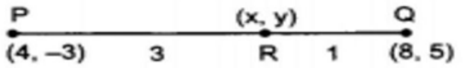
KENDRIYA VIDYALAYA SANGATHAN CHENNAI REGION
CLASS X MATHEMATICS -SOLUTION -BASIC (241)
PREBOARD -1 EXAMINATION 2024-25

Q.NO:	SECTION A	MARKS
1	(c) $3, \frac{-3}{2}$	1
2	(d) $-\frac{7}{2}$	1
3	(a) no solution	1
4	(d) No Real roots	1
5	(d) 16^{th}	1
6	(b) $(6, -12)$	1
7	(c) 4 units.	1
8	(a) $\sqrt{3}$	1
9	(a) $\sqrt{2}$	1
10	(d) $2\sqrt{7}$ cm	1
11	(b) 30 cm	1
12	(c) 6 cm	1
13	(a) πcm^3	1
14	(d) 6400	1
15	(a) 7.5	1
16	(a) Mode = 3 Median -2 Mean	1
17	(b) 1.6	1
18	(b) $\frac{1}{3}$	1
19	(c) A is true but R is false	1
20	(c) A is false but R is true.	1
	SECTION B	
21	We have, $96 = 2^5 \times 3$ and $404 = 2^2 \times 101$ $\therefore$ HCF $= 2^2 = 4$ Now, HCF $\times$ LCM $= 96 \times 404$ $\Rightarrow$ LCM $= \frac{96 \times 404}{\text{HCF}} = \frac{96 \times 404}{4} = 96 \times 101 = 9696$	2

	OR 12,15 and 21 $12 = 2^2 \times 3$ $15 = 3 \times 5$ $21 = 3 \times 7$ HCF = 3 $\text{LCM} = 2^2 \times 3 \times 5 \times 7 = 420$	
22	$\text{PQ} = 10$ $\text{PQ}^2 = 10^2 = 100$ $\Rightarrow (10-2)^2 + \{y-(-3)\}^2 = 100$ $\Rightarrow (8)^2 + (y+3)^2 = 100$ $\Rightarrow 64 + y^2 + 6y + 9 = 100$ $\Rightarrow y^2 + 6y - 27 = 0$ $\Rightarrow y^2 + 9y - 3y - 27 = 0$ $\Rightarrow y(y+9) - 3(y+9) = 0$ $\Rightarrow (y+9)(y-3) = 0$ $\Rightarrow y + 9 = 0$ or $y - 3 = 0$ $\Rightarrow y = -9$ or $y = 3$ $\Rightarrow y = -9, 3$ Hence, the required value of y is -9 or 3 .	**2**
23	 Let coordinates of the required point be R(x, y). This means R divides the join of P(4, −3) and Q(8,5) in the ratio 3: 1 internally. Using the Section formula for internal division, here $x_1 = 4, y_1 = -3, x_2 = 8, y_2 = 5, m = 3, n = 1$ $\Rightarrow (x, y) = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$ $\Rightarrow (x, y) = \left(\frac{3(8) + 1(4)}{3+1}, \frac{3(5) + 1(-3)}{3+1}\right)$ $\Rightarrow (x, y) = \left(\frac{24+4}{4}, \frac{15-3}{4}\right)$ $\Rightarrow (x, y) = \left(\frac{28}{4}, \frac{12}{4}\right) = (7,3)$ $\Rightarrow x = 7$ and $y = 3$ Thus, the coordinates of $R(x, y) = (7,3)$	**2**
24	$\cos A = \frac{5}{13} \Rightarrow \sin A = \frac{12}{13}, \tan A = \frac{12}{5}$ and $\cot A = \frac{5}{12}$ $\text{LHS} = \frac{\frac{5}{13}}{1-\frac{12}{5}} + \frac{\frac{12}{13}}{1-\frac{5}{12}} = \frac{25}{-91} + \frac{144}{91}$ $= \frac{119}{91} = \frac{17}{13}$	**2**

