Solution
PRELIMINARY EXAM - I
Class 10 - Mathematics

Section A

1.
(b) an irrational number
Explanation:
an irrational number

2. **(a)** a > 0, b < 0 and c > 0
Explanation:
Clearly, $f(x) = ax^2 + bx + c$ represent a parabola opening upwards.
Therefore, $a > 0$
The vertex of the parabola is in the fourth quadrant, therefore b < 0
$y = ax^2 + bx + c$ cuts Y axis at P which lies on OY.
Putting x = 0 in $y = ax^2 + bx + c$, we get y = c.
So the coordinates of P is (0, c).
Clearly, P lies on OY. $\Rightarrow$ c>0
Hence, a>0, b<0 and c>0

3.
(c) no solution
Explanation:
Given, equations are
x + 2y + 5 = 0, and
- 3x - 6y + 1 = 0.
Comparing the equations with general form:
$a_1x + b_1y + c_1 = 0$
$a_2x + b_2y + c_2 = 0$
Here, $a_1 = 1$, $b_1 = 2$, $c_1 = 5$
And $a_2 = -3$, $b_2 = -6$, $c_2 = 1$
Taking the ratio of coefficients to compare
$\frac{a_1}{a_2} = \frac{-1}{3}, \frac{b_1}{b_2} = \frac{-1}{3}, \frac{c_1}{c_2} = \frac{5}{1}$
So $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
This represents a pair of parallel lines.
Hence, the pair of equations has no solution.

4. **(a)** $-x^2 + 3x - 3 = 0$
Explanation:
Given, $-x^2 + 3x - 3 = 0$
Sum of roots = $\frac{-3}{-1} = 3$

5. **(a)** 3 : 1
Explanation:
Here, 18th term : 11th term = 3: 2
$\Rightarrow \frac{a_{18}}{a_{11}} = \frac{3}{2} \Rightarrow \frac{a+17d}{a+10d} = \frac{3}{2}$
$\Rightarrow 2a + 34d = 3a + 30d$
$\Rightarrow 34d - 30d = 3a - 2a \Rightarrow a = 4d$
Now $\frac{a_{21}}{a_5} = \frac{a+20d}{a+4d} = \frac{4d+20d}{4d+4d}$

$= \frac{24d}{8d} = \frac{3}{1}$

$a_{21} : a_5 = 3 : 1$

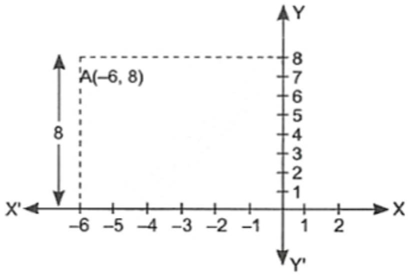
6.

(d) 8 units

Explanation:

The distance of the point (x, y) form x-axis is y-coordinate

∴ The distnace of the point (-6, 8) form x-axis is 8 units.



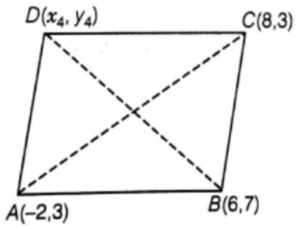
7.

(d) (0, -1)

Explanation:

Given a parallelogram ABCD whose three vertices are;

A (- 2, 3), B (6, 7) and C (8, 3)



Let the fourth vertex of parallelogram, D = (x_4, y_4) and L, M be the middle points of AC and BD, respectively

L = $\left(\frac{-2+8}{2}, \frac{3+3}{2}\right) = (3, 3)$

Since, mid - point of a line segment having points (x_1, y_1) and (x_2, y_2)

= $\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}$

and

M = $\frac{6+x_4}{2}, \frac{7+y_4}{2}$

As we know ABCD is a parallelogram, therefore diagonals AC and BD will bisect each other.

So, L and M are the same points

3 = $\frac{6+x_4}{2}$ and 3 = $\frac{7+y_4}{2}$

$\Rightarrow$ 6 = 6 + x_4 and 6 = 7 + y_4

$\Rightarrow$ x_4 = 0 and y_4 = 6 – 7

∴ x_4 = 0 and y_4 = - 1

Hence, the fourth vertex of parallelogram is D = (x_4, y_4) = (0, -1)

8.

