# Class X Session 2025-26
# Subject - Mathematics (Basic)
# Sample Question Paper - 06

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

**General Instructions:**

Read the following instructions carefully and follow them:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study-based questions carrying 4 marks each with sub-parts of the values of 1,1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Questions of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
9. Draw neat and clean figures wherever required.
10. Take $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

**Section A**

1. If the LCM of a and 18 is 36 and the HCF of a and 18 is 2, then a = **[1]**

a) 1 b) 3

c) 2 d) 4

2. The number $(\sqrt{3}+\sqrt{5})^2$ is **[1]**

a) an integer b) an irrational number

c) not a real number d) a rational number

3. The quadratic equation $ax^2 + 2x + a = 0$ has two distinct roots, if **[1]**

a) 0 = - 1, 0 b) a = 0

c) a = $\pm$ 1 d) a = 0, 1

4. The pair of equations ax + 2y = 9 and 3x + by = 18 represent parallel lines, where a, b are integers, if: **[1]**

a) a = b

b) 3a = 2b

c) 2a = 3b

d) ab = 6

5. The positive value of k for which the equation $x^2 + kx + 64 = 0$ and $x^2 - 8x + k = 0$ will both have real roots, is **[1]**

a) 16

b) 8

c) 4

d) 12

6. The perimeter of the triangle formed by the points (0, 0), (1, 0) and (0, 1) is **[1]**

a) $\sqrt{2}+1$

b) 3

c) $1 \pm \sqrt{2}$

d) $2+\sqrt{2}$

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

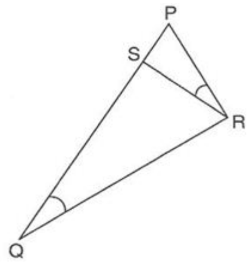
a) 22.5 cm

b) 25 cm

c) 30 cm

d) 27 cm

8. In the adjoining figure $\angle PQR = \angle PRS$. If PR = 8cm, PS = 4 cm, then PQ is equal to **[1]**



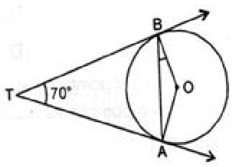

a) 32 cm.

b) 12 cm.

c) 16 cm.

d) 24 cm.

9. In the given figure, If TA and TC are two tangents to the circle with centre O, such that $\angle ATB = 70^o$, then $\angle OBA$ is equal to : **[1]**




a) 35°

b) 30°

c) 45°

d) 25°

10. If $\tan\theta = \frac{1}{\sqrt{7}}$ then $\frac{cosec^2\theta - \sec^2\theta}{cosec^2\theta + \sec^2\theta} =$ **[1]**

a) $\frac{1}{12}$

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

c) $\frac{3}{7}$

d) $\frac{5}{7}$

11. The tops of two poles of height 20 m and 14 m are connected by a wire. If the wire makes an angle of 30° with horizontal, then the length of the wire is **[1]**

a) 12 m

b) 8 m

c) 6 m

d) 10 m

12. If 3 cot $\theta$ = 4 then $\frac{(5\sin\theta + 3\cos\theta)}{(5\sin\theta - 3\cos\theta)} = ?$ **[1]**

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

b) $\frac{1}{9}$

c) 3

d) 9

13. The area of a sector whose perimeter is four times its radius r units, is **[1]**

a) $2r^2$ sq. units

b) $\frac{r^2}{2}$sq units

c) $r^2$ sq. units

d) $\frac{r^2}{4}$sq units

14. Find the area of a sector of a circle of radius 28 cm and central angle $45^o$. **[1]**

a) 318 $cm^2$

b) 308 $cm^2$

c) 208 $cm^2$

d) 305 $cm^2$

15. Two dice are rolled together. The probability that the sum of the numbers that appeared is 9, is: **[1]**

a) $\frac{1}{9}$

b) $\frac{4}{9}$

c) $\frac{2}{9}$

d) $\frac{5}{9}$

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

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

The median of the above distribution is

a) 56.5

b) 57.5

c) 58.5

d) 59

17. A solid spherical ball fits exactly inside the cubical box of side 2a. The volume of the ball is **[1]**

a) $\frac{32}{3}\pi a^3$

b) $\frac{16}{3}\pi a^3$

c) $\frac{1}{6}\pi a^3$

d) $\frac{4}{3}\pi a^3$

18. In a data, if l = 40, h = 15, $f_1 = 7$, $f_0 = 3$, $f_2 = 6$, then the mode is **[1]**

a) 52

b) 82

c) 62

d) 72

19. **Assertion (A):** Mid-point of a line segment divides the line segment in the ratio 1 : 1. **[1]**

**Reason (R):** The ratio in which the point (-3, k) divides the line segment joining the points (-5, 4) and (-2, 3) is 1 : 2.

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):** $\sqrt{a}$ is an irrational number, where a is a prime number. **[1]**

**Reason (R):** Square root of any prime number is an irrational number.

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.

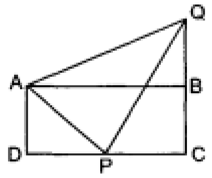
c) A is true but R is false.

d) A is false but R is true.

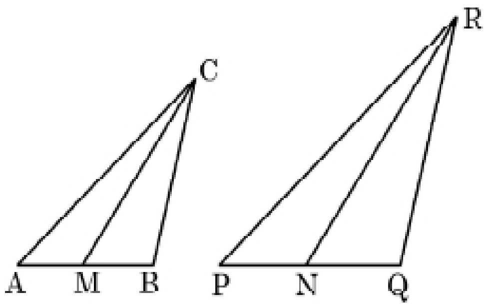
**Section B**

21. 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 coincident: $5x - 4y - 8 = 0$; $7x + 6y - 9 = 0$. **[2]**

22. In the given figure, ABCD is a rectangle. P is mid-point of DC. If QB = 7 cm, AD = 9 cm and DC = 24 cm, then prove that $\angle APQ = 90°$. **[2]**




OR




In the given figure, CM and RN are respectively the medians of $\triangle ABC$ and $\triangle PQR$. If $\triangle ABC \sim \triangle PQR$, then prove that $\triangle AMC \sim \triangle PNR$.