	RHS $= \frac{5}{13} + \frac{12}{13} = \frac{17}{13}$ $\Rightarrow$ LHS = RHS	
25	There are $13(8+5)$ fish out of which one can be chosen in 13 ways. Total number of elementary events $= 13$ There are 5 male fish out of which one male fish can be chosen in 5 ways. Favourable number of elementary events $= 5$ Hence, required probability $= \frac{5}{13}$ **(OR)** Total number of balls in the bag $= 2+3+4 = 9$ i. No of balls which are not green $= 3+4 = 7$ Probability(not green) $= \frac{7}{9}$ ii. No of balls which are not black $= 3+2 = 5$ Probability(not black) $= \frac{5}{9}$	**2**
	SECTION C	
26	We have to prove that $\sqrt{2}$ is an irrational number. Let $\sqrt{2}$ be a rational number. $\therefore\ \sqrt{2} = \frac{p}{q}$ where p and q are co-prime integers and $q \neq 0$ On squaring both the sides, we get, or, $2 = \frac{p^2}{q^2}$ or, $p^2 = 2q^2$ $\therefore$ p^2 is divisible by 2 . p is divisible by 2 Let $p = 2r$ for some integer r or, $p^2 = 4r^2$ $2q^2 = 4r^2 [\because p^2 = 2q^2]$ or, $q^2 = 2r^2$ or, q^2 is divisible by 2 . $\therefore$ q is divisible by 2 From (i) and (ii) p and q are divisible by 2 , which contradicts the fact that p and q are co-primes. Hence, our assumption is wrong. $\therefore$ $\sqrt{2}$ is irrational number.	**3**

27	Let the polynomial be $ax^2 + bx + c$. and its zeroes be α and β. Then, $\alpha + \beta = \sqrt{2} = -\frac{b}{a}$ and $\alpha\beta = \frac{1}{3} = \frac{c}{a}$ If $a = 3$, then $b = -3\sqrt{2}$ and $c = 1$. So, one quadratic polynomial which fits the given conditions is $3x^2 - 3\sqrt{2}x + 1$. It is given that $\alpha + \beta = \sqrt{2}$ and $\alpha\beta = \frac{1}{3}$ Now, standard form of quadratic polynomial is given by $x^2 - (\alpha+\beta)x + \alpha\beta$ $= x^2 - (\alpha+\beta)x + \alpha\beta$ $= x^2 - \sqrt{2}x + \frac{1}{3}$ $= \frac{1}{3}\left(3x^2 - 3\sqrt{2}x + 1\right)$ Hence the required quadratic polynomial is $3x^2 - 3\sqrt{2}x + 1$	**3**
28	Let the length and breadth of the park be l and b. Perimeter $= 2(l + b) = 80$ $l + b = 40$ or, $b = 40 - l$ Area $= l \times b = l(40 - l)$ $= 40l - l^2 = 400$ Given $l^2 - 40l + 400 = 0$ Comparing this equation with $al^2 + bl + c = 0$, we obtain $a = 1, b = -40, c = 400$ Discriminant $D = b^2 - 4ac = (-40)^2 - 4(1)(400) = 1600 - 1600 = 0$ As $b^2 - 4ac = 0$ Therefore, this equation has equal real roots and hence, this situation is possible. Root of this equation, $l = -\frac{b}{2a}$ $l = -\frac{(-40)}{2(1)} = \frac{40}{2} = 20$ Therefore, length of park, $l = 20$ m And breadth of park, $b = 40 - l = 40 - 20 = 20$ m	**3**
29	$\sin A$ can be expressed in terms of sec A as: $\sin A = \sqrt{\sin^2 A}$ $\sin A = \sqrt{(1 - \cos^2 A)}$ $\sin A = \sqrt{1 - \frac{1}{\sec^2 A}}$ $\sin A = \sqrt{\frac{\sec^2 A - 1}{\sec^2 A}}$ $\sin A = \frac{1}{\sec A}\sqrt{\sec^2 A - 1}$	**3**

Now,

$\cos A$ can be expressed in terms of sec A as:

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

tan A can be expressed in the form of sec A as:

As, $1 + \tan^2\ \mathrm{A} = \sec^2\ \mathrm{A}$

$\Rightarrow \tan A = \pm\sqrt{(\sec^2 A - 1})$

since A is an acute angle, and tan A is positive when A is acute, $\mathrm{So}, \tan \mathrm{A} = \sqrt{(\sec^2 A - 1)}$

