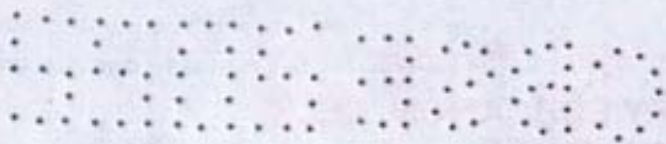


Class-X

Mathematics Standard (041)



Section-A

Ques 1 To prove: - $ORPQ$ is a square i.e. $\angle O = \angle Q = \angle P = \angle R = 90^\circ$
and $OQ = QP = PR = OR$

Proof: - $\left. \begin{array}{l} \angle OQP = 90^\circ \\ \angle ORP = 90^\circ \end{array} \right\}$ Tangent is perpendicular to — ①
the radius at the point of contact.

Now, In $\triangle ORP$ and $\triangle OQP$

$OP = OP$ (Common)

$OR = OQ$ (Radii of same circle)

$PR = PQ$ (Tangents from an external point
to a circle are equal)

Therefore, $\triangle ORP \cong \triangle OQP$ by SSS rule

$\therefore \angle OPR = \angle OQP$ (By CPCT)

$$\Rightarrow \angle OPR = \angle OQP = 45^\circ$$

$$\Rightarrow \angle OPR + \angle OQP = 90^\circ$$

$$\Rightarrow \angle QPR = 90^\circ \text{ — ②}$$

In quad. $OQPR$

$$\angle OQP + \angle QPR + \angle PRO + \angle ROQ = 360^\circ \text{ (Angle Sum Property)}$$

$$90 + 90 + 90 + \angle ROQ = 360$$

$$\angle ROQ = 360 - 270$$

$$\angle ROQ = 90^\circ \text{ --- (3)}$$

$$\text{Also } OR = PR \text{ --- (4)}$$

(As $\angle ROP = \angle RPO = 45^\circ$) (Isosceles triangle property)

Also $OQ = PR$ (Tangents from an external point to a circle are equal) --- (5)

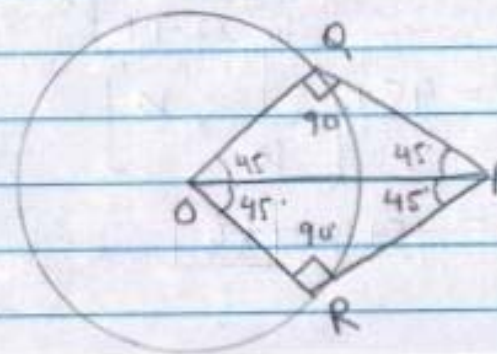
\Rightarrow Using (4) and (5)

$$OQ = PQ = PR = OR \text{ --- (6)}$$

Using (1), (2), (3), (6)

$OQPR$ is a square.

Hence proved.



Ques 2

| Class | Frequency |
|-------|------------------------------------|
| 15-25 | 6 |
| 25-35 | 11 |
| 35-45 | f_0 22 |
| 45-55 | f_1 23 \rightarrow Modal class |
| 55-65 | f_2 14 |
| 65-75 | 5 |

$$\begin{aligned}
 \text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\
 &= 45 + \left(\frac{23 - 22}{46 - 22 - 14} \right) \times 10 \\
 &= 45 + \left(\frac{1}{10} \times 10 \right) \\
 &= 45 + 1 = \boxed{46}
 \end{aligned}$$

$$\begin{array}{r}
 23 \\
 \times 2 \\
 \hline
 46 \\
 -22 \\
 \hline
 24 \\
 -14 \\
 \hline
 10 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 46 \\
 \times 2 \\
 \hline
 92 \\
 -22 \\
 \hline
 70 \\
 -14 \\
 \hline
 56 \\
 \hline
 \end{array}$$