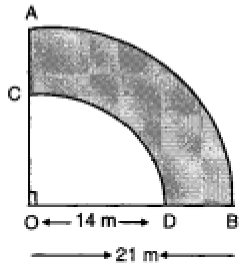
23. Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle is bisected at the point of contact. **[2]**

24. Prove that: $\frac{\tan A}{1-\cot A} + \frac{\cot A}{1-\tan A} = 1 + \sec A \operatorname{cosec} A$ **[2]**

25. Find the area of a sector of a circle with radius 6 cm, if the angle of the sector is $60^{o}$. **[2]**

OR

ABCD is a flower bed. If OA =21 m and OC = 14 m, find the area of the bed.




**Section C**

26. Prove that $7\sqrt{5}$ is irrational. **[3]**

27. Find the zeros of $f(x) = x^2 - 2x - 8$ and verify the relationship between the zeros and its coefficients. **[3]**

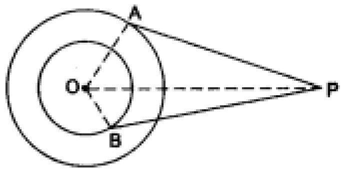
28. The difference between the two numbers is 26 and one number is three times the other. Find them by substitution method. **[3]**

OR

If x + 1 is a factor of $2x^3 + ax^2 + 2bx + 1$, then find the values of a and b given that 2a -3b = 4.

29. In the given figure, O is the centre of two concentric circles of radii 4 cm and 6 cm respectively. PA and PB are tangents to the outer and inner circle respectively. If PA = 10 cm, find the length of PB up to one place of **[3]**

decimal.

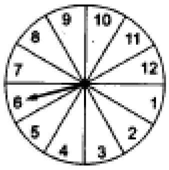



30. Prove that $\frac{\sin\theta-\cos\theta+1}{\sin\theta+\cos\theta-1}=\frac{1}{\sec\theta-\tan\theta}$, using identity $sec^2\theta=1+tan^2\theta$. **[3]**

OR

If tan A = n tanB and sin A = m sinB, then prove that $\cos^2$ A = $\frac{m^2-1}{n^2-1}$

31. A game of chance consists of spinning an arrow which is equally likely to come to rest pointing to one of the numbers 1,2,3,..., 12 as shown in the figure. What is the probability that it will point to **[3]**




i. 6

ii. an even number?

iii. a prime number?

iv. a number which is a multiple of 5?

**Section D**

32. If x = - 2 is a root of the equation $3x^2+7x+p=0$, find the value of k so that the roots of the equation $x^2+k(4x+k-1)+p=0$ are equal. **[5]**

OR

The hypotenuse (in cm) of a right angled triangle is 6 cm more than twice the length of the shortest side. If the length of third side is 6 cm less than thrice the length of shortest side, then find the dimensions of the triangle.

33. If a line is drawn parallel to one side of a triangle to intersect the other two sides at distinct points, then prove that the other two sides are divided in the same ratio. **[5]**

34. A vessel is in the form of a hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14 cm and the total height of the vessel is 13 cm. Find the inner surface area of the vessel. Also, find the volume of the vessel. **[5]**

OR

A cylindrical tub of radius 12 cm contains water to a depth of 20 cm. A spherical ball is dropped into the tub and the level of the water is raised by 6.75 cm. Find the radius of the ball.

35. Find the mean marks of students for the following distribution: **[5]**

| **Marks** | **Number of students** |
|---|---|
| 0 and above | 80 |
| 10 and above | 77 |
| 20 and above | 72 |
| 30 and above | 65 |
| 40 and above | 55 |
| 50 and above | 43 |

| | |
|---|---|
| 60 and above | 28 |
| 70 and above | 16 |
| 80 and above | 10 |
| 90 and above | 8 |
| 100 and above | 0 |

**Section E**

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

In a potato race, a bucket is placed at the starting point, which is 5 m from the first potato, and the other potatoes are placed 3 m apart in a straight line. There are ten potatoes in the line. A competitor starts from the bucket, picks up the nearest potato, runs back with it, drops it in the bucket, runs back to pick up the next potato, runs to the bucket to drop it in, and she continues in the same way until all the potatoes are in the bucket. What is the total distance the competitor has to run?

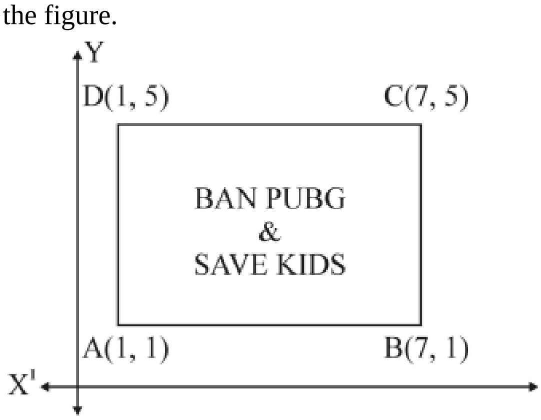
i. Find the terms of AP formed in above situation. (1)
ii. What is the total distance the competitor has to run? (1)
iii. Find distance cover after 4 potato drop in the bucket? (2)

**OR**

Find the distance covered by competitor in order to put $5^{th}$ potato in the bucket. (2)

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

Use of mobile screen for long hours makes your eye sight weak and give you headaches. Children who are addicted to play “PUBG’’ can get easily stressed out. To raise social awareness about ill effects of playing PUBG, a school decided to start ‘BAN PUBG’ campaign, in which students are asked to prepare campaign board in the shape of a rectangle. One such campaign board made by class X student of the school is shown in the figure.




i. Find the coordinates of the point of intersection of diagonals AC and BD. (1)
ii. Find the length of the diagonal AC. (1)
iii. Find the area of the campaign Board ABCD. (2)

**OR**

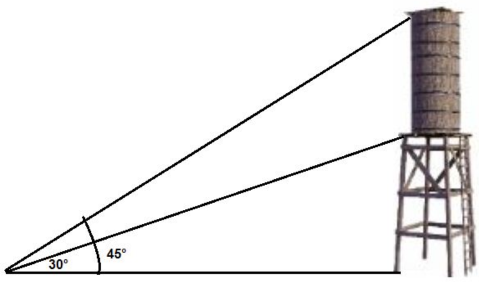
Find the ratio of the length of side AB to the length of the diagonal AC. (2)

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

In a society, there are many multistory buildings. The RWA of the society wants to install a tower and a water tank so that all the households can get water without using water pumps.