Now cosec$A$ can be expressed in the form of sec A as:

$$\mathrm{cosec}A = \frac{1}{\sin A_1}$$

$$\mathrm{cosec}A = \frac{1}{\frac{\sec A}{\sqrt{1 - \sec^2 A}}}$$

$$\mathrm{cosec}A = \frac{\sqrt{1 - \sec^2 A}}{\sec A}$$

Now, cot A can be expressed in terms of sec A as:

$$\cot \mathrm{A} = \frac{1}{\tan A}$$

as, $1 + \tan^2\ \mathrm{A} = \sec^2\ \mathrm{A}$

$$\cot A = \frac{1}{\sqrt{\sec^2 A - 1}}$$

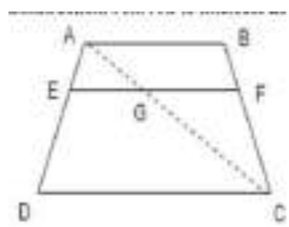
30

Given, In trapezium ABCD ,

$AB \| DC$ and $EF| \mid DC$

To prove $\frac{AE}{ED} = \frac{BF}{FC}$

Construction: Join AC to intersect EF at G.



Proof Since, $AB \| DC$ and $EF \| DC$

$EF \| AB$ [since, lines parallel to the same line are also parallel to each other].

In $\triangle ADC, EG \| DC [\because EF \| DC]$

By using basic proportionality theorem,

$$\frac{AE}{ED} = \frac{AG}{GC}$$

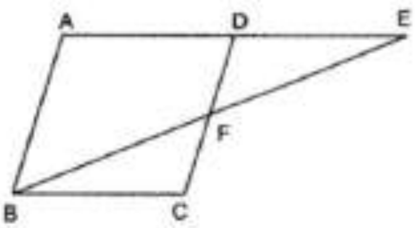
3

In $\triangle ABC, GF || AB [\because EF || AB$ from (i)]
By using basic proportionality theorem ,
$\frac{CG}{AG} = \frac{CF}{BF}$ or $\frac{AG}{GC} = \frac{BF}{CF}$ [On taking reciprocal of the terms]. (iii)

From Equations (ii) and (iii), we get
$$\frac{AE}{ED} = \frac{BF}{FC}$$
Hence Proved.

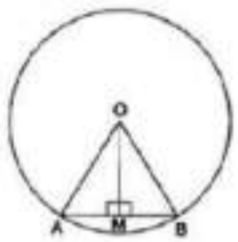
OR

In Δ 's ABE and CFB , we have



$\angle AEB = \angle CBF$ [Alternate angles]
$\angle A = \angle C$ [Opposite angles of a parallelogram]
Thus, by AA-criterion of similarity, we have,
$\triangle ABE \sim \triangle CFB$.

31 | **3**



Given, $\mathrm{r} = 21$ cm and $\theta = 60°$
i. Length of arc $== \frac{\theta}{360} 2\pi \mathrm{r} = \frac{60}{360} \times 2 \times \frac{22}{7} \times 21 = 22$ cm
ii. Area of the sector $= \frac{\theta}{360} \pi \mathrm{r}^2 = \frac{60}{360} \times \frac{22}{7} \times 21 \times 21 = 231\ \mathrm{cm}^2$
iii. Area of segment formed by corresponding chord = Area of the sector - Area of $\triangle$ OAB $= \frac{\theta}{360} \pi \mathrm{r}^2$ - Area of $\triangle$ OAB
$\Rightarrow$ Area of segment = 231 - Area of $\triangle$ OAB
In right angled triangle OMA and OMB,
OM = OB [Radii of the same circle]

