Solution

PREBOARD EXAM- 2 2025-26 (MATHS BASIC)

Class 10 - Mathematics

Section A

1.
(b) 2
Explanation:
Smallest two digit number is 10 and smallest composite number is 4 .
Clearly, 2 is the greatest factor of 4 and 10, so their H.C.F. is 2.

2. **(a)** 1650
Explanation:
We know that
HCF $\times$ LCM = $N_1 \times N_2$
$40 \times 252\, K = 2520 \times 6600$
$K = \frac{2520 \times 6600}{40 \times 252}$
K = 1650

3.
(d) 2 km/hr
Explanation:
Let the speed of the stream be x km/hr
Speed of the boat upstream = (5 - x)km/hr
Speed of the boat downstream = (5 + x)km/hr
Time taken for going 5.25 km upstream = $\frac{5.25}{5-x}$,hours
Time taken for going 5.25 km downstream = $\frac{5.25}{5+x}$ hours
Obviously, time taken for going 5.25 km upstream is more than the time taken for going 5.25 km, downstream
It is given that the time taken for going 5.25 km, upstream is 1 hour more than the time taken for going 5.25 downstream
$\therefore \frac{5.25}{5-\mathrm{x}} - \frac{5.25}{5+\mathrm{x}}$ = 1
$\Rightarrow$ 5.25 $\left\{\frac{1}{5-x} - \frac{1}{5+x}\right\}$ = 1 $\Rightarrow \frac{21}{4}\left(\frac{5+x-5+x}{(5-x)(5+x)}\right)$ = 1
$\Rightarrow \frac{21}{4} \times \frac{2x}{25-x^2} = 1 \Rightarrow \frac{21}{2} \times \frac{x}{25-x^2} = 1$
$\Rightarrow$ $2x^2$ + 21x - 50 = 0
$\Rightarrow$ x(2x + 25) - 2(2x + 25) = 0 $\Rightarrow$ (2x + 25) (x - 2) = 0
$\Rightarrow$ x - 2 = 0, 2x + 25 = 0
$\Rightarrow$ x = 2 $\left[\because x = \frac{-25}{2}\right]$
$\therefore$ speed of the stream = 2km/hr

4. **(a)** y = 2x - 1
Explanation:
y = 2x - 1

5.
(c) $\left(\sqrt{2}x + \sqrt{3}\right)^2 + x^2 = 3x^2 - 5x$
Explanation:
In equation $\left(\sqrt{2}x + \sqrt{3}\right)^2 + x^2 = 3x^2 - 5x$
$\Rightarrow 2x^2 + 3 + 2\sqrt{6}x + x^2 = 3x^2 - 5x$
$\Rightarrow 3x^2 - 3x^2 + 5x + 2\sqrt{6}x + 3 = 0$
$\Rightarrow \left(5 + 2\sqrt{6}\right)x + 3 = 0$
It is not the quadratic equation because its degree is not 2.

6.

(d) None of these

Explanation:

Let the point be A(a, 0) be equidistant from the two given points P(-3, 4) and Q(2, 5) So applying distance formula, we get,

$AP^2 = AQ^2$

Therefore,

$(a + 3)^2 + (-4)^2 = (a - 2)^5 + 5^2$

10a = 4

$a = \frac{2}{5}$

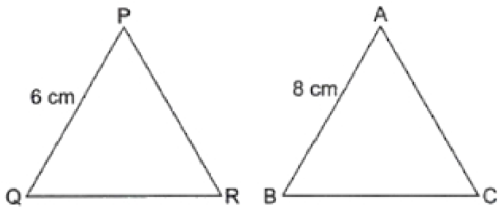
Hence the coordinates of A are $\left(\frac{2}{5}, 0\right)$

So the answer is none of these.

7.

(b) 27 cm

Explanation:



∵ Ratio of side = Ratio of perimeter

$\Rightarrow \frac{PQ}{AB} = \frac{\text{Perimeter of } \triangle PQR}{\text{Perimeter of } \triangle ABC}$

$\Rightarrow \frac{6}{8} = \frac{\text{Perimeter of } \Delta PQR}{36}$

$\Rightarrow \frac{3}{4} = \frac{\text{Perimeter of } \Delta PQR}{36}$

$\Rightarrow$ Perimeter of $\triangle$PQR = $\frac{36 \times 3}{4}$

= 9 $\times$ 3

= 27 cm

8.