For this they have measured the height of the tallest building in the society and now they want to install a tower that will be taller than that so that the level of water must be higher than the tallest building in their society. Here is one solution they have found and now they want to check if it will work or not.

From a point on the ground 40 m away from the foot of a tower, the angle of elevation of the top of the tower is 300. the angle of elevation of the top of the water tank is $45^o$.




i. What is the height of the tower? (1)

ii. What is the height of the water tank? (1)

iii. At what distance from the bottom of the tower the angle of elevation of the top of the tower is $45^o$. (2)

**OR**

What will be the angle of elevation of the top of the water tank from the place at $\frac{40}{\sqrt{3}}$m from the bottom of the tower. (2)

# Solution

**Section A**

1.

**(d)** 4

**Explanation:**

LCM (a, 18) = 36

HCF (a, 18) = 2

We know that the product of numbers is equal to the product of their HCF and LCM.

Therefore,

18a = 2(36)

$a = \frac{2(36)}{18}$

a = 4

2.

**(b)** an irrational number

**Explanation:**

$\left(\sqrt{3}+\sqrt{5}\right)^2 = \left(\sqrt{3}\right)^2 + \left(\sqrt{5}\right)^2 + 2 \times \sqrt{3} \times \sqrt{5}$

$= 3 + 5 + 2\sqrt{15}$

$= 8 + 2\sqrt{15}$

Here, $\sqrt{15} = \sqrt{3} \times \sqrt{5}$

Since $\sqrt{3}$ and $\sqrt{5}$ both are an irrational number. Therefore, $\left(\sqrt{3}+\sqrt{5}\right)^2$ is an irrational number.

3.

**(c)** a = $\pm$ 1

**Explanation:**

In the equation $ax^2 + 2x + a = 0$

$D = b^2 - 4ac = (2)^2 - 4 \times a \times a = 4 - 4a^2$

Roots are real and equal

D = 0

$\Rightarrow 4 - 4a^2 = 0$

$\Rightarrow 4 = 4a^2$

$\Rightarrow 1 = a^2$

$\Rightarrow a^2 = 1$

$\Rightarrow a^2 = (\pm 1)^2$

$\Rightarrow a = \pm 1$

4.

**(d)** ab = 6

**Explanation:**

for Parallel lines,

$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\frac{a}{3} = \frac{2}{b} \neq \frac{-9}{-18}$

ab = 6

5. **(a)** 16

**Explanation:**

In the equation $x^2 + kx + 64 = 0$
a = 1, b = k, c = 64
$D = b^2 - 4ac = k^2 - 4 \times 1 \times 64$
$= k^2 - 256$
∵ The roots are real
$\therefore D \geq 0 \Rightarrow k^2 \geq (\pm 16)2$
$\Rightarrow k \geq 16$ .....(i)
Only positive value is taken.
**Now in second equation**
x2 - 8x + k = 0
D =(-8)2 - 4 × 1 × k = 64 - 4k
∵ Roots are real
$\therefore D \geq 0 \Rightarrow 64 - 4k \geq 0 \Rightarrow 64 \geq 4k$
$16 \geq k$ ........(ii)
From (i) and
$16 \geq k \geq 16 \Rightarrow k = 16$

6.

**(d)** $2 + \sqrt{2}$

**Explanation:**

Let the vertices of $\triangle ABC$ be A(0, 0), B(1, 0) and C(0, 1)
Now length of AB $= \sqrt{(1-0)^2 + (0-0)^2}$
$= \sqrt{(1)^2 + 0^2} = \sqrt{1^2} = 1$
Length of AC $= \sqrt{(0-0)^2 + (1-0)^2} = \sqrt{0^2 + (1)^2}$
$= \sqrt{1^2} = 1$
and length of BC $= \sqrt{(0-1)^2 + (1-0)^2}$
$= \sqrt{(1)^2 + (1)^2} = \sqrt{1+1} = \sqrt{2}$
Perimeter of $\triangle ABC$ = Sum of sides
$= 1 + 1 + \sqrt{2} = 2 + \sqrt{2}$

7.

**(c)** 30 cm

**Explanation:**

$\triangle DEF \sim \triangle ABC$
$\therefore \frac{DE}{AB} = \frac{EF}{BC} = \frac{DF}{AC} = \frac{DE+EF+DF}{AB+BC+AC}$
$\Rightarrow \frac{DE}{9} = \frac{8}{6} = \frac{DF}{7.5}$
$\frac{DE}{9} = \frac{8}{6} \Rightarrow DE = \frac{8 \times 9}{6} = 12cm$
$\frac{DF}{7.5} = \frac{8}{6} \Rightarrow DF = \frac{7.5 \times 8}{6} = 10cm$
Perimeter of $\triangle DEF$ = DE + EF + DF
= 12 + 8 + 10 = 30 cm

8.

**(c)** 16 cm.

**Explanation:**

In ΔPQR and ΔPRS,
∠PRS = ∠PQR [Given]
∠P = ∠P [Common]
∴ΔPQR∼ ΔPRS [AA similarity]
$\therefore \frac{PS}{PR} = \frac{PR}{PQ}$

$\Rightarrow \frac{4}{8} = \frac{8}{PQ}$

$\Rightarrow$ PQ = $\frac{8 \times 8}{4}$ = 16 cm

9. **(a)** 35°

**Explanation:**

Here, ∠AOB = 180° - 70° = 110°

Now, in triangle AOB∠AOB + ∠OAB + ∠OBA = 180°

⇒110° + ∠OAB + ∠OBA = 180° ⇒2∠OBA = 70°

[Angles opposite to radii] ⇒∠OBA = 35°

10.