	$\mathrm{OM} = \mathrm{OM}$[Common] $\therefore \triangle \mathrm{OMA} \cong \triangle \mathrm{OMB}$[RHS congruency] $\therefore \mathrm{AM} = \mathrm{BM}$[By CPCT] $\therefore M$ is the mid-point of AB and $\angle \mathrm{AOM} = \angle \mathrm{BOM}$ $\Rightarrow \angle \mathrm{AOM} = \angle \mathrm{BOM} = \frac{1}{2} \angle \mathrm{AOB} = \frac{1}{2} \times 60^\circ = 30^\circ$ Therefore, in right angled triangle OMA, $\cos 30^\circ = \frac{OM}{OA}$ $\Rightarrow \frac{\sqrt{3}}{2} = \frac{OM}{21}$ $\Rightarrow \mathrm{OM} = \frac{21\sqrt{3}}{2}$ cm Also, $\sin 30^\circ = \frac{AM}{OA}$ $\Rightarrow \frac{1}{2} = \frac{AM}{21}$ $\Rightarrow \mathrm{AM} = \frac{21}{2}$ cm $\therefore \mathrm{AB} = 2\mathrm{AM} = 2 \times \frac{21}{2} = 21$ cm $\therefore$ Area of $\triangle \mathrm{OAB} = \frac{1}{2} \times \mathrm{AB} \times \mathrm{OM} = \frac{1}{2} \times 21 \times \frac{21\sqrt{3}}{2} = \frac{441\sqrt{3}}{4}\ \mathrm{cm}^2$ Using eq. (1), Area of segment formed by corresponding chord $= \left[231 - \frac{441\sqrt{3}}{4}\right] \mathrm{cm}^2$ $= 40.05\ \mathrm{cm}^2$ **OR** i. $\because$ Diameter $= 35$ mm $\therefore$ Radius $= \frac{35}{2}$ mm $\therefore$ Circum ference $= 2\pi r$ $= 2 \times \frac{22}{7} \times \frac{35}{2} = 110$ mm Length of 5 diameters $= 35 \times 5 = 175$ mm $\therefore$ The total length of the silver wire required $$= 110 + 175 = 285 \text{ mm}$$ ii. $r = \frac{35}{2}$ mm, $\theta = \frac{360^\circ}{10} = 36^\circ$ $\therefore$ The area of each sector of the brooch	

$= \frac{36}{360} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} = \frac{385}{4}\ \text{mm}^2$

SECTION D

32 | **5**

32. Let the dimensions (i.e., length and width) of the garden be x and y respectively.

Then, $x = y + 4$ and $\frac{1}{2}(2x + 2y) = 36$

$\Rightarrow \mathrm{x} - \mathrm{y} = 4 \ldots (1)$

$\mathrm{x} + \mathrm{y} = 36$

Let us draw the graphs of equations (1) and (2) by finding two solutions for each of the equations. These two solution of the equations (1) and (2) are given below in table 1 and table 2 respectively.

For equation (1)

$x - y = 4$

$\Rightarrow \mathrm{y} = \mathrm{x} - 4$

Table 1 of solutions

x	4	2
y	0	-2

For equation (2) $\mathrm{x} + \mathrm{y} = 36$

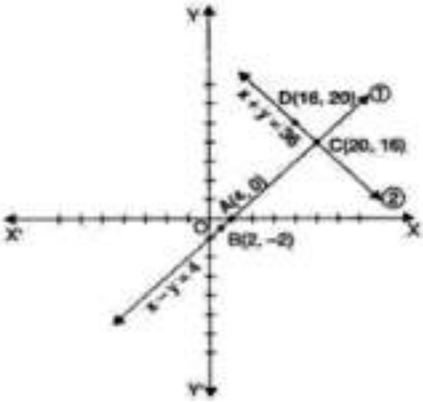
$\Rightarrow \mathrm{y} = 36 - \mathrm{x}$

Table 2 of solutions

x	20	16
y	16	20

We plot the points $\mathrm{A}(4,0)$ and $\mathrm{B}(2,-2)$ on a graph paper and join these points to form the line AB representing. The equation (1) as shown in the figure.

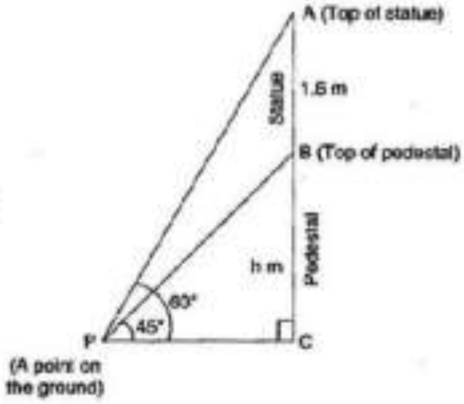
Also, we plot the points $C(20,16)$ and $D(16,20)$ on the same graph paper and join these points to form the line CD representing the equation (2) as shown in the same figure.