(b) 4

Explanation:

Given, In $\triangle$ABC,

DE || BC

∴ By BPT,

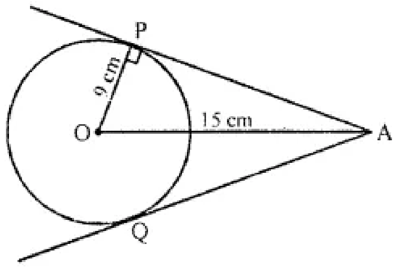
$\frac{AD}{DB} = \frac{AE}{EC}$

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

$\Rightarrow 6x = 4x + 8$
$\Rightarrow 2x = 8$
$\Rightarrow x = 4$

9.
(d) PS
Explanation:
Tangents drawn from external point to the circle are equal.
PA = PD ...(i)
CS = SD ...(ii)
Adding equation (i) & (ii)
PA + CS = PD + SD
= PS

10.
(d) 24 cm
Explanation:
OP is radius, PA is the tangent
$\mathrm{OP} \perp \mathrm{AP}$



Now in right $\Delta\mathrm{OAP}$
$OA^2 = OP^2 + AP^2$
$(15)^2 = (9)^2 + AP^2$
$225 = 81 + AP^2$
$\Rightarrow AP^2 = 225 - 81 = 144 = (12)^2$
AP = 12 cm
But AP = AQ = 12 cm (tangents from A to the circle)
AP + AQ = 12 + 12 = 24 cm

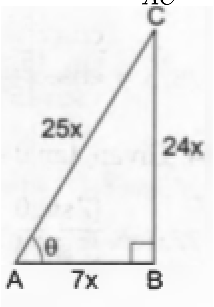
11.
(c) 1
Explanation:
Given that, $\sin A + \sin^2 A = 1$
$\Rightarrow \sin A = 1 - \sin^2 A$
$\Rightarrow \sin A = \cos^2 A$
$\Rightarrow \sin^2 A = \cos^4 A$
$\Rightarrow 1 - \cos^2 A = \cos^4 A$
$\Rightarrow \cos^2 A + \cos^4 A = 1$

12.
(c) $\frac{24}{25}$
Explanation:

$\sec\theta = \frac{AC}{AB} = \frac{25}{7} = \frac{25x}{7x} \Rightarrow$ AC = 25x and AB = 7x

$\therefore$ $BC^2 = AC^2 - AB^2 = 625x^2 - 49x^2 = 576x^2 \Rightarrow$ BC = 24x

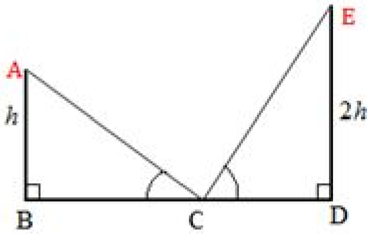
$\therefore \sin\theta = \frac{BC}{AC} = \frac{24x}{25x} = \frac{24}{25}$



13.

(b) $5\sqrt{2}$ m

Explanation:



Let the height of the building = AB = h meters, then

Height of the tower = ED = 2h meters

According to question, ∠ACB = θ then ∠EDC = $90^\circ - \theta$ And BC = CD = 10 m

Now, in triangle ABC, $\tan\theta = \frac{AB}{BC} \Rightarrow \tan\theta = \frac{h}{10}$ ......(i)

Now, in triangle EDC, $\tan(90^\circ - \theta) = \frac{ED}{CD}$

$\Rightarrow \cot\theta = \frac{2h}{10} = \frac{h}{5}$ ......(ii)

$h2h$ Multiplying eq. (i) and (ii), we get

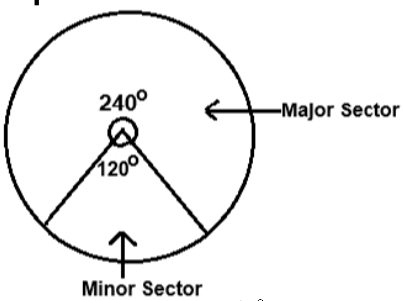
$\tan\theta . \cot\theta = \frac{h}{10} \times \frac{h}{5} \Rightarrow 1 = \frac{h^2}{50}$

$\Rightarrow h^2 = 50 \Rightarrow h = 5\sqrt{2}$ m

14.