Ques 3

$a=10$

$$S_{14} = \frac{n}{2} (2a + (n-1)d)$$

$$1505 = \frac{14}{2} (2(10) + 13d)$$

$$1505 = 7(20 + 13d)$$

$$\frac{1505}{7} = 20 + 13d$$

$$215 = 20 + 13d$$

$$\frac{195}{13} = d$$

$$\underline{\underline{d=15}}$$

Ques 4

9, 7, 5 _____ and 15, 12, 9 _____

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

$$= 9 + (n-1) \cdot (-2)$$

$$= 9 - 2n + 2$$

$$= 11 - 2n$$

$$a'_n = a' + (n-1)d'$$

$$= 15 + (n-1) \cdot (-3)$$

$$= 15 - 3n + 3$$

$$= 18 - 3n$$

$$\begin{array}{r} \overline{)1505} \quad 215 \\ \underline{42} \\ 10 \\ \underline{70} \\ 35 \end{array}$$

$$\begin{array}{r} \overline{)215} \\ \underline{21} \\ 0 \\ \underline{0} \\ 0 \end{array}$$

$$\begin{array}{r} \overline{)195} \\ \underline{13} \\ 82 \\ \underline{79} \\ 3 \end{array}$$

$$\begin{array}{r} \overline{)195} \\ \underline{13} \\ 82 \\ \underline{79} \\ 3 \end{array}$$

$$\begin{array}{r} 613 \\ \times 5 \\ \hline 3065 \end{array}$$

$$\begin{array}{r} \overline{)195} \quad 15 \\ \underline{13} \\ 65 \end{array}$$

5



6

$$\text{Since } a_n = a^n$$

$$11 - 2n = 18 - 3n$$

$$11 - 18 = -3n + 2n$$

$$-7 = -n$$

$$\boxed{n=7}$$

Ques 5

$$(a) \quad x^2 - 2ax - (4b^2 - a^2) = 0$$

$$\begin{aligned} b^2 - 4ac &= 4a^2 - 4[-(4b^2 - a^2)] \quad (i) \\ &= 4a^2 - 4[-4b^2 + a^2] \\ &= 4a^2 + 16b^2 - 4a^2 \\ &= 16b^2 \end{aligned}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{2a \pm \sqrt{16b^2}}{2(1)} = \frac{2a \pm 4b}{2}$$

$$\Rightarrow x = \frac{2a + 4b}{2} \quad x = \frac{2a - 4b}{2}$$

$$x = \underline{a + 2b} \quad x = \underline{a - 2b}$$

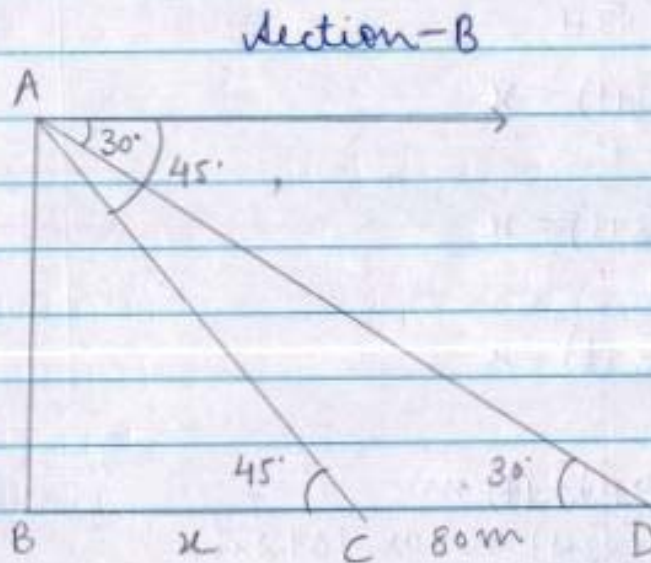
Ques 6

- (b) length of cuboid = 18cm
- Breadth of cuboid = 6cm
- Height of cuboid = 6cm

$$\begin{aligned}
 \text{TSA of the cuboid} &= 2(lb + bh + hl) \\
 &= 2(18 \times 6 + 6 \times 6 + 6 \times 18) \\
 &= 2(108 + 36 + 108) \\
 &= 2(252) \\
 &= \underline{504 \text{ cm}^2}
 \end{aligned}$$

$$\begin{array}{r}
 8 \\
 \times 6 \\
 \hline
 48 \\
 0 \\
 \hline
 48 \\
 \times 2 \\
 \hline
 96 \\
 \times 2 \\
 \hline
 192 \\
 \times 2 \\
 \hline
 384 \\
 \times 2 \\
 \hline
 768 \\
 \times 2 \\
 \hline
 1536 \\
 \times 2 \\
 \hline
 3072 \\
 \times 2 \\
 \hline
 6144
 \end{array}$$

