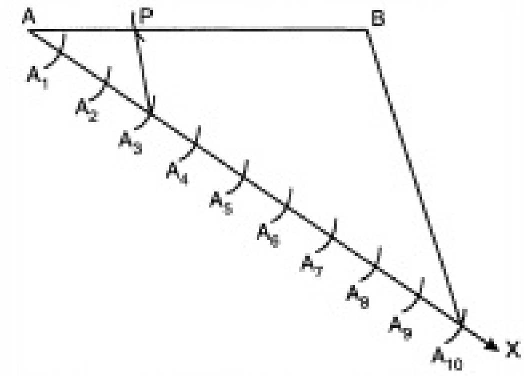
35. 

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



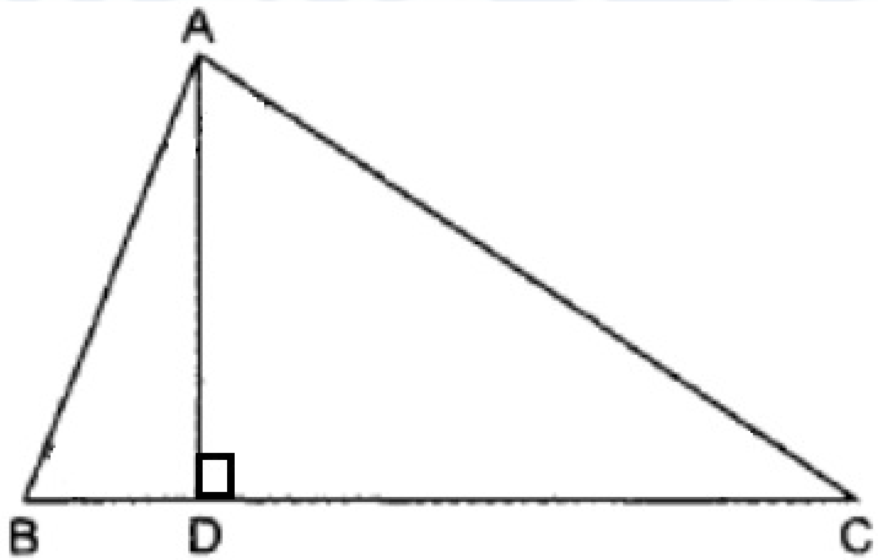
We have to draw a line segment of length 5 cm and divide it in the ratio 3 : 7.We write the steps of construction as follows:

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 poitns A_1 ,A_2 ,A_3 .... A_{10} on AX such that $AA_1 = A_1A_2 .... = A_9A_{10}$.
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 ΔABC , $AD \perp BC$ and $AD^2 = BD \times DC$

To prove : ∠BAC = 90°

Proof: In right triangles, ΔADB and ΔADC,

Applying Pythagoras theorem we have,

$AB^2 = AD^2 + BD^2$..............(i)

$AC^2 = AD^2 + DC^2$.............(ii)

Adding eq. (i) and (ii),

$AB^2 + AC^2 = 2AD^2 + BD^2 + DC^2$

$= 2BD \cdot CD + BD^2 + CD^2$ [$\because$ given $AD^2 = BD.CD$]

$= (BD + CD)^2 = BC^2$

Thus in ΔABC 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, $\angle BAC = 90°$

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 = $(L \times B) - 196$

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

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

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

$-2B - 2L = -200$ ....(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 = $(L \times B) + 246$

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

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

$3B + 2L = 246 - 6$

$3B + 2L = 240$ ....(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

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

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

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

And, $\angle C - \angle B = 9^\circ$ ....(iv)

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

y - (3x - 2) = 9

⇒ y - 3x + 2 = 9

⇒ y - 3x = 9 - 2

⇒ -3x + y = 7 ...(v)

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

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

⇒ x + 3x - 2 + y = 180

⇒ 4x + y = 180 + 2

⇒ 4x + y = 182 ...(vi)

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

4x + 3x = 182 - 7

⇒ 7x = 175

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

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

-3 $\times$ 25 + y = 7

⇒ -75 + y = 7

⇒ y = 7 + 75

⇒ y = 82

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

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

And, $\angle C = y^\circ = 82^\circ$

38. We have,

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

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

Also, we have

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

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

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

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

$= \left(280 - \frac{77}{2}\right) m^2 = \left(\frac{560-77}{2}\right) m^2 = \frac{483}{2} m^3$

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

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

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

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

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

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.

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

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

$= 176 m^3$

Let r be the width of embankment,then

the radius of outer circle of embankment = 2 + r

Area of upper surface of embankment $= \pi \left[(2 + r)^2 - (2)^2\right]$

Volume of embankment = Volume of earth taken out or, $\pi\left[(2+r)^2-(2)^2\right]\times 0.4=176$

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

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

or, $r^2+4r=140$

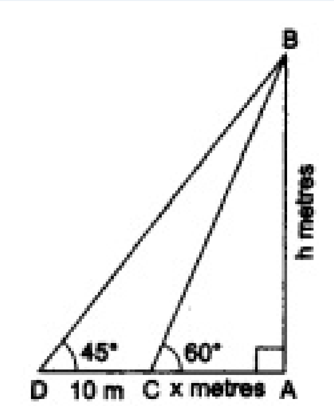
or, $r^2+4r-140=0$

or, $(r+14)(r-10)=0$

or, r = 10 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.



$\therefore \quad \angle ACB=60^\circ, \angle ADB=45^\circ$(given)

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

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

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

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

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

Again from right ΔDAB, we have

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

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

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

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

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

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

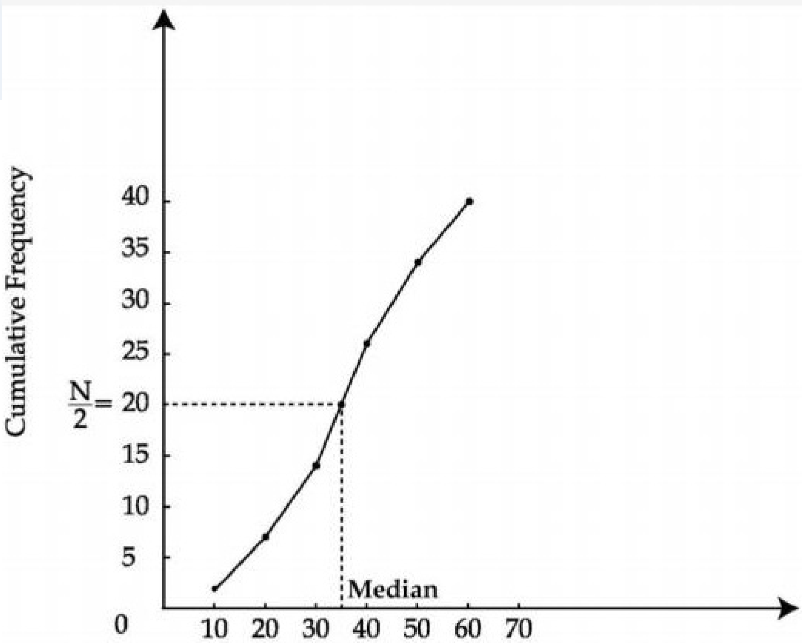
$\Rightarrow h = (15 + 5 \times 1.732) = (15 + 8.66) = 23.66.$

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 $= 32$