(b) 4.5

Explanation:

$\angle$ADE = $\angle$ABC and $\angle$DAE = $\angle$BAC. Hence ΔADE $\sim$ ΔABC(AA similarity)

hence the corresponding sides are in proportion

$\frac{AD}{AB} = \frac{AE}{Ac}$

$\Rightarrow \frac{2}{5} = \frac{3}{CE+3}$

$\Rightarrow$ CE = 4.5

9. **(a)** 115°

Explanation:

Here $\angle$T = 90° [Angle between tangent and radius through the point of contact]

Now, in triangle OPT, we know that

$\angle$O + $\angle$P + $\angle$T = 180° [Angle sum property of a triangle]

$\Rightarrow\angle$O + 25° + 90° = 180°

$\Rightarrow\angle$O = 180° - 115° = 65°

Now, x + $\angle$TOP = 180° [Linear pair]

$\Rightarrow$ x + 65° = 180°

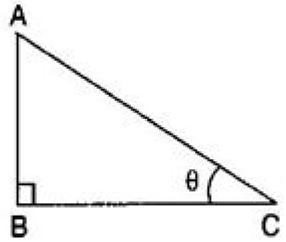
$\Rightarrow$ x = 180° - 65° = 115°

10.

(b) $\frac{\sqrt{b^2 - a^2}}{b}$

Explanation:
Given: $\sin\theta = \frac{a}{b}$
we know that cosθ = $\sqrt{1 - sin^2\theta}$
[∵, sin²θ+cos²θ=1]
or, cosθ = $\sqrt{1 - a^2/b^2}$
or, cosθ = $\frac{\sqrt{b^2-a^2}}{b}$

11.

(c) 60°
Explanation:


Let the height of the pole be AB = $\sqrt{3}x$ meters and the length of the shadow be BC = x meters and angle of elevation = θ
$\therefore \tan\theta = \frac{\sqrt{3}x}{x}$
$\Rightarrow \tan\theta = \sqrt{3}$
$\Rightarrow \tan\theta = \tan 60^\circ$
$\Rightarrow \theta = 60^\circ$

12.

(c) $\frac{a^2+b^2}{a^2-b^2}$
Explanation:
$\tan\theta = \frac{a}{b}$
$\frac{a\sin\theta+b\cos\theta}{a\sin\theta-b\cos\theta} = \frac{a\frac{\sin\theta}{\cos\theta}+b\frac{\cos\theta}{\cos\theta}}{a\frac{\sin\theta}{\cos\theta}-b\frac{\cos\theta}{\cos\theta}}$ (Dividing by cos θ)
= $\frac{a\tan\theta+b}{a\tan\theta-b} = \frac{a\times\frac{a}{b}+b}{a\times\frac{a}{b}-b}$
= $\frac{\frac{a^2}{b}+b}{\frac{a^2}{b}-b} = \frac{\frac{a^2+b^2}{b}}{\frac{a^2-b^2}{b}}$
= $\frac{a^2+b^2}{b} \times \frac{b}{a^2-b^2}$
= $\frac{a^2+b^2}{a^2-b^2}$

13.

(b) 308 cm^2
Explanation:
We know that the area A of a sector of a circle of radius r and central angle θ(in degrees) is given by
$A = \frac{\theta}{360} \times \pi r^2$
Here, r = 28 cm and θ = 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

14.

(b) $\frac{132}{7}$cm^2
Explanation:
Angle of the sector is 60°
Area of sector = $(\frac{\theta}{360^o}) \times \pi$r^2

$\therefore$ Area of the sector with angle 60^o = $(\frac{60^o}{360^o}) \times \pi r^2$ cm^2

= $(\frac{36}{6})\pi$ cm^2

= 6 $\times$ $(\frac{22}{7})$ cm^2

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

15.