(c) 462 cm^2

Explanation:



ar. major sector $\frac{240^\circ}{360^\circ} \times \pi \times (21)^2$

$= \frac{2}{3} \times \frac{22}{7} \times 21 \times 21$

$= 44 \times 21$

= 924 cm^2

ar. minor sector

$= \frac{120^\circ}{360^\circ} \times \frac{22}{7} \times 21 \times 21$

$= \frac{1}{3} \times \frac{22}{7} \times 21 \times 21$

= 462 cm^2

difference between area = 924 - 462

= 462 cm^2

15.

(d) 10.90 cm

Explanation:

The area of the sector $= \frac{x^\circ}{360^\circ} \times \pi r^2$

$= \frac{50^\circ}{360^\circ} \times \frac{22}{7} \times 5^2$

= 10.90 cm

16. **(a)** $\frac{8}{75}$

Explanation:

Number of possible outcomes = {1, 4, 9, 16, 25, 36, 49, 64} = 8

Number of Total outcomes = 75

$\therefore$ Probability (of getting a perfect square) = $\frac{8}{75}$

17.

(c) 15

Explanation:

Given, Number of red ball = 5

Number of green ball = n

$\therefore$ Total ball = n + 5

Now P(red ball) = $\frac{5}{n+5}$

and P(green ball) = $\frac{n}{n+5}$

Now, according to the question

$\frac{n}{n+5} = \frac{3 \times 5}{n+5}$

n = 15

So, number of green ball = 15

18.

(c) $\frac{x_i - a}{h}$

Explanation:

Given $\overline{\mathrm{x}}$ = a + h $\left(\frac{1}{\mathrm{N}} \Sigma f_i u_i\right)$

Above formula is a step deviation formula, where

u_i = $\frac{x_i - a}{h}$

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

Explanation:

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

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

Explanation:

Common difference, d = -1 - 1(-5) = 4

So, both A and R are true and R is the correct explanation of A.

Section B

21. If possible let a = 6 + $\sqrt{7}$ be a rational number.

Squaring $a^2 = (6 + \sqrt{7})^2$

$a^2 = 36 + 7 + 12\sqrt{7}$

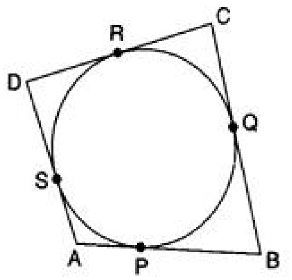
$\sqrt{2}$ = $\frac{a^2-43}{12}$ ...(1)
Since a is a rational number the expression $\frac{a^2-43}{12}$ is also rational number.
$\Rightarrow$ $\sqrt{7}$ is a rational number
This is a contradiction. Hence, 6 + $\sqrt{7}$ is irational.
Hence proved.

OR

Let us assume that $5-2\sqrt{3}$ is a rational number.
Then, there must exist positive co primes a and b such that
$\Rightarrow\ 5-2\sqrt{3}=\frac{\mathrm{a}}{\mathrm{b}}$
$\Rightarrow -2\sqrt{3}=\frac{\mathrm{a}}{\mathrm{b}}-5$
$\Rightarrow\ 2\sqrt{3}=5-\frac{\mathrm{a}}{\mathrm{b}}$
$\Rightarrow\ 2\sqrt{3}=\frac{5\mathrm{b}-\mathrm{a}}{\mathrm{a}}$
$\Rightarrow\ \sqrt{3}=\frac{5\mathrm{b}-\mathrm{a}}{2\mathrm{a}}$
The right side $\frac{5\mathrm{b}-\mathrm{a}}{2\mathrm{a}}$ is a rational numbers so $\sqrt{3}$ is a rational number
This contradicts the fact that $\sqrt{3}$ is an irrational number
Hence our assumption is incorrect and $5-2\sqrt{3}$ is an irrational number.

22. It is given that AB = 5.6 cm, BC = 6 cm and DC = 3 cm
In $\triangle ABC,$ AD is the bisector of $\angle A,$ meeting side BC at D
We have to find BC
Since AD is $\angle A$ bisector
So $\frac{AC}{AB}=\frac{BD}{DC}$
Then, $\frac{6}{5.6}=\frac{3}{DC}$
$\Rightarrow$ DC = 2.8
So, BC = 2.8 + 3
= 5.8
Hence, BC = 5.8 cm

23. We know that the tangent segments from an external point to a circle are equal



$\therefore$ AP = AS ....(1)
BP = BQ ....(2)
CR = CQ ....(3)
DR = DS ....(4)
Adding (1), (2), (3) and (4), we get
(AP + BP) + (CR + DR) = (AS + BQ + CQ + DS)
$\Rightarrow$ AB + CD = (AS + DS) + (BQ + CQ)
$\Rightarrow$ AB + CD = AD + BC