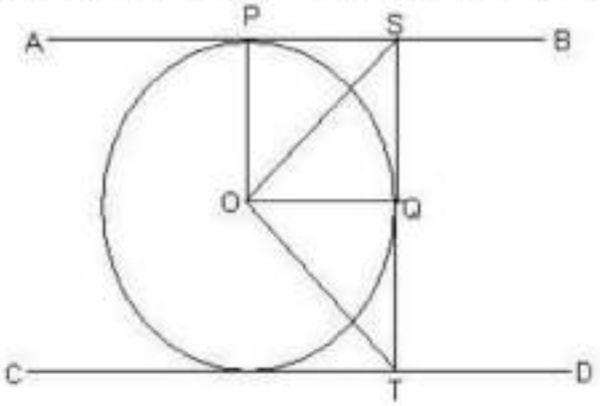


In the figure, we observe that the two lines intersect at the point $C(20,16) So\ x=20, y=16$ is the required solution of the pair of linear equations formed. i.e., the dimensions of the garden are 20 m and 16 m .
Verification : substituting $x=20$ and $y=16$ in (1) and (2), we find that both the equations are satisfied as shown below:
$20-16=4$
$20+16=36$
This verifies the solution.

OR

Suppose the numerator and denominator of the fraction be x and y respectively.
Then the fraction is $\frac{x}{y}$.
If 1 is added to the numerator and 1 is subtracted from the denominator, the fraction becomes 1 .
Thus, we have $\frac{x+1}{y-1}=1$
$\Rightarrow (x+1)=(y-1)$
$\Rightarrow x+1-y+1=0$
$\Rightarrow x-y+2=0$
If 1 is added to the denominator, the fraction becomes $\frac{1}{2}$.
Thus, we have $\frac{x}{y+1}=\frac{1}{2}$
$\Rightarrow 2x=(y+1)$
$\Rightarrow 2x-y-1=0$
We have two equations
$x-y+2=0$
$2x-y-1=0$
By Solving
So, $x=3$ and $y=5$.
The fraction is $\frac{3}{5}$.

33	 Let the height of the pedestal be h m. $\therefore$ BC = h m In right triangle ACP, $\tan 60^\circ = \frac{AC}{PC}$ $\Rightarrow \sqrt{3} = \frac{AB+BC}{PC}$ $\Rightarrow \sqrt{3} = \frac{1.6+h}{\text{PC}}$ ....(i) In right triangle BCP, $\tan 45^\circ = \frac{BC}{PC}$ $\Rightarrow 1 = \frac{h}{\text{PC}} \Rightarrow \text{PC} = h$ $\therefore \sqrt{3} = \frac{1.6+h}{h}$ [From eq. (i)] $\Rightarrow \sqrt{3}h = 1.6 + h \Rightarrow h(\sqrt{3}-1) = 1.6 \Rightarrow \frac{1.6}{\sqrt{3}-1}$ $\Rightarrow \quad \frac{1.6(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} \Rightarrow h = \frac{1.6(\sqrt{3}+1)}{3-1} \Rightarrow h = \frac{1.6(\sqrt{3}+1)}{2}$ $\Rightarrow h = 0.8(\sqrt{3}+1)_{\text{m}}$	**5**

34	34. Given, AB and CD are two parallel tangents to a circle with centre O.  From the figure we get, AB⊥ST then $\angle ASQ = 90°$ and CD⊥TS then $\angle CTQ = 90°$ $\angle ASO = \angle QSO = \frac{90°}{2} = 45°$ Similarly, $\angle OTQ = 45°$ Consider ΔSOT, $\angle OTS = 45°$ and $\angle OST = 45°$ $\angle SOT + \angle OTS + \angle OST = 180°$ (angle sum property) $\angle SOT = 180° - (\angle OTS + \angle OST) = 180° - (45° + 45°)$ $= 180° - 90° = 90°$ $\therefore \angle SOT = 90°$	**5**
35	35. <u>Mode:</u> Here, the maximum frequency is 23 and the class corresponding to this frequency is 35 - 45. So, the modal class is 35 - 45. Now, size (h) = 10 lower limit it (l) of modal class = 35 frequency (f_1) of the modal class = 23 frequency (f_0) of class previous the modal class = 21 frequency (f_2) of class succeeding the modal class = 14 $\therefore$ Mode $= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 35 + \frac{23-21}{2\times 23-21-14} \times 10$ $= 35 + \frac{2}{11} \times 10 = 35 + \frac{20}{11}$ $= 35 + 1.8$ (approx.) $= 36.8$ years (approx.)	**5**

Mean:-

Take a = 40, h = 10.