**(b)** $\frac{3}{4}$

**Explanation:**

$\tan\theta = \frac{1}{\sqrt{7}} = \frac{\text{Perpendicular}}{\text{Base}}$

By Pythagoras Theorem,

$(\text{Hyp.})^2 = (\text{Base})^2 + (\text{Perp.})^2$

$= (1)^2 + (\sqrt{7})^2 = 1 + 7 = 8$

$\therefore$ Hyp. $= \sqrt{8} = 2\sqrt{2}$

Now, cosec $\theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{2\sqrt{2}}{1}$

$\sec\theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{2\sqrt{2}}{\sqrt{7}}$

Now, $\frac{cosec^2\theta - \sec^2\theta}{cosec^2\theta + \sec^2\theta} = \frac{\left(\frac{2\sqrt{2}}{1}\right)^2 - \left(\frac{2\sqrt{2}}{\sqrt{7}}\right)^2}{\left(\frac{2\sqrt{2}}{1}\right)^2 + \left(\frac{2\sqrt{2}}{\sqrt{7}}\right)^2}$

$= \frac{8 - \frac{8}{7}}{8 + \frac{8}{7}}$

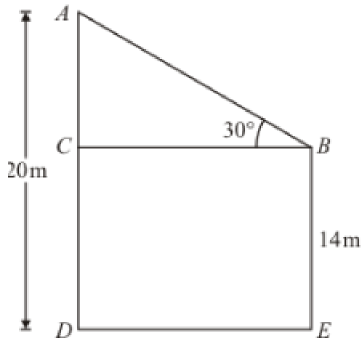
$= \frac{\frac{56-8}{7}}{\frac{56+8}{7}} = \frac{\frac{48}{7}}{\frac{64}{7}}$

$= \frac{48}{7} \times \frac{7}{64} = \frac{3}{4}$

11. **(a)** 12 m

**Explanation:**

Let h be the length of wire AB.




Given that wire makes an angle ∠B = $30^o$

Now, AC = (20-14) cm = 6 cm,

Here, we have to find length of wire.

So we use trigonometric ratios.

In a triangle ABC,

$\Rightarrow \sin B = \frac{AC}{AB}$

$\Rightarrow \sin 30^\circ = \frac{6}{h}$

$\Rightarrow \frac{1}{2} = \frac{6}{h}$

$\Rightarrow$ h = 12 m

12.

**(d)** 9

**Explanation:**

Given, $\cot\theta = \frac{4}{3}$

$\therefore \frac{(5\sin\theta+3\cos\theta)}{(5\sin\theta-3\cos\theta)} = \frac{5+3\cot\theta}{5-3\cot\theta}$ [dividing num. and denom. by sin $\theta$]

$= \frac{\left(5+3\times\frac{4}{3}\right)}{\left(5-3\times\frac{4}{3}\right)} = \frac{(5+4)}{(5-4)} = \frac{9}{1} = 9$

13.

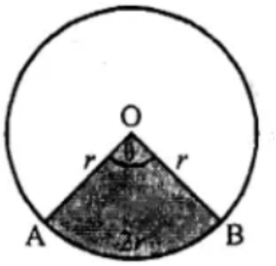
**(c)** $r^2$ sq. units

**Explanation:**

Radius of sector = r

Perimeter = 4r

and length of arc = 4r - 2r = 2r




$\therefore$ Let angle at the centre = $\theta$

Then, $2\pi r = \frac{\theta}{360^\circ}$ and $2r = \frac{\theta}{360^\circ}$

$\Rightarrow \pi \times \frac{\theta}{360^\circ}$ = 1 ...(i)

Now area = $\pi r^2 \times \frac{\theta}{360^\circ} = r^2\left(\pi \times \frac{\theta}{360^\circ}\right)$

= $r^2 \times 1$ [from (i)]

= $r^2$

14.

**(b)** 308 $cm^2$

**Explanation:**

We know that the area A of a sector of a circle of radius r and central angle $\theta$(in degrees) is given by

$A = \frac{\theta}{360} \times \pi r^2$

Here, r = 28 cm and $\theta$ = 45.

$\therefore A = \frac{45}{360} \times \pi \times (28)^2 = \frac{1}{8} \times \frac{22}{7} \times 28 \times 28\text{cm}^2$ = 308 $cm^2$

15. **(a)** $\frac{1}{9}$

**Explanation:**

Number of possible outcomes = {(3, 6), (5, 4), (4, 5), (6, 3)} = 4

Number of Total outcomes = 6 $\times$ 6 = 36

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

16.

**(b)** 57.5

**Explanation:**

| Class interval | Frequency | Cumulative frequency |
|---|---|---|
| 35-45 | 8 | 8 |
| 45-55 | 12 | 20 |
| 55-65 | 20 | 40 |

| | | |
|---|---|---|
| 65-75 | 10 | 50 |

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

The cumulative frequency just greater than 25 is 40.

Hence, median class is 55-65.

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

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

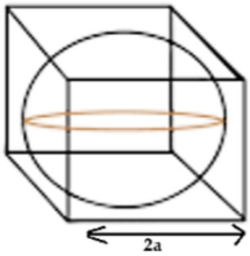
= 55 + 2.5

= 57.5

17.

**(d)** $\frac{4}{3}\pi a^3$

**Explanation:**




∵ Spherical ball is inside the cubical box.

∴ diameter = 2a.

radius = a

Volume of sphere = $\frac{4}{3}\pi r^3$

Volume of sphere = $\frac{4}{3}\pi r^3$ cubic units.

18. **(a)** 52

**Explanation:**

Mode = $l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$

= 40 + $\frac{7-3}{7\times2-3-6} \times 15$

= 40 + $\frac{4}{5} \times 15$

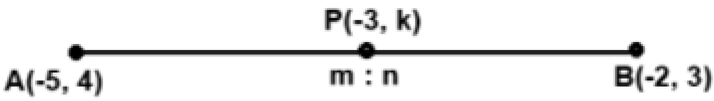
= 40 + 12

= 52

19.

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

**Explanation:**




Let the required ratio is m : n

coordinate of P

$P\left(\frac{-2m-5n}{m+n}, \frac{3m+4n}{m+n}\right)$

On comparing x coordinate

$\frac{-2m-5n}{m+n} = -3$

$-2m - 5n = -3m - 3n$

$-2m + 3m = -3n + 5n$

$m = 2n$

$\frac{m}{n} = \frac{2}{1}$

m : n = 2 : 1

Reason is false

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

**Explanation:**

As we know that square root of every prime number is an irrational number. So, both assertion and reason are correct and reason explains assertion.