24. We have,
$\sin 60^\circ=\frac{\sqrt{3}}{2},\ \cos 45^\circ=\frac{1}{\sqrt{2}},\ \cot 30^\circ\ =\ \sqrt{3},\ \cos 90^\circ=0$
therefore,
$\frac{\sin 60^\circ}{\cos^2 45^\circ}-\cot 30^\circ+15\cos 90^\circ$

$= \frac{\frac{\sqrt{3}}{2}}{(1/\sqrt{2})^2} - \sqrt{3} + 15 \times 0$
$= \sqrt{3} - \sqrt{3} + 0 = 0$

OR

LHS = $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$
$= \frac{\frac{\sin\theta}{\cos\theta}}{1-\frac{\cos\theta}{\sin\theta}} + \frac{\frac{\cos\theta}{\sin\theta}}{1-\frac{\sin\theta}{\cos\theta}} \quad \left[\because \tan\theta = \frac{\sin\theta}{\cos\theta}, \cot\theta = \frac{\cos\theta}{\sin\theta}\right]$
$= \frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)} + \frac{\cos^2\theta}{\sin\theta(\cos\theta-\sin\theta)}$
$= \frac{\sin^2\theta}{\cos\theta(\sin\theta-\cos\theta)} - \frac{\cos^2\theta}{\sin\theta(\sin\theta-\cos\theta)}$
$= \frac{\sin^3\theta-\cos^3\theta}{\sin\theta\cos\theta(\sin\theta-\cos\theta)}$
$= \frac{(\sin\theta-\cos\theta)\left(\sin^2\theta+\cos^2\theta+\sin\theta\cos\theta\right)}{(\sin\theta-\cos\theta)\sin\theta\cos\theta}$ [$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$]
$= \frac{1+\sin\theta\cos\theta}{\sin\theta\cos\theta}$
$= \frac{1}{\sin\theta\cos\theta} + 1 = 1 + \sec\theta cosec\theta$ = RHS
therefore, RHS = LHS

25. Area of quadrant = $\frac{1}{4}\pi(7)^2 = \frac{49}{4}\pi$ cm^2
Area of triangle = $\frac{1}{2} \times 7 \times 3 = \frac{21}{2}$ cm^2
Area of shaded region = $\frac{49}{4}\pi - \frac{21}{2}$
= $\frac{7}{2}\left(\frac{7}{2}\pi - 3\right)$ cm^2 or 28 cm^2

Section C

26. We have,
60 = $2^2 \times 3 \times 5$
168 = $2^3 \times 3 \times 7$
330 = $2 \times 3 \times 5 \times 11$
HCF = 6
They can put 6 food items in 1 packet.
so the number of packets required for 60 pieces of pastries = $\frac{60}{6}$ = 10
the number of packets required for 168 pieces of cookies = $\frac{168}{6}$ = 28
the number of packets required for 330 chocolate bars = $\frac{330}{6}$ = 55
Total Packets required = 10+28+55 = 93

27. The given polynomial p(x) = $x^2 + 2\sqrt{2}x - 6$
= $x^2 + 3\sqrt{2}x - \sqrt{2}x - 6$
= $x(x + 3\sqrt{2}) - \sqrt{2}(x + 3\sqrt{2})$
= $(x + 3\sqrt{2})(x - \sqrt{2})$
p(x) = 0 if $x+3\sqrt{2} = 0$ or $x = \sqrt{2}$
Zeroes of the polynomials are $\sqrt{2}$ and $-3\sqrt{2}$
For p(x) = $x^2 + 2\sqrt{2}x - 6$
a = 1, b = $2\sqrt{2}$, c = -6
Sum of the zeroes $\sqrt{2} - 3\sqrt{2} = -2\sqrt{2} = -\frac{2\sqrt{2}}{1} = -\frac{b}{a}$
Product of the zeroes $=\sqrt{2} \times -3\sqrt{2} = \frac{-6}{1} = \frac{c}{a}$
Hence, the relationship is verified.