Age (in years)	Number of patients (f_i)	Class marks (x_i)	$d_i = x_i - 40$	$u_i = \frac{x_i - 40}{10}$	$f_i u_i$
5-15	6	10	-30	-3	-18
15-25	11	20	-20	-2	-22
25-35	21	30	-10	-1	-21
35-45	23	40	0	0	0
45-55	14	50	10	1	14
55-65	5	60	20	2	10
Total	$\sum f_i = 80$				$\sum f_i u_i = -37$

Using the step deviation method,

$\bar{x} = a + \left(\frac{\sum f_i u_i}{\sum f_i}\right) \times h = 40 + \left(\frac{-37}{80}\right) \times 10$

$= 40 - \frac{37}{8} = 40 - 4.63$

$= 35.37$ years

Interpretation:- Maximum number of patients admitted in the hospital are of the age 36.8 years (approx.), while on an average the age of a patient admitted to the hospital is 35.37 years.

OR

Life time	Number of lamps (f_i)	Cumulative frequency
1500-2000	14	14
2000-2500	56	14 + 56 = 70
2500-300	60	70 + 60 = 130
3000-3500	86	130 + 86 = 216
3500-4000	74	216 + 74 = 290
4000-4500	62	290 + 62 = 352
4500-5000	48	352 + 48 = 400
	400	

N = 400

Now we may observe that cumulative frequency just greater than $\frac{n}{2}$ (ie., $\frac{400}{2}$ = 200) is 216

Median class = 3000 - 3500

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

Here,

l = Lower limit of median class

F = Cumulative frequency of class prior to median class.

f = Frequency of median class.

h = Class size.

Lower limit (l) of median class = 3000

Frequency (f) of median class 86

Cumulative frequency (cf) of class preceding median class = 130

Class size (h) = 500

$$\text{Median} = 3000 + \left(\frac{200-130}{86}\right) \times 500$$

$= 3000 + \frac{70 \times 500}{86}$

= 3406.98

SECTION E

36 (4 marks)

(i) n=16

(ii) a_{16} =15

(iii) a_{10}= 21

(or)

26 bricks in 5^{th} row

37	37. i. Since $\angle D = \angle C$ and $\angle B = \angle A$ (Alternate interior angles) $\therefore \triangle OAC \sim \triangle OBD$ (By AA similarity) ii. $\triangle OAC \sim \triangle OBD \Rightarrow \frac{OA}{OB} = \frac{AC}{BD}$ or $\frac{OA}{AC} = \frac{OB}{BD}$ iii. a. $\triangle OAC \sim \triangle OBD \Rightarrow \frac{OA}{OB} = \frac{OC}{OD}$ $\Rightarrow \frac{3x+4}{x} = \frac{3x+19}{x+3} \Rightarrow x = 2$ $\therefore OC = 25$ **OR** b. $\triangle OBD \sim \triangle OAC \Rightarrow \frac{OB}{OA} = \frac{OD}{OC} = \frac{BD}{AC}$ $\Rightarrow \frac{x}{3x+4} = \frac{x+3}{3x+19} \Rightarrow x = 2$ $\therefore \frac{BD}{AC} = \frac{2}{10}$ or $\frac{1}{5}$	**4**
38	38. i. Volume of the cuboid $= 15 \times 10 \times 3.5 = 525\text{cm}^3$ ii. Volume of a conical depression $= \frac{1}{3}\pi(0.5)^2(1.4)$ $= \frac{1}{3} \times \frac{22}{7} \times 0.25 \times \frac{14}{10} = \frac{11}{30}\text{cm}^3$ $\therefore$ Volume of four conical depressions $= 4 \times \frac{11}{30}\text{cm}^3 = \frac{22}{15}\text{cm}^3 = 1.47\text{cm}^3$ iii. $\therefore$ Volume of the wood in the entire stand = volume of cuboid - volume of 4 conical depressions $= 525 - 1.47 = 523.53\text{cm}^3$ **OR** Cost of wood per cm^3 = ₹ 10 Total cost of making pen stand = 10×523.53 = ₹ 5235.3	**4**