Ques 7



8

In $\triangle ABC$

$$\tan 45 = \frac{p}{b} = \frac{AB}{x}$$

$$1 = \frac{AB}{x}$$

$$\boxed{AB = x}$$

In $\triangle ABD$

$$\tan 30 = \frac{p}{b} = \frac{AB}{80+x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{80+x}$$

$$80+x = \frac{AB}{\sqrt{3}}$$

$$80+x = \frac{x}{\sqrt{3}}$$

$$80+x = \sqrt{3}x$$

$$80 = \sqrt{3}x - x$$

$$80 = x(\sqrt{3}-1)$$

$$\frac{80}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = x$$

$$\frac{80(\sqrt{3}+1)}{(\sqrt{3})^2-1^2} = x$$

$$\frac{80(\sqrt{3}+1)}{3-1} = x$$

$$\frac{80(\sqrt{3}+1)}{2} = x$$

$$x = 40(\sqrt{3}+1) \text{ m}$$

$$\Rightarrow AB = 40(\sqrt{3}+1) \text{ m or } 109.2 \text{ m}$$

$$\begin{array}{r} 1.73 \\ \times 2.73 \\ \hline 10920 \end{array}$$

$$\begin{array}{r} 2.73 \\ \times 4 \\ \hline 10920 \end{array}$$

$$\begin{array}{r} 1.73 \\ \times 2.73 \\ \hline 10920 \end{array}$$

$$\begin{array}{r} 2.73 \\ \times 40 \\ \hline 10920 \end{array}$$

$$\begin{array}{r} 273 \\ \times 40 \\ \hline 10920 \end{array}$$



Ques 8

| Class | Frequency | C.F. |
|-----------|-----------|-------------------|
| 1400-1550 | 6 | 6 |
| 1550-1700 | 13 | 19 |
| 1700-1850 | 25 | 44 → Median class |
| 1850-2000 | 10 | 54 = n |

$$\begin{aligned} \text{Median} &= l + \left(\frac{\frac{n}{2} - CF}{f} \right) \times h \\ &= 1700 + \left(\frac{27 - 19}{25} \right) \times 150 \\ &= 1700 + \left(\frac{8}{25} \right) \times 150 \\ &= 1700 + 48 \\ &= \underline{\underline{1748}} \end{aligned}$$

$$\begin{array}{r} 13 \\ + 6 \\ \hline 19 \\ + 25 \\ \hline 44 \\ \hline 54 \\ \hline \end{array}$$