(d) $\frac{3}{8}$

Explanation:

Area of square JMLK = 6^2 = 36 sq. units
A and B are the mid-points of sides KL and LM.
$\therefore$ AL = KA = LB = BM = 3 units
Now, Area of $\triangle$ALB = $\frac{1}{2} \times$ AL $\times$ LB = $\frac{1}{2} \times 3 \times 3 = \frac{9}{2}$ sq. units
Area of $\triangle$JMB = $\frac{1}{2} \times$ BM $\times$ JM = $\frac{1}{2} \times 6 \times 3$ = 9 sq. units
Area of $\triangle$KAJ = $\frac{1}{2} \times$ KJ $\times$ KA = $\frac{1}{2} \times 6 \times 3$ = 9 sq. units
Total area of all the three triangles = $(\frac{9}{2}$ + 9 + 9)
= $\frac{45}{2}$ sq. units
$\therefore$ Area of $\triangle$JAB = $(36 - \frac{45}{2}) = \frac{27}{2}$ sq. units
$\therefore$ Required probability = $\frac{\frac{27}{2}}{36} = \frac{27}{2 \times 36} = \frac{3}{8}$

16.

(c) 30 - 40

Explanation:

30 - 40

17.

(d) 6400

Explanation:

Volume of the wall = $(800 \times 600 \times 22.5)$ cm^3,
Number of bricks = $\frac{volume\ of\ the\ wall}{volume\ of\ 1\ brick}$
= $\left(\frac{800 \times 600 \times 22.5}{25 \times 11.25 \times 6}\right)$ = 6400

18. **(a)** 9, 15

Explanation:

Class Interval	**(x_i)**	**Frequency (f_i)**	**Cumulative frequency**
0-100	50	2	2
100-200	150	5	7
200-300	250	f_1	7 + f_1
300-400	350	12	19 + f_1
400-500	450	17	36 + f_1
500-600	550	20	56 + f_1
600-700	650	f_2	56 + f_1 + f_2
700-800	750	9	65 + f_1 + f_2
800-900	850	7	76 + f_1 + f_2

900-1000	950	4	$76 + f_1 + f_2$

We have given n = 100 ⇒ $76 + f_1 + f_2 = 100$

⇒ $f_1 + f_2 = 24$ ...(i)

Since median is 525, so median class is 500-600.

Median = l + $\left(\frac{\frac{n}{2}-cf}{f}\right) \times h$ ⇒ 525 = 500 + $\frac{50-(36+f_1)}{20} \times 100$

⇒ $25 = (14 - f_1) \times 5$ ⇒ $25 = 70 - 5f_1$ ⇒ $5f_1 = 45$ ⇒ $f_1 = 9$

From (i), $9 + f_2 = 24$ ⇒ $f_2 = 24 - 9 = 15$

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

Explanation:

We know that the mid-point of the line segment joining the points $P\left(x_1, y_1\right)$ and $Q\left(x_2, y_2\right)$ is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

So, Reason is correct.

Since, C(y, −1) is the mid-point of P(4, x) and Q(−2, 4).

We have, $\frac{4-2}{2}$ = y ⇒ y = 1

and $\frac{x+4}{2}$ = -1 ⇒ X + 4 = -2

⇒ X = -6

So, Assertion is correct

Correct option is Both A and R are true and R is the correct explanation of A.

20.

(c) A is true but R is false.

Explanation:

A is true but R is false.

Section B

21. The pair of linear equations are given as:

x + 2y – 4 = 0 ...(i)

2x + 4y – 12 = 0 ...(ii)

We express x in terms of y from equation (i), to get

x = 4 – 2y

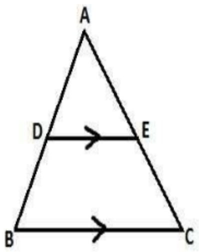
Now, we substitute this value of x in equation (ii), to get

2(4 – 2y) + 4y – 12 = 0

i.e., 8 – 12 = 0

i.e., – 4 = 0

Which is a false statement. Therefore, the equations do not have a common solution. So, the two rails will not cross each other.

22. 

Given: In △ABC, DE || BC. Also AD = 6x - 7, DB = 4x - 3, AE = 3x - 3 and EC = 2x - 1

By basic proportionality theorem,

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

⇒ $\frac{6x-7}{4x-3} = \frac{3x-3}{2x-1}$

⇒ (6x - 7)(2x - 1) = (3x - 3)(4x - 3)

⇒ $12x^2 - 6x - 14x + 7 = 12x^2 - 9x - 12x + 9$

⇒ -20x + 7 = -21x + 9

⇒ -20x + 21x = 9 - 7

⇒ x = 2

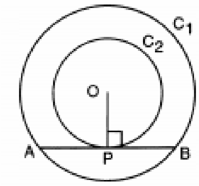
OR

In △ABC and △AMP

∠ABC = ∠AMP ...(i) [Each equal to 90^o]

∠BAC=∠MAP ...(ii) [Common angle]

△ABC ∼ △AMP (AA similarity criterion)

23. 