28. We know that class mark $x_i = \frac{\text{Upper class limit +Lower class limit}}{2}$
So x_i and f_ix_i can be calculated as follows:

Class	Frequency (f_i)	x_i	f_ix_i
10 - 30	15	20	300

30 - 50	18	40	720
50 - 70	25	60	1500
70 - 90	10	80	800
90 - 110	2	100	200
Total	$\sum x_i$ = 70		$\sum f_i x_i$ = 3520

Here from above, we get
$\sum x_i$ = 70
$\sum f_i x_i$ = 3520
Hence $\overline{\mathrm{x}} = \frac{\sum \mathrm{f_i x_i}}{\sum \mathrm{x_i}} = \frac{3520}{70}$ = 50.28

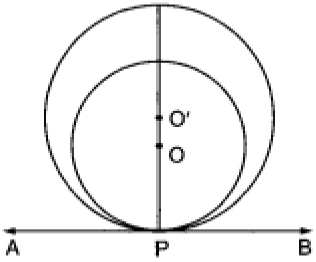
29. x + y = 14; x - y = 4
the given pair of linear equations is
x + y = 14.................(1)
x - y = 4....................(2)
From equation(1),
y = 14 - x...................(3)
Substitute this value of y in equation(2), we get
x - (14 - x) = 4
$\Rightarrow$ x - 14 + x = 4
$\Rightarrow$ 2x - 14 = 4
$\Rightarrow$ 2x = 4 + 14
$\Rightarrow$ 2x = 18
$\Rightarrow x = \frac{18}{2} = 9$
Substituting this value of x in equation (3), we get y = 14 - 9 = 5
Therefore, the solution is x = 9, y = 5
verification: Substituting x = 9 and y = 5, we find that both the equations (1) and (2) are satisfied as shown below:
x + y = 9 + 5 = 14
x - y = 9 - 5=4
This verifies the solution.

OR

Let the age of father is x years and that of son is y years.
Then by the given question,
Two years ago father was five times as old as his son
$x - 2 = 5(y - 2)$
or, $x - 5y = -10 + 2$
or, $x - 5y = -8$
or, $x = 5y - 8$
Two years later, his age will be 8 years more than three times the age of the son
$x + 2 = 3(y + 2) + 8$
or, $x - 3y = 6 + 8 - 2$
or, $5y - 8 - 3y = 12$
or, $2y = 12 + 8$
or, $y = \frac{20}{2}$
or, $y = 10$
then x=5y-8=50-8=42
Then, the age of father is 42 yrs. and the age of son is 10 yrs.

30. LHS
= $\frac{1}{\cot^2\theta} + \frac{1}{1+\tan^2\theta}$
= $\tan^2\theta$ + $\frac{1}{\sec^2\theta}$

$= \tan^2\theta + \cos^2\theta$
$= (\sec^2\theta - 1) + \cos^2\theta$
$= \sec^2\theta - (1 - \cos^2\theta)$
$= \sec^2\theta - \sin^2\theta$
$= \frac{1}{\cos^2\theta} - \sin^2\theta$
$= \frac{1}{1-\sin^2\theta} - \frac{1}{cosec^2\theta}$
= R.H.S
Hence proved.

31. 

Let APB be the given line, and let a circle with centre O touch APB at P.
Then, $\angle OPB$= 90°.
Let there be another circle with centre O' which touches the line APB at P.
Then, $\angle O'PB$=90°.
This is possible only when O and O' lie on the same line O'OP.
Hence, the required locus is a line perpendicular to the given line at the point of contact.

OR

Here, OA = OB
And OA $\perp$ AP, OB $\perp$ BP (Since tangent is perpendicular to the radius at the point of contact)
$\therefore \angle OAP$ = 90°,
$\angle OBP$ = 90°
$\therefore \angle OAP + \angle OBP$ =90° + 90° = 180°
$\therefore \angle AOB + \angle APB$ = 180°
(Since, $\angle AOB + \angle OAP + \angle OBP + \angle APB$ = 360°)
Thus, sum of opposite angle of a quadrilateral is 180°.
Hence, A, O, B and P are concyclic.

Section D

32. i.