$$\frac{54}{2} = 27$$

$$\begin{array}{r} 1850 \\ - 1700 \\ \hline 150 \\ \hline \end{array}$$

$$\begin{array}{r} 1270 \\ - 19 \\ \hline 1251 \\ \hline \end{array}$$

$$\begin{array}{r} 19 \\ + 25 \\ \hline 44 \\ \hline \end{array}$$

$$\begin{array}{r} 1850 \\ - 1700 \\ \hline 150 \\ \hline \end{array}$$

$$\frac{54}{2} = 27$$

$$\begin{array}{r} 27 \\ - 19 \\ \hline 8 \\ \hline \end{array}$$

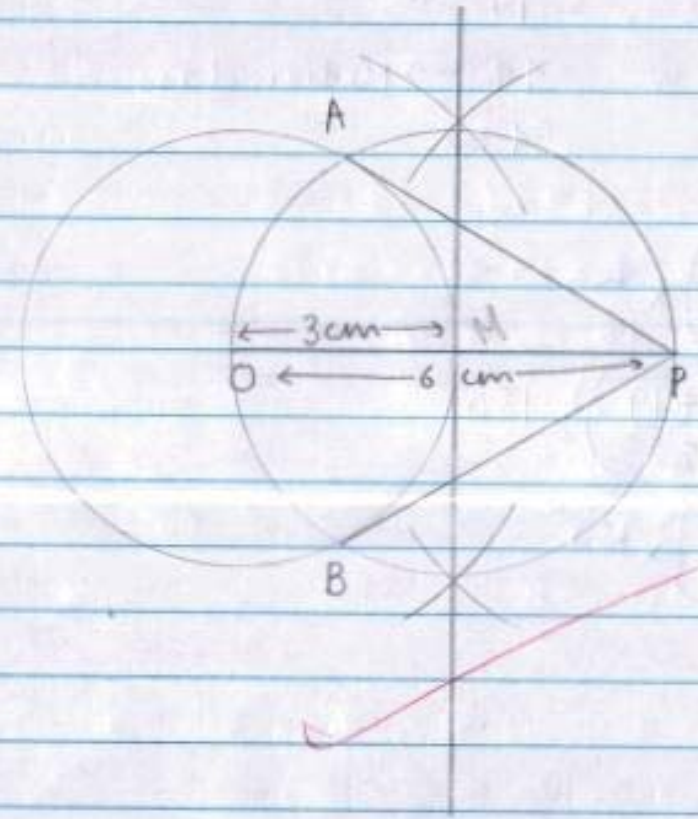


10

CONSTRUCTION

CONSTRUCTION

Ques?
(b)



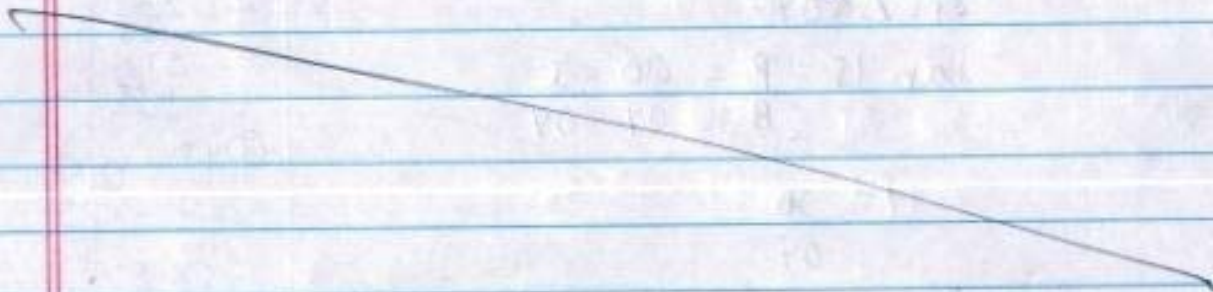
CONSTRUCTION

CONSTRUCTION

11

Steps of Construction →

1. Draw a circle with O as centre and radius 3cm .
2. Take a point P outside the circle at a distance of 6cm from its centre O .
3. Join OP .
4. Construct the perpendicular bisector of OP .
5. Name the mid-point of OP as H .
6. Draw a circle with H as centre and radius OH .
7. The second circle intersects the first circle at two points. Name them A and B .
8. Connect PA and PB .
9. PA and PB are the required tangents.



12

Ques 10

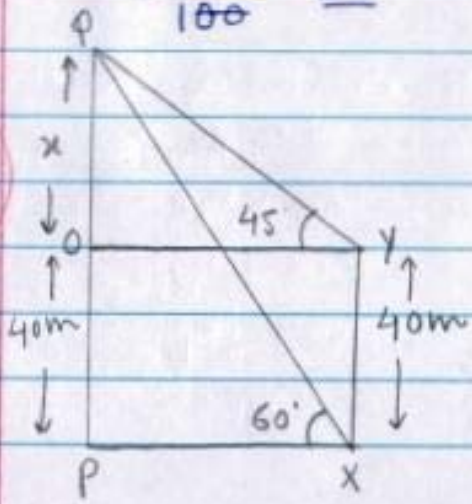
| Class | Frequency (fi) | xi | fixi |
|-------|----------------|----|-------------|
| 0-10 | 12 | 5 | 60 |
| 10-20 | 18 | 15 | 270 |
| 20-30 | 27 | 25 | 675 |
| 30-40 | 20 | 35 | 700 |
| 40-50 | 17 | 45 | 765 |
| 50-60 | 6 | 55 | 330 |
| | <u>100</u> | | <u>2800</u> |