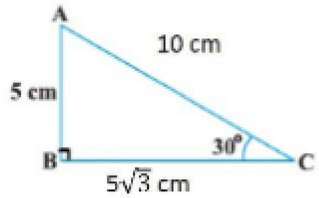
In larger circle C1 , AB is the chord and OP is the tangent.

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

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

24. Given AB = 5 cm

∠ACB = 30^o



According to diagram,

tan C = $\frac{side\ opposite\ to\ angle\ C}{side\ adjacent\ to\ angle\ C}$

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

$\frac{1}{\sqrt{3}}$ = $\frac{5}{BC}$

BC = $5\sqrt{3}$ cm

sin C = $\frac{side\ of\ angle\ C}{hypotenuse}$

sin 30^o = $\frac{AB}{AC}$

$\frac{1}{2}$ = $\frac{5}{AC}$

AC = 10 cm.

25. We have, r = 16.5 km and θ = 80°.

Let A be the area of the sea over which the ships are warmed. Then,

$A = \frac{\theta}{360} \times \pi r^2$ = $\frac{80}{360} \times 3.14 \times 16.5 \times 16.5\ km^2$ = 189.97 km^2

OR

Angle described by the minute hand in 60 minutes = 360^0

∴Angle described by the minute hand in 56 minutes = $\left(\frac{360}{60} \times 56\right)^0 = 336^\circ$

$\therefore \theta = 336^\circ$ and r = 7.5 cm

∴Area swept by the minute hand in 56 minutes $= \left(\frac{\pi r^2 \theta}{360}\right)$

$= \left(3.14 \times 7.5 \times 7.5 \times \frac{336}{360}\right)$ cm^2

= 165 cm^2

Section C

26. Let us assume, to the contrary, that is $3 + 2\sqrt{5}$ rational.

That is, we can find coprime integers a and b $(b \neq 0)$ such that

$3 + 2\sqrt{5} = \frac{a}{b}$ Therefore, $\frac{a}{b} - 3 = 2\sqrt{5}$

$\Rightarrow \frac{a-3b}{b} = 2\sqrt{5}$

$\Rightarrow \frac{a-3b}{2b} = \sqrt{5} \Rightarrow \frac{a}{2b} - \frac{3}{2}$

Since a and b are integers,

We get $\frac{a}{2b} - \frac{3}{2}$ is rational, also so $\sqrt{5}$ is rational.

But this contradicts the fact that $\sqrt{5}$ is irrational.

This contradiction arose because of our incorrect assumption that $3+2\sqrt{5}$ is rational.

So, we conclude that $3+2\sqrt{5}$ is irrational.

27. Let the given polynomial is p(x) = $4x^2 + 4x + 1$

Since, α, β are zeroes of p(x),

$\therefore \alpha+\beta$= sum of zeroes = $\frac{-4}{4}$

Also, $\alpha.\beta$= Product of zeroes = $\alpha.\beta=\frac{1}{4}$

Now a quadratic polynomial whose zeroes are 2α and 2β

x^2 - (sum of zeroes)x + Product of zeroes

$=x^2-(2\alpha+2\beta)x+2\alpha\times 2\beta$

$=x^2-2(\alpha+\beta)x+4(\alpha\beta)$

$=x^2-2\times(-1)x+4\times\frac{1}{4}$

= $x^2 + 2x + 1$

The quadratic polynomial whose zeroes are 2α and 2β is $x^2 + 2x + 1$

28. Let the fraction be $\frac{x}{y}$

Then, according to the question,

$\frac{x+1}{y-1}=1$ ......(1)

$\frac{x}{y+1}=\frac{1}{2}$ ....(2)

⇒x + 1 = y - 1 ....(3)

2x = y + 1................(4)

⇒x - y = - 2................(5)

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

Substituting equation (5) from equation (6), we get x =3

Substituting this value of x in equation (5), we get

3 - y = -2

⇒ y = 3 + 2

⇒ y = 5

Hence, the required fraction is $\frac{3}{5}$

Verification: Substituting the value of x = 3 and y = 5,

we find that both the equations(1) and (2) are satisfied as shown below:

$\frac{x+1}{y-1}=\frac{3+1}{5-1}=\frac{4}{4}=1$

$\frac{x}{y+1}=\frac{3}{5+1}=\frac{3}{6}=\frac{1}{2}$

Hence, the solution is correct.