Class intereval	**Frequency**	**Cumulative frequency**
10-20	12	12
20-30	30	42
30-40	x	42 + x(F)
40-50	65(f)	107 + x
50-60	y	107 + x + y
60-70	25	132 + x + y
70-80	18	150 + x + y
	N = 230	

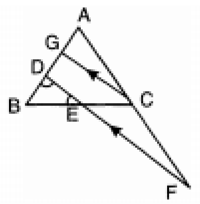
let the unknown frequencies are 'x' and 'y'.
Median = 46
Then, median class = 40 - 50
$\therefore$ Median = l + $\frac{\frac{N}{2} - F}{f} \times$ n
Here,
L = Lower limit of median class

cf = Cumulative frequency of class prior to median class.
f = Frequency of median class.
h = Class size.
$\therefore$ l = 40, h = 50 - 40 = 10, f = 65, F = 42 + x
$\Rightarrow$ 46 = 40 + $\frac{115-(42+x)}{65} \times 10$
$\Rightarrow$ 46 - 40 = $\frac{115-(42+x)}{65} \times 10$
$\Rightarrow$ $\frac{6\times65}{10}$ = 73 - x
$\Rightarrow$ x = 73 - 39 = 34
Given
N = 230
$\Rightarrow$ 12 + 30 + 34 + 65 + y + 25 + 18 = 230
$\Rightarrow$ y = 230 - 184 = 46

ii.

Class interval	Mid value	Frequency	f_x
10-20	15	12	180
20-30	25	30	750
30-40	35	34	1190
40-50	45	65	2925
50-60	55	46	2530
60-70	65	25	1625
70-80	75	18	1350
		N = 230	Σf_x **= 10550**

$\therefore$ Mean = $\frac{\sum fx}{N}$
$= \frac{10550}{230}$ = 45.87

33. 

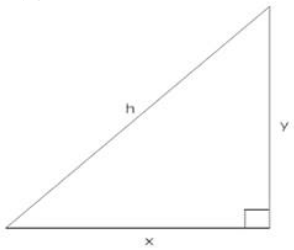
Construction: Draw $CG||FD$
Given $\angle BED = \angle BDE$.
or, BE = BD = EC .....(1) ($\because$ Given that E is mid-point of BC)
In $\triangle BCG, DE||GC$
or, $\frac{BD}{DG} = \frac{BE}{EC} = \frac{BE}{BE} = 1$ ....(2)
From (1) and (2) we get
or, BE = BD = DG .....(3) (From (1))
In $\triangle ADF\ GC \| DF$
$\therefore \frac{AG}{GD} = \frac{AC}{CF}$
Adding 1 on both sides
$\frac{AG}{GD} + 1 = \frac{AC}{CF} + 1$
$\frac{AG+GD}{GD} = \frac{AC+CF}{CF}$
$\frac{AD}{GD} = \frac{AF}{CF}$
or $\frac{AF}{CF} = \frac{AD}{BE}$ (because BE=GD from(3))
Hence proved

34. Let the boy and his sister's ages be 'x' years and 'y' years, respectively
According to the question,

x + y = 25 ...(i)
and xy = 150
or, y = $\frac{150}{x}$ ...(ii)
Using equation (ii) in equation (i), we get
$x+\frac{150}{x}$ = 25
$\Rightarrow$ x^2 - 25x + 150 = 0
$\Rightarrow$ x^2 - 15x - 10x + 150 = 0
$\Rightarrow$ x(x - 15) -10(x - 15) = 0
$\Rightarrow$ x - 15 = 0 or x - 10 = 0
$\Rightarrow$ x = 15 or x = 10
When x = 15 i.e., boy's age is 15 years.
Then, sister's age, y = $\frac{150}{15}$ = 10 years
When x = 10 i.e, boy's age is 10 years
Then, sister's age, y = $\frac{150}{10}$ = 15 years

OR

Let base = x
Altitude = y
Hypotenuse = h



According to question,
h = x + 2
h = 2y + 1
$\Rightarrow$ x + 2 = 2y + 1
$\Rightarrow$ x + 2 - 1 = 2y
$\Rightarrow$ x - 1 = 2y
$\Rightarrow \frac{x-1}{2}=y$
And $x^2 + y^2 = h^2$
$\Rightarrow x^2+\left(\frac{x-1}{2}\right)^2=(x+2)^2$
$\Rightarrow$ x^2 - 15x + x - 15 = 0
$\Rightarrow$ x^2 - 15x + x - 15 = 0
$\Rightarrow$ (x - 15)(x + 1) = 0
$\Rightarrow$ x = 15 or x = -1
Base = 15 cm
Altitude = $\frac{x+1}{2}=8\mathrm{cm}$
Height, $h=2\times 8+1=17\mathrm{cm}$