$\frac{30}{2} = 65$
 $\frac{18}{2} \times 15 = 270$
 $\frac{27}{2} \times 25 = 675$
 $\frac{20}{2} \times 35 = 700$
 $\frac{17}{2} \times 45 = 765$
 $\frac{6}{2} \times 55 = 330$

$$\text{Mean} = \frac{\sum fixi}{\sum fi}$$

$$\bar{x} = \frac{2800}{100} = \underline{\underline{28}}$$

Ques 11



In ΔPOY
 $\tan 45 = \frac{P}{B} = \frac{PO}{OY} = \frac{x}{x}$
 $1 = \frac{x}{OY}$
 $OY = x \Rightarrow PY = x$

In ΔQP_x

$$\tan 60 = \frac{PQ}{BQ} = \frac{QP}{P_x} = \frac{40+x}{x}$$

$$\sqrt{3} = \frac{40+x}{x}$$

$$\sqrt{3}x = 40+x$$

$$\sqrt{3}x - x = 40$$

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

$$x = \frac{40}{(\sqrt{3}-1)} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{40(\sqrt{3}+1)}{(\sqrt{3})^2 - 1^2} = \frac{40(\sqrt{3}+1)}{3-1}$$

$$x = \frac{40(\sqrt{3}+1)}{2}$$

$$x = 20(\sqrt{3}+1) \text{ m}$$

$$x = 54.6 \text{ m}$$

$$\Rightarrow \boxed{P_x = 54.6 \text{ m}}$$

$$PQ = 40 + x$$

$$= 40 + 54.6$$

$$= \boxed{94.6 \text{ m}}$$

1.73

$$\frac{41}{2.73}$$

$$\begin{array}{r} 273 \text{ } \\ \times 2 \\ \hline 546 \end{array}$$

$$\begin{array}{r} 273 \text{ } \\ \times 20 \\ \hline 5460 \end{array}$$

$$\begin{array}{r} 546 \text{ } \\ \times 20 \\ \hline 10920 \end{array}$$

$$\begin{array}{r} 40 \\ \times 23 \\ \hline 920 \\ \hline 946 \end{array}$$

$$\begin{array}{r} 18 \\ \times 5 \\ \hline 90 \\ \hline 270 \end{array}$$

$$\begin{array}{r} 18 \\ \times 5 \\ \hline 90 \\ \hline 270 \end{array}$$

$$\begin{array}{r} 27 \\ \times 25 \\ \hline 135 \\ \hline 540 \end{array}$$

$$\begin{array}{r} 27 \\ \times 25 \\ \hline 135 \\ \hline 540 \end{array}$$

$$\begin{array}{r} 35 \\ \times 2 \\ \hline 70 \\ \hline 700 \end{array}$$

$$\begin{array}{r} 35 \\ \times 2 \\ \hline 70 \\ \hline 700 \end{array}$$

$$\begin{array}{r} 35 \\ \times 2 \\ \hline 70 \\ \hline 700 \end{array}$$

$$\begin{array}{r} 35 \\ \times 2 \\ \hline 70 \\ \hline 700 \end{array}$$

$$\begin{array}{r} 1.73 \\ \times 1 \\ \hline 1.73 \end{array}$$

$$\begin{array}{r} 1.73 \\ \times 1 \\ \hline 1.73 \end{array}$$

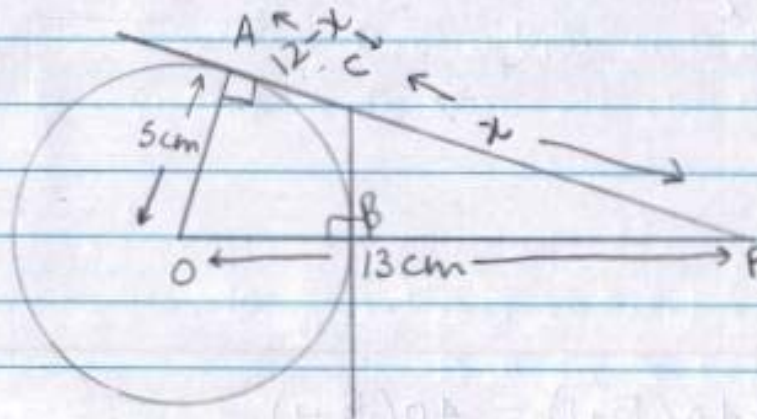
$$\begin{array}{r} 45 \\ \times 7 \\ \hline 315 \end{array}$$

$$\begin{array}{r} 45 \\ \times 7 \\ \hline 315 \end{array}$$

$$\begin{array}{r} 45 \\ \times 7 \\ \hline 315 \end{array}$$

$$\begin{array}{r} 45 \\ \times 7 \\ \hline 315 \end{array}$$

Ques 12
(b)