OR

Let the digits at units and tens place of the given number be x and y respectively

Thus, the number is $10y+x$.

The sum of the two digits of the number is 9.

Thus, we have $x+y=9$ .....(i)

After interchanging the digits, the number becomes $10x+y$.

Also, 9 times the number is equal to twice the number obtained by reversing the order of the digits.

Thus, we have

$9(10y+x)=2(10x+y)$

$\Rightarrow 90y+9x=20x+2y$

$\Rightarrow 20x+2y-90y-9x=0$

$\Rightarrow 11x-88y=0$

$\Rightarrow 11(x-8y)=0$

$\Rightarrow x-8y=0$ .....(ii)

So, we have the systems of equations

x + y = 9,

x - 8y = 0

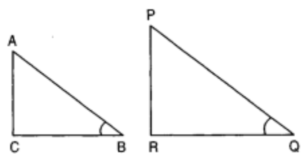
Here x and y are unknowns.

Substituting $x=8y$ from the second equation to the first equation, we get

$8y+y=9$
$\Rightarrow 9y=9$
$\Rightarrow y=\frac{9}{9}$
$\Rightarrow y=1$
Substituting the value of y in the second equation, we have
$x-8\times 1=0$
$\Rightarrow x-8=0$
$\Rightarrow x=8$
$\therefore$ the number is $10\times 1+8=18$

29. TP = TQ ...(length of tangents drawn from external points)
$\therefore$ $\angle$TQP = $\angle$TPQ (angles oppo to equal sides are equal)
OP $\perp$ TP ($\because$ at point of contact radius and tangent are $\perp$r)
$\angle$OPT = 90^o
$\angle$OPQ + $\angle$CPQ = 90^o
$\angle$TPQ = 90 - $\angle$OPQ
Now, In $\triangle$PTQ
$\angle$TPQ + $\angle$PTQ + $\angle$QTP = 180^o
90^o - $\angle$OPQ + 90 - $\angle$OPQ + $\angle$PTQ = 180^o
$\angle$PTQ = 2$\angle$OPQ
Proved.

30. Consider two right triangles ABC and PQR in which $\angle B$ and $\angle Q$ are the right angles.
We have,



In $\triangle ABC$
$\sin B=\frac{AC}{AB}$
and, In $\triangle PQR$
$\sin Q=\frac{PR}{PQ}$
$\because \quad \sin B=\sin Q$
$\Rightarrow \quad \frac{AC}{AB}=\frac{PR}{PQ}$
$\Rightarrow \quad \frac{AC}{PR}=\frac{AB}{PQ}=k$ (say) ...... (i)
$\Rightarrow$ AC = kPR and AB = kPQ .....(ii)
Using Pythagoras theorem in triangles ABC and PQR, we obtain
$AB^2 = AC^2 + BC^2$ and $PQ^2 = PR^2 + QR^2$
$\Rightarrow \quad BC=\sqrt{AB^2-AC^2}$ and $QR=\sqrt{PQ^2-PR^2}$
$\Rightarrow \quad \frac{BC}{QR}=\frac{\sqrt{AB^2-AC^2}}{\sqrt{PQ^2-PR^2}}=\frac{\sqrt{k^2PQ^2-k^2PR^2}}{\sqrt{PQ^2-PR^2}}$ [using (ii)]
$\Rightarrow \quad \frac{BC}{QR}=\frac{k\sqrt{PQ^2-PR^2}}{\sqrt{PQ^2-PR^2}}=k$ ...(iii)
From (i) and (iii), we get
$\frac{AC}{PR}=\frac{AB}{PQ}=\frac{BC}{QR}$
$\Rightarrow \quad \Delta ACB-\Delta PRQ$ [By S.A.S similarity]
$\therefore \quad \angle B=\angle Q$
Hence proved.

OR

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.

31. The total number of persons = 12.

The number of persons who are extremely patient = 3.

The number of persons who are extremely honest = 6.