**Section B**

21. 5 x - 4 y - 8 = 0

7 x + 6 y - 9 = 0

Here, $a_1$= 5, $b_1$ = -4, $c_1$= 8

$a_2$= 7, $b_2$= 6, $c_2$ = -9

We see that $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

Hence, the lines representing the given pair of linear equations intersect at the point and the equations are consistent having unique solution.

22. According to question it is given that ABCD is a rectangle and p is the midpoint of DC.

$\therefore$ AD = BC = 9 cm

QC = BQ + BC = 7 + 9 = 16 cm

PC = $\frac{1}{2}$CD $\Rightarrow$ PC = 12 cm

In right $\triangle$PCQ using Pythagoras theorem

$PQ^2 = QC^2 + PC^2$

$PQ^2 = 16^2 + 12^2 = 400 \Rightarrow PQ = 20$ cm

In right $\triangle$ABQ using Pythagoras theorem

$AQ^2 = AB^2 + BQ^2 \Rightarrow AQ^2 = 24^2 + 7^2 = 625$

$\Rightarrow$ AQ = 25 cm

In right $\triangle$ADP using Pythagoras theorem

$AP^2 = AD^2 + DP^2 \Rightarrow AP^2 = 9^2 + 12^2$

$\Rightarrow AP^2 = 81 + 144$

$\Rightarrow AP^2 = 255$

AP = 15 cm

In $\triangle$APQ,

$AP^2 = 15^2 = 225$

$PQ^2 = 20^2 = 400 \Rightarrow AP^2 + PQ^2 = 625$

Also, $AQ^2 = 25^2 = 625 \Rightarrow AQ^2 = AP^2 + PQ^2$

$\therefore \triangle$APQ is a right angled $\triangle$(using converse of BPT)

$\therefore \angle APQ = 90°$

OR

Given: $\triangle ABC \sim \triangle PQR$

and CM and RN are medians of $\triangle$ABC and $\triangle$PQR respectively.

To Prove: $\triangle AMC \sim \triangle PNR$

Proof: $\triangle ABC \sim \triangle PQR$ ...(Given)

$\therefore \angle A = \angle P$,

and $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$

$\frac{AB}{PQ} = \frac{AC}{PR}$

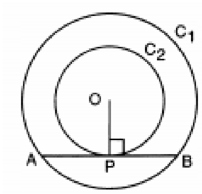
$\frac{2AM}{2PN} = \frac{AC}{PR}$

$\frac{AM}{PN} = \frac{AC}{PR}$

and $\angle A = \angle P$

$\therefore \triangle AMC \sim \triangle PQR$ ...(SAS Test)

Hence Proved.

23. 


In larger circle C1 , AB is the chord and OP is the tangent.

Therefore, $\angle OPB = 90^\circ$

Hence, AP = PB ( perpendicular from center of the circle to the chord bisects the chord)

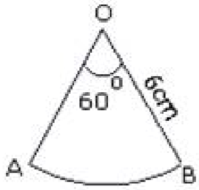
24. LHS $= \frac{\frac{\sin A}{\cos A}}{\frac{(\sin A - \cos A)}{\sin A}} + \frac{\frac{\cos A}{\sin A}}{\frac{(\cos A - \sin A)}{\cos A}}$

$= \frac{1}{(\sin A - \cos A)}\left[\frac{\sin^2 A}{\cos A} - \frac{\cos^2 A}{\sin A}\right]$

$= \frac{1}{(\sin A - \cos A)} \times \frac{(\sin A - \cos A)(\sin^2 A + \cos^2 A + \sin A \cos A)}{\sin A \cos A}$

$= \frac{1}{\sin A \cos A} + 1$

= 1 + sec A cosec A = RHS

25. 


We know that Area of sector $= \frac{\theta}{360}\pi r^2$

Here, $\theta = 60, r = 6$

$\therefore$ Required area $= \frac{60}{360} \times \frac{22}{7} \times (6)^2$

$= \frac{1}{6} \times \frac{22}{7} \times 36$

$= \frac{22 \times 6}{7}$

$= \frac{132}{7} = 18\frac{6}{7}cm^2$

OR

We have, OA = R = 21 m and OC = r = 14 m

$\therefore$Area of the flower bed = Area of a quadrant of a circle of radius R - Area of a quadrant of a circle of radius r

$= \frac{1}{4}\pi R^2 - \frac{1}{4}\pi r^2$

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

$= \frac{1}{4} \times \frac{22}{7}\left(21^2 - 14^2\right) \mathrm{cm}^2$

$= \left\{\frac{1}{4} \times \frac{22}{7} \times (21 + 14)(21 - 14)\right\} m^2$

$= \left\{\frac{1}{4} \times \frac{22}{7} \times 35 \times 7\right\} \mathrm{m}^2$

= 192.5 $m^2$

**Section C**

26. We can prove $7\sqrt{5}$ irrational by contradiction.

Let us suppose that $7\sqrt{5}$ is rational.

It means we have some co-prime integers *a* and *b* ($b \neq 0$)

such that

$7\sqrt{5} = \frac{a}{b}$

$\Rightarrow \sqrt{5} = \frac{a}{7b}$ .......(1)

R.H.S of (1) is rational but we know that $\sqrt{5}$ is irrational.

It is not possible which means our assumption is wrong.

Therefore, $7\sqrt{5}$ cannot be rational.

Hence, it is irrational.

27. f(x) = $x^2$ - 2x - 8

= $x^2$ - 4x + 2x - 8

= x(x - 4) + 2(x - 4)

= (x + 2) (x - 4)

f(x) = 0 if x+2 = 0 or x-4 = 0
x = -2 or 4
So the zeroes of the polynomials are -2 and 4.

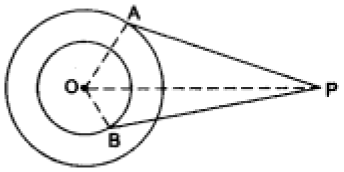
For the Polynomial $f(x)=x^2 - 2x - 8$
a=1,b=-2, c=-8
Sum of the zeroes = - 2 + 4 = 2 = $-\frac{b}{a}$
Product of zeros =(-2)(4) = -8 = $\frac{c}{a}$
Hence, the relationship between the zeros and coefficients is verified.