35. We have, Diameter of the graphite cylinder = 1 mm = $\frac{1}{10}$cm
$\therefore$ Radius of graphite (r) = $\frac{1}{20}\mathrm{cm}$ = 0.05 cm
Length of the graphite cylinder =10 cm
Volume of the graphite cylinder = $\frac{22}{7}\times(0.05)^2\times 10$
= 0.0785 cm^3
Weight of graphite = Volume$\times$ Specific gravity
= 0.0785 $\times 2.1$

= 0.164 gm

Diameter of pencil = $7\mathrm{mm} = \frac{7}{10}\mathrm{cm}$ = 0.7 cm

$\therefore$ Radius of pencil = $\frac{7}{20}$ cm = 0.35 cm

and, Length of pencil = 10 cm

$\therefore$ Volume of pencil = {tex}\style{font-size:11px}{\mathrm{πr}^2\mathrm h}{/tex}

= $\frac{22}{7} \times (0.35)^2 \times 10\ \mathrm{cm}^3$ = 3.85 cm^3

Volume of wood = volume of the pencil - volume of graphite

= (3 .85 - 0.164) cm^3= 3. 686 gm

$\therefore$ Weight of wood = volume density

= 3. 686 × 0.7 = 3.73

Hence, Total weight = (3.73+ 0.164) gm = 3.894gm.

OR

Volume of one cube = 125 cm^3

$\therefore$ side of the cube = 5 cm

Volume of the resulting cuboid = volume of 2 cubes = 250 cm^3

$\therefore$ Length of new cuboid 5 + 5 = 10 cm

Breadth of new cuboid = 5 cm

Height of new cuboid = 5 cm

Surface area of the resulting cuboid = 2(lb + bh + hl)

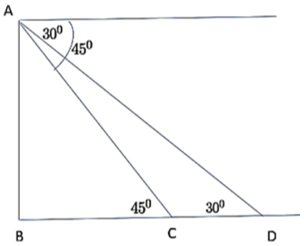
= 2(10 $\times$ 5 + 5 $\times$ 5 + 5 $\times$ 10)

= 250 cm^2

Section E

36. i. Number of pots in the 10^{th} row
    = a_{10} = a + 9d = 29
    ii. a_5 - a_2 = (a + 4d) - (a + d) = 3d = 9
    iii. S_n = 100 $\Rightarrow$ $\frac{n}{2}[2(2) + (n-1)3$ = 100
    $3n^2$ + n - 200 = 0 $\Rightarrow$ (3n + 25)(n - 8) = 0
    $\therefore$ n = 8 (n = $-\frac{25}{3}$ rejected).
    OR
    S_{12} = $\frac{12}{2}[2(2) + 11(3)]$
    = 222
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.



The distance of ship from the base of the light house after 6 seconds from the initial position when angle of depression is 45$^{\text{o}}$.

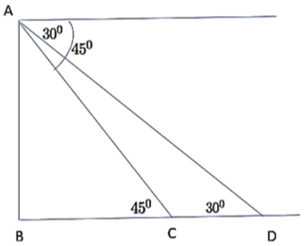
In $\triangle$ABC

tan 45$^{\text{o}}$ = $\frac{AB}{BC}$

$\Rightarrow 1 = \frac{40}{BC}$

$\Rightarrow$ BC = 40 m

ii.



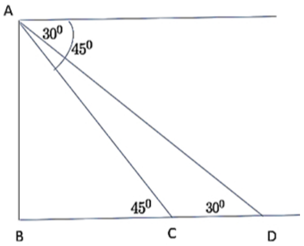
The distance between two positions of ship after 6 seconds

CD = BD - BC

$\Rightarrow$ CD = 40$\sqrt{3}$ - 40 = 40($\sqrt{3}$ - 1)

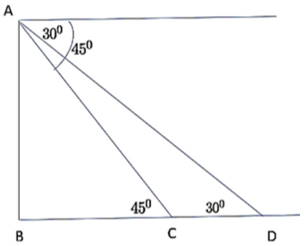
$\Rightarrow$ CD = 29.28 m

iii.



Speed of ship = $\frac{Distance}{Time} = \frac{29.28}{6}$ = 4.88 m/sec

OR



The distance of ship from the base of the light house when angle of depression is 30$^{\text{o}}$.

In $\triangle$ABD

tan 30$^{\text{o}}$ = $\frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{40}{BD}$

$\Rightarrow$ BD = 40$\sqrt{3}$ m