Number of persons who are extremely kind = 12 – 3 – 6 = 3.

i. P(selecting a person who is extremely patient)= $\frac{\text{Number of favorable outcomes}}{\text{Number of all possible outcomes}}$

$= \frac{3}{12} = \frac{1}{4}$

Thus, the probability of selecting a person who is extremely patient is $\frac{1}{4}$.

ii. P(selecting a person who is extremely kind or honest) = $\frac{\text{Number of favorable outcomes}}{\text{Number of all possible outcomes}} = \frac{6+3}{12} = \frac{9}{12} = \frac{3}{4}$

Thus, the probability of selecting a person who is extremely kind or honest is $\frac{3}{4}$.

From the three given values, we prefer honesty more.

Section D

32. Let the original duration of the tour be x days.

Total expenses of the tour = ₹ 4200

So, expense of one day = ₹ $\frac{4200}{x}$

If tour extends for 3 more days, total duration = (x + 3) days

Hence, expense of one day = $\frac{4200}{x+3}$

Now, according to the question ;

$\frac{4200}{x} - \frac{4200}{(x+3)} = 70$

$\Rightarrow 4200 \times \left[\frac{1}{x} - \frac{1}{(x+3)}\right] = 70 \Rightarrow \frac{(x+3)-x}{x(x+3)} = \frac{70}{4200}$

$\Rightarrow$ x(x +3) = 180 $\Rightarrow$ x^2 + 3x - 180 = 0

$\Rightarrow$ x^2 + 15x - 12x - 180 = 0 $\Rightarrow$ x(x + 15) - 12(x + 15) = 0

$\Rightarrow$ (x + 15) (x - 12) = 0 $\Rightarrow$ x + 15 = 0 or x - 12 = 0

$\Rightarrow$ x = -15 or x = 12

$\Rightarrow$ x = 12 [$\because$ number of days cannot be negative.]

$\therefore$ original duration of the tour is 12 days.

OR

Let the ten's digit be x and the one's digit be y.

The number will be 10x + y

Given, a product of digits is 24

$\therefore$ xy = 24

or, y = $\frac{24}{x}$ ...(i)

Given that when 18 is subtracted from the number, the digits interchange their places.

$\therefore$ 10x + y - 18 = 10y + x

or, 9x - 9y = 18

Substituting y from equation (i) in equation (ii), we get

$9x - 9\left(\frac{24}{x}\right)$ = 18

or, $x - \frac{24}{x}$ = 2

or, x^2 - 24 - 2x = 0

or, x^2 - 2x - 24 = 0

or, x^2 - 6x + 4x - 24 = 0

or, x(x - 6) + 4(x - 6) = 0

or, (x - 6)(x + 4) = 0

or, x - 6 = 0 and x + 4 = 0

or, x = 6 and x = -4

Since, the digit cannot be negative, so, x = 6

Substituting x = 6 in equation (i), we get

y = $\frac{24}{6}$ = 4

$\therefore$ The number = 10(6) + 4 = 60 + 4 = 64

33. In $\triangle$PQR, $\angle$1 = $\angle$2

$\therefore$ PQ = PR (sides opposite to equal angles)

Now $\frac{QR}{QS}$ = $\frac{QT}{PR}$

$\Rightarrow$ $\frac{QS}{QR}$ = $\frac{PR}{QT}$ $\Rightarrow$ $\frac{QS}{QR}$ = $\frac{PQ}{QT}$ (as PR = PQ) ...(i)

In ΔPQS and ΔTQR,

$\angle$Q = $\angle$Q (common)

$\frac{QS}{QR}$ = $\frac{PQ}{QT}$ (from (i))

$\therefore$ ΔPQS $\sim$ ΔTQR (SAS similarity)

34. According to question

Diameterdiameter of the well = 7m

Radius of the well (r) = $\frac{7}{2}$ m = 3.5m and, height of the well (h) = 22.5 m

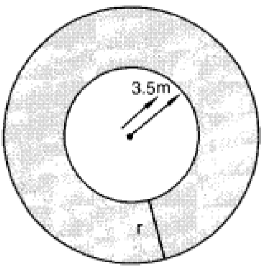
$\therefore$ Volume of the earth dugout = $\pi\times$ (3.5)^2 $\times$ 22.5 m^3 = π $\times$ $\frac{7}{2}$ $\times$ $\frac{7}{2}$ $\times$ $\frac{45}{2}$ m^3

Let the width of the embankment be r metres. Clearly, embankment forms a cylindrical shell whose inner and outer radii are 3.5 m and (r + 3.5) m respectively and height 1.5 m.