28. Let the two numbers be x and y (x > y) then, according to the question,
the pair of linear equations formed is:
x - y = 26.........(1)
x = 3y.............(2)
Substitute the value of x from equation (2) in equation (1), we get
3y - y = 26
$\Rightarrow \quad 2y = 26$
$\Rightarrow \quad y = \frac{26}{2}$
$\Rightarrow \quad y = 13$
Substituting this value of y in equation (2), we get
x = 3(13) = 39
Hence, the required numbers are 39 and 13.
verification: Substituting x = 39 and y = 13, we find that both
the equation (1) and (2) are satisfied as shown below:
x - y = 39 - 13 = 26
3y = 3(13) = 39 = x.
This verifies the solution.

OR

Since $(x+1)$ is a factor of $2x^3 + ax^2 + 2bx + 1$
$\Rightarrow x = -1$ is a zero of $2x^3 + ax^2 + 2bx + 1$
$\Rightarrow 2(-1)^3 + a(-1)^2 + 2b(-1) + 1 = 0$
$\Rightarrow a - 2b - 1 = 0$
$\Rightarrow$ a - 2b = 1 ...(i)
Given that $2a - 3b = 4$ ...(ii)
Multiplying equation (i) by 2, we get
$2a - 4b = 2$ ...(iii)
Subtracting equation (iii) from (ii), we get
b = 2
Substituting b = 2 in equation (i), we have
a - 2(2) = 1
$\Rightarrow$ a - 4 = 1
$\Rightarrow$ a = 5
Hence, a = 5 and b = 2.

29.




Given, O is the center of two concentric circles of radii OA = 6 cm and OB = 4 cm. PA and PB are the two tangents to the outer and inner circles respectively and PA = 10 cm.
Now, tangent drawn from an external point is perpendicular to the radius at the point of contact.
$\therefore \angle OAP = \angle OBP = 90^\circ$
$\therefore$ From right - angled $\Delta OAP, OP^2 = OA^2 + PA^2$
$\Rightarrow OP = \sqrt{OA^2 + PA^2}$

$\Rightarrow OP = \sqrt{6^2 + 10^2}$
$\Rightarrow OP = \sqrt{136}$cm
$\therefore$ From right - angled $\Delta OBP, OP^2 = OB^2 + PB^2$
$\Rightarrow PB = \sqrt{OP^2 - OB^2}$
$\Rightarrow PB = \sqrt{136 - 16}$
$\Rightarrow PB = \sqrt{120}$cm
$\Rightarrow PB = 10.9$cm
$\therefore$ The length of PB is 10.9 cm.

30. We have to prove that, $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{1}{\sec\theta - \tan\theta}$ using identity $sec^2\theta = 1 + tan^2\theta$

**LHS =** $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1} = \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$ [ dividing the numerator and denominator by $\cos\theta$.]

$= \frac{(\tan\theta + \sec\theta) - 1}{(\tan\theta - \sec\theta) + 1} = \frac{\{(\tan\theta + \sec\theta) - 1\}(tan\theta - \sec\theta)}{\{(\tan\theta - \sec\theta) + 1\}(\tan\theta - \sec\theta)}$ [ Multiplying and dividing by $(\tan\theta - \sec\theta)$]

$= \frac{(\tan^2\theta - \sec^2\theta) - (tan\theta - \sec\theta)}{\{(\tan\theta - \sec\theta) + 1\}(\tan\theta - \sec\theta)}$ $[\because (a - b)(a + b) = a^2 - b^2$ ]

$= \frac{-1 - \tan\theta + \sec\theta}{(\tan\theta - \sec\theta + 1)(\tan\theta - \sec\theta)}$ $[\because \tan^2\theta - \sec^2\theta = -1$ ]

$= \frac{-(\tan\theta - \sec\theta + 1)}{(\tan\theta - \sec\theta + 1)(\tan\theta - \sec\theta)} = \frac{-1}{\tan\theta - \sec\theta}$

$= \frac{1}{\sec\theta - \tan\theta}$ =**RHS**

**Hence Proved.**

OR

Given,
tan A = n tan B
$\Rightarrow$ tanB = $\frac{1}{n}$tan A
$\Rightarrow$ cotB = $\frac{n}{\tan A}$ ..........(1)
Also given,
sin A = m sin B
$\Rightarrow$ sin B = $\frac{1}{m}$sin A
$\Rightarrow$ cosec B = $\frac{m}{\sin A}$ .....(2)
We know that, $cosec^2B - cot^2B = 1$, hence from (1) & (2) :-

$\frac{m^2}{\sin^2 A} - \frac{n^2}{\tan^2 A} = 1$
$\Rightarrow \frac{m^2}{\sin^2 A} - \frac{n^2\cos^2 A}{\sin^2 A} = 1$
$\Rightarrow \frac{m^2 - n^2\cos^2 A}{\sin^2 A} = 1$
$\Rightarrow m^2 - n^2cos^2A = sin^2A$
$\Rightarrow m^2 - n^2cos^2A = 1 - cos^2A$
$\Rightarrow m^2 - 1 = n^2cos^2A - cos^2A$
$\Rightarrow m^2 - 1 = (n^2 - 1) cos^2A$
$\Rightarrow \frac{m^2 - 1}{n^2 - 1} = cos^2A$

31. The possible outcomes are 1, 2, 3, 4, 5 ……….. 12.
Number of all possible outcomes = 12
   i. Let $E_1$ be the event that the pointer rests on 6.
      Then, number of favorable outcomes = 1
      Probability = $\frac{Number\ of\ favourable\ outcome}{Total\ Number\ of\ outcomes}$
      Therefore, P(arrow pointing at 6) = $P(E_1) = \frac{1}{12}$
   ii. Out of the given numbers, the even numbers are
      2, 4, 6, 8, 10 and 12
      Let $E_2$ be the event of getting an even number.
      Then, number of favorable outcomes = 6

Probability = $\frac{Number\ of\ favourable\ outcome}{Total\ Number\ of\ outcomes}$

Therefore, P(arrow pointing at an even number) = $P(E_2) = \frac{6}{12} = \frac{1}{2}$

iii. Out of the given numbers, the prime numbers are 2, 3, 5, 7 and 11.