$\angle OAP = 90^\circ$ (Tangent is perpendicular to radius at the point of contact)

Using pythagoras theorem in $\triangle OAP$

$$H^2 = B^2 + P^2$$

$$OP^2 = AP^2 + OA^2$$

$$13^2 = AP^2 + 5^2$$

$$169 = AP^2 + 25$$

$$169 - 25 = AP^2$$

$$\Rightarrow AP^2 = 144$$

$$AP = \sqrt{144} = \underline{\underline{12\text{cm}}}$$

Let PC be x and AC be $12-x$

$AC = BC = 12-x$ (Tangents from point C to the circle are equal)

Also $OP = 13 \text{ cm}$

$OB = 5 \text{ cm}$

$BP = OP - OB$

$BP = 8 \text{ cm}$

$\angle OBC = 90^\circ$ (Tangent is perpendicular to the radius at the POC)
 $\Rightarrow \angle CBP = 90^\circ$ (Linear pair)

Using Pythagoras theorem in ΔCBP

$$H^2 = B^2 + P^2$$

$$CP^2 = BP^2 + BC^2$$

$$x^2 = 8^2 + (12-x)^2$$

$$x^2 = 64 + 144 + x^2 - 24x$$

$$24x = 64 + 144$$

$$24x = 208$$

$$x = \frac{208 + 104 \cancel{52}}{24 \div 12 \cdot 6} = \frac{312}{3}$$

$$BC = 12 - x$$

$$BC = 12 - \frac{26}{3}$$

$$BC = \frac{36 - 26}{3} = \frac{10}{3} = \boxed{3.34 \text{ m}}$$

$$\begin{array}{r} 944 \\ 104 \\ \hline 208 \end{array}$$

$$\begin{array}{r} 0144 \\ 144 \\ \hline 208 \end{array}$$

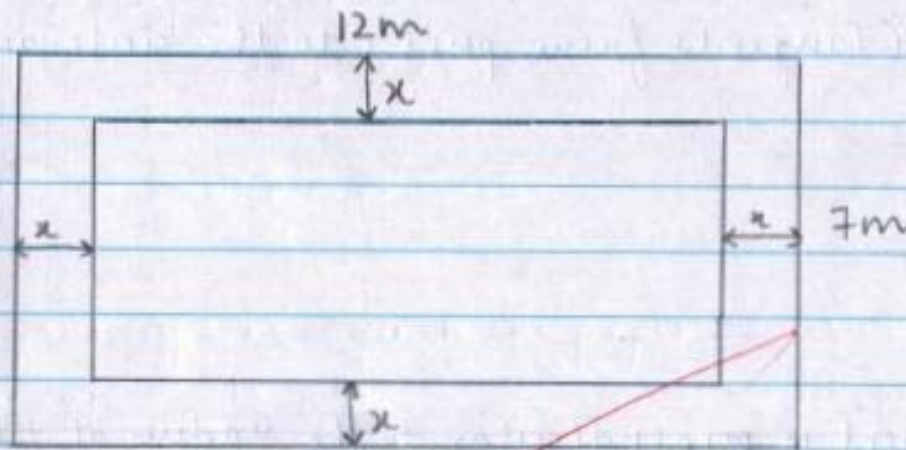
$$\begin{array}{r} 208 \\ 208 \\ \hline 24 \end{array}$$

$$\begin{array}{r} 20 \\ 20 \\ \hline 10 \end{array}$$

$$\begin{array}{r} 26 \\ 104 \\ 24 \\ \hline 3 \end{array}$$

16

Ques 13



Length of pool = $(12-2x)$ m Dimensions of pool —
 Breadth of pool = $(7-2x)$ m $(12-2x)$ and $(7-2x)$

(a) Area = length \times breadth

$$36 = (12-2x)(7-2x)$$

$$36 = (84 - 24x - 14x + 4x^2)$$

$$36 = 84 - 38x + 4x^2