$\therefore$ Volume of the embankment = Area of ring at top $\times$ height of the embankment

= π{(r + 3.5)^2 - (3.5)^2} $\times$ 1.5 m^3 = π(r + 7) r $\times\frac{3}{2}$ m^3

But, Volume of the embankment = Volume of the well



$\Rightarrow \pi r(r+7) \times \frac{3}{2} = \pi \times \frac{7}{2} \times \frac{7}{2} \times \frac{45}{2}$

$\Rightarrow$ r (r + 7) = $\frac{49}{4}\times$ 15

$\Rightarrow$ 4r^2 + 28r = 735

$\Rightarrow$ 4r^2 + 28r - 735 = 0

4r^2 + 70x - 42x - 735 = 0

$\Rightarrow$ 2r(2r + 35) - 21(2r + 35) = 0

$\Rightarrow$ (2r + 35)(2r - 21) = 0

$\Rightarrow$ 2r + 35 = 0 or 2r - 21 = 0

$\Rightarrow$ r = $\frac{-35}{2}$ or x = $\frac{21}{2}$

$\frac{-35}{2}$ is negative, hence neglect this value

$\Rightarrow x = \frac{21}{2}$ = 10.5 m

Hence, the width of the embankment is 10.5 m

OR

The volume of the spherical vessel is

calculated by the given formula

V = $\frac{4}{3}\pi \times r^3$

Now,

V = $\frac{4}{3} \times \frac{22}{7} \times 9 \times 9 \times 9$

V = 3,054.85 cm^3

The volume of the cylinder neck is calculated by the given formula.

V = $\pi \times R^2 \times h$

Now,

V = $\frac{22}{7} \times 1 \times 1 \times 8$

V = 25.14 cm^3

The total volume of the vessel is equal to the volume of the spherical shell and the volume of its cylindrical neck.

3054.85 + 25.14 = 3, 080 cm^3

The total volume of the vessel is 3,080 cm^3.

As we know,

1 L = 1000 cm^3

$\frac{3080}{1000}$ = 3.080 L

Thus, the amount of water (in litres) it can hold is 3.080 L.

35. Since value of number of mangoes and number of boxes are large numerically. So we use step-deviation method

True Class Interval	**No. of boxes(f_i)**	**Class mark(x_i)**	$u_i = \frac{x_i - a}{h}$	**$f_i u_i$**
49.5-52.5	15	51	-2	-30
52.5-55.5	110	54	-1	-110
55.5-58.5	135	57	0	0
58.5-61.5	115	60	1	115
61.5-64.5	25	63	2	50
	$\sum f_i$ = 400			$\sum f_i u_i$ = 25

Let assumed mean (a) = 57,

h = 3 ,

$\therefore \overline{u} = \frac{\sum f_i u_i}{\sum f_i} = \frac{25}{400} = 0.0625$ (approx.)

Using formula, Mean $(\overline{x})$ = a + h$\overline{u}$

= 57 + 3 (0.0625

= 57 + 0.1875

= 57.1875

= 57.19 (approx)

Therefore, the mean number of mangoes is 57.19

Section E

36. i. 51, 49, 47, ... 31 AP

d = -2

First 4 terms of AP are: 51, 49, 47, 45 ...

ii. 51, 49, 47, ... 31 AP

d = -2

t_n = a +(n - 1)d

31 = 51 + (n - 1) (-2)

31 = 51 - 2n + 2

31 = 53 - 2n

31 - 53 = -2n

-22 = -2n

n = 11

i.e., he acheived his goal in 11 days.

iii. 51, 49, 47, ... 31 AP

d = -2

t_6 = a + (n - 1)d

= 51 + (6 - 1)(-2)

= 51 + (-10)

= 41 sec

OR

The given AP is

51, 49, 47, 45, 43, 41, 39, 37, 35, 33, 31, 29

$\therefore$ 30 is not in the AP.

37. i. We have, P(-3, 4), Q(3, 4) and R(-2, -1).