Let $E_3$ be the event of the arrow pointing at a prime number.

Then, number of favorable outcomes = 5

Probability = $\frac{Number\ of\ favourable\ outcome}{Total\ Number\ of\ outcomes}$

Therefore, P(arrow pointing at a prime number) = $P(E_3) = \frac{5}{12}$

iv. Out of the given numbers, the numbers that are multiple of 5 are 5 and 10 only.

Let $E_4$ be the event of the arrow pointing at a multiple of 5.

Then, number of favorable outcomes = 2

Probability = $\frac{Number\ of\ favourable\ outcome}{Total\ Number\ of\ outcomes}$

Therefore, P(arrow pointing at a number that is a multiple of 5) = $P(E_4) = \frac{2}{12} = \frac{1}{6}$

## Section D

32. Here x = - 2 is the root of the equation $3x^2 + 7x + p = 0$

then, $3(-2)^2 + 7(-2) + p = 0$

or, p=2

Roots of the equation $x^2 + 4kx + k^2 - k + 2 = 0$ are equal,then,

$16k^2 - 4\left(k^2 - k + 2\right) = 0$

or, $16k^2 - 4k^2 + 4k - 8 = 0$

or, $12k^2 + 4k - 8 = 0$

or, $3k^2 + k - 2 = 0$

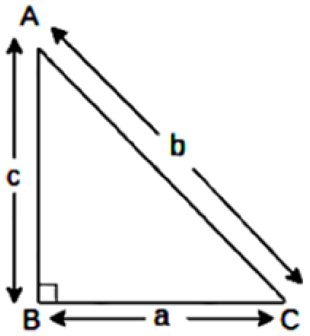
or, (3k-2)(k + 1) = 0

or, $k = \frac{2}{3}, -1$

Hence, roots = $\frac{2}{3}, -1$

OR

Let $\triangle$ABC be the right angle triangle, right angled at B, as shown in figure.




Also, let AB = c cm, BC = a cm and AC = b cm

Then, according to the given information, we have

b = 6 + 2a ...(i) (Let a be the shortest side)

and c = 3a - 6

We know that, $b^2 = c^2 + a^2$

$\Rightarrow (6 + 2a)^2 = (3a - 6)^2 + a^2$ ...[Using (i) and (ii)]

$\Rightarrow 36 + 4a^2 + 24a = 9a^2 + 36 - 36a + a^2$

$\Rightarrow 60a = 6a^2$

$\Rightarrow$ 6a=60 ...[$\because$ a cannot be zero]

$\Rightarrow$ a = 10 cm

Now, from equation (i),

b = 6 + 2 $\times$ 10 = 26

and from equation (ii),

c = 3 $\times$ 10 - 6 = 24

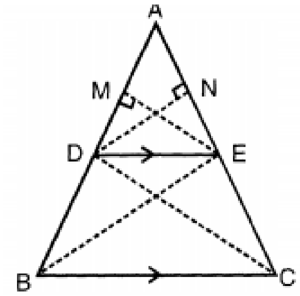
Thus, the dimensions of the triangle are 10 cm, 24 cm and 26 cm.

33. Given: ABC is a triangle in which DE || BC.

To prove: $\frac{AD}{BD} = \frac{AE}{CE}$

Construction: Draw DN ⊥ AE and EM ⊥ AD., Join BE and CD.

Proof :




In $\triangle ADE$,

Area of $\Delta ADE = \frac{1}{2} \times AE \times DN$ ...(i)

In $\Delta DEC$,

Area of $\Delta\, DCE = \frac{1}{2} \times CE \times DN$ ...(ii)

Dividing equation (l) by equation (ii),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEC)} = \frac{\frac{1}{2} \times AE \times DN}{\frac{1}{2} \times CE \times DN}$

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEC)} = \frac{AE}{CE}$ ...(iii)

Similarly, In $\Delta ADE$,

Area of $\Delta\, ADE = \frac{1}{2} \times AD \times EM$ ...(iv)

In $\Delta DEB$,

Area of $\Delta\, DEB = \frac{1}{2} \times EM \times BD$ ...(v)

Dividing equation (iv) by equation (v),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{\frac{1}{2} \times AD \times EM}{\frac{1}{2} \times BD \times EM}$

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{AD}{BD}$ ...(vi)

$\Delta DEB$ and $\Delta DEC$ lie on the same base DE and between two parallel lines DE and BC.

$\therefore$ Area ($\Delta DEB$) = Area ( $\Delta DEC$)

From equation (iii),

$\Rightarrow \frac{\text{area }(\Delta ADE)}{\text{area }(\Delta DEB)} = \frac{AE}{CE}$. ......(vii)

From equation (vi) and equation (vii),

$\frac{AE}{CE} = \frac{AD}{BD}$

$\therefore$ If a line is drawn parallel to one side of a triangle to intersect the other two sides in two points, then the other two sides are divided in the same ratio.

34. Radius of hemispherical bowl = radius of cylinder = 7 cm

Height of cylinder = 13 - 7 = 6 cm

Inner surface area of the vessel = $2\pi rh + 2\pi r^2$

$= 2\pi r(h + r) = 2 \times \frac{22}{7} \times 7(6 + 7)$

$= 44 \times 13 = 572\ cm^2$

Volume of the vessel = $\pi r^2 h + \frac{2}{3}\pi r^3$

$= \pi r^2 (h + \frac{2}{3} r)$

$= \frac{22}{7} \times 7 \times 7 (6 + \frac{14}{3})$

$= \frac{4928}{3} cm^3$ or $1642.67\ cm^3$

OR

According to question it is given that

Radius of cylindrical tub = 12 cm

Depth of cylindrical tub = 20 cm

Let us suppose that (r) be the radius of spherical ball

Again it is given that level of water is raised by 6.75 cm

Now, according to the question,

Volume of spherical ball = Volume of water rise in cylindrical tub

$\Rightarrow \frac{4}{3}\pi r^3 = \pi\ (12)^2 \times 6.75$

$\Rightarrow \frac{4}{3}r^2$ = 12 $\times$ 12 $\times$ 6. 75

$\Rightarrow$ $r^3$ = $\frac{12\times12\times6.75\times3}{4}$

$\Rightarrow$ $r^3$ = = 729

$\Rightarrow r = \sqrt[3]{729}$ = 9cm

Therefore, Radius of the ball = 9 cm

35. Calculation of mean:

| **Class** | $f_i$ | $x_i$ | $u_i = \frac{x_i - a}{h}$ | $f_i u_i$ |
|---|---|---|---|---|
| 0 - 10 | 3 | 5 | -5 | -15 |
| 10- 20 | 5 | 15 | -4 | -20 |
| 20 - 30 | 7 | 25 | -3 | -21 |
| 30 - 40 | 10 | 35 | -2 | -20 |
| 40 - 50 | 12 | 45 | -1 | -12 |
| 50 - 60 | 15 | 55 | 0 | 0 |
| 60 - 70 | 12 | 65 | 1 | 12 |
| 70 - 80 | 6 | 75 | 2 | 12 |
| 80 - 90 | 2 | 85 | 3 | 6 |
| 90 -100 | 8 | 95 | 4 | 32 |
| | $\Sigma f_i = 80$ | | | $\Sigma f_i u_i = -26$ |

$a = 55\ and\ h = 10$

We know that, Mean = $a + \left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) \times h$

$=55 + \left(\frac{-26}{80}\right) \times 10$

$= 55 - 3.25 = 51.75$

**Section E**

36. i. Distance travel by the competitor to pick up each potato form an AP

10, 16, 22 ...

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

$S_{10} = \frac{10}{2}$ {2 $\times$10 + 9 $\times$ 6}

$S_{10}$ = 5{20 + 54}

$S_{10}$ = 5 $\times$ 74

$S_{10}$ = 370 m

i.e., The competitor has to run 370 m.

iii. $S_4 = \frac{4}{2}$ {2 $\times$ 10 + (4 - 1)6}

= 2 {20 + 18}

= 2 $\times$ 38

$S_4$ = 76

$\therefore$ Required distance = 370 - 76

= 294

**OR**

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

$t_5$ = 10 + (5 - 1)6

$t_5 = 10 + 24$

$t_5 = 34$ m

37. i. Point of intersection of diagonals is their midpoint

So, $\left[\frac{(1+7)}{2}, \frac{(1+5)}{2}\right]$

= (4, 3)

ii. Length of diagonal AC

AC = $\sqrt{(7-1)(7-1)+(5-1)(5-1)}$

= $\sqrt{52}$ units

iii. Area of campaign board

= 6 $\times$ 4

= 24 units square

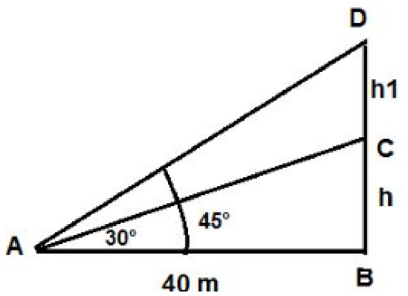
**OR**

Ratio of lengths = $\frac{AB}{AC}$

= $\frac{6}{\sqrt{52}}$

= 6 : $\sqrt{52}$

38. i.




Let BC be the tower of height h and CD be the water tank of height $h_1$

In $\Delta$ABD, we have

$\tan 45^\circ = \frac{BD}{AB}$

$\Rightarrow 1 = \frac{h+h_1}{40}$

$\Rightarrow h + h_1 = 40$ ...(1)

In $\Delta ABC$, we have

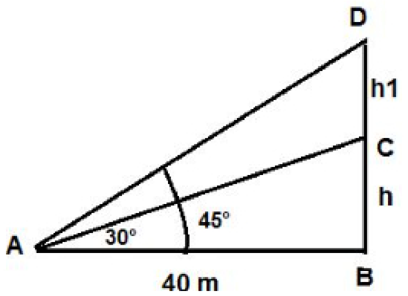
$\tan 30^\circ = \frac{BC}{AB}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{40}$

$\Rightarrow h = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3}$ = 23.1 m

Thus height of the tower is 23.1 m.

ii.




Let BC be the tower of height h and CD be the water tank of height $h_1$

In $\Delta$ABD, we have

$\tan 45^\circ = \frac{BD}{AB}$

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$\Rightarrow h + h_1 = 40$ ...(1)

In $\Delta ABC$, we have

$\tan 30^\circ = \frac{BC}{AB}$

$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{40}$

$\Rightarrow h = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3}$ = 23.1 m

Thus height of the tower is 23.1 m.

Substituting the value of h in (1), we have

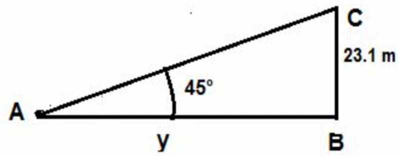
$23.1 + h_1 = 40$

$\Rightarrow h_1 = 40 - 23.1$

= 6.9 m

Thus height of the tank is 6.9 m.

iii.



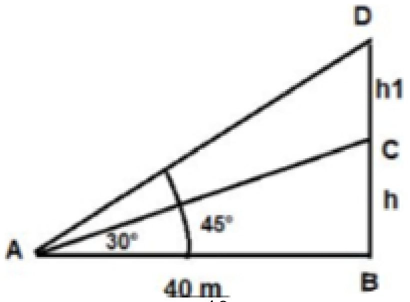

In the $\triangle ABC$ if $\angle CAB = 45^\circ$ then

$\cot 45^\circ = \frac{y}{23.1} = 1$

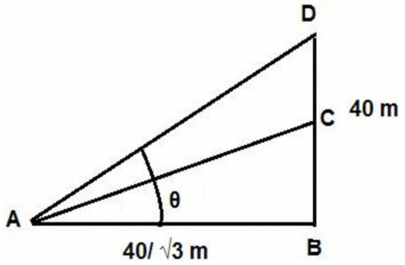
y = 23.1 m

Thus the angle of elevation will be $45^o$ at 23.1 m.

**OR**




Given that $AB = \frac{40}{\sqrt{3}}$




In the $\triangle ABD$

$\cot \theta = \frac{AB}{BD} = \frac{\frac{40}{\sqrt{3}}}{40}$

$\cot \theta = \frac{1}{\sqrt{3}}$

$\Rightarrow \theta = 60^\circ$

Hence the angle of elevation would be $60^o$.