$\therefore$ Coordinates of centroid of $\triangle$PQR

= $\left(\frac{-3+3-2}{3}, \frac{4+4-1}{3}\right)$ = $\left(\frac{-2}{3}, \frac{7}{3}\right)$

ii. Coordinates of T = $\left(\frac{-2+3}{2}, \frac{-1+4}{2}\right) = \left(\frac{1}{2}, \frac{3}{2}\right)$

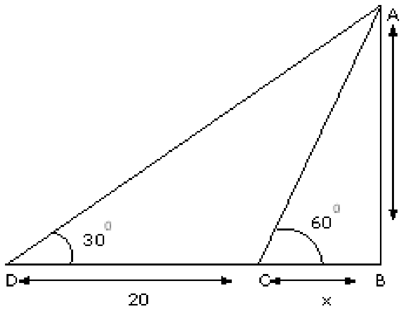
iii. Coordinates of U = $\left(\frac{-2-3}{2}, \frac{-1+4}{2}\right) = \left(\frac{-5}{2}, \frac{3}{2}\right)$

OR

The centroid of the triangle formed by joining the mid-points of sides of a given triangle is the same as that of the given triangle.

So, centroid of $\triangle$STU = $\left(\frac{-2}{3}, \frac{7}{3}\right)$

38. i.



Let 'h' (AB) be the height of tower and x be the width of the river.

In $\triangle ABC$, $\frac{h}{x} = \tan 60^\circ$

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

In ΔABD, $\frac{h}{x+20} = \tan 30^\circ$

$\Rightarrow h = \frac{x+20}{\sqrt{3}}$ ...(ii)

Equating (i) and (ii),

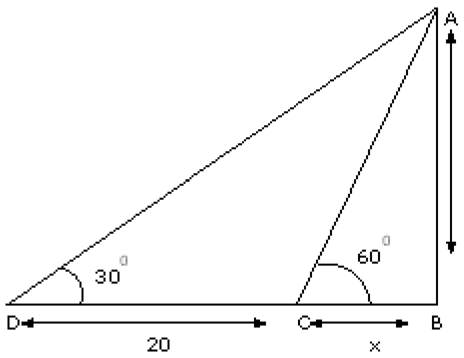
$\sqrt{3}x = \frac{x+20}{\sqrt{3}}$

$\Rightarrow$ 3x = x + 20

$\Rightarrow$ 2x = 20

$\Rightarrow$ x = 10 m

ii.



Let 'h' (AB) be the height of tower and x be the width of the river.

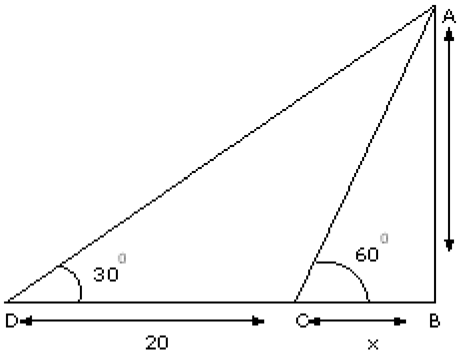
In $\triangle ABC$, $\frac{h}{x} = \tan 60^\circ$

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

Put x = 10 in (i), $h = \sqrt{3}x$

$\Rightarrow h = 10\sqrt{3}\text{m}$

iii.



In $\triangle$ABD

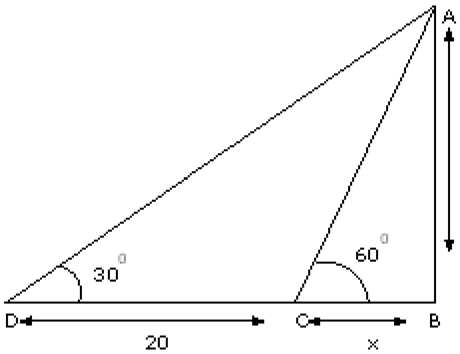
sin 30^o = $\frac{AB}{AD}$

$\Rightarrow$ AD = $\frac{AB}{\sin 30^\circ}$

$\Rightarrow$ AD = $\frac{10\sqrt{3}}{\frac{1}{2}}$

$\Rightarrow$ AD = $20\sqrt{3}$ m

OR



In $\triangle$ABC

sin 60^o = $\frac{AB}{AC}$

$\Rightarrow$ AC = $\frac{AB}{\sin 30^0}$

$\Rightarrow$ AC = $\frac{10\sqrt{3}}{\frac{\sqrt{3}}{2}}$

$\Rightarrow$ AC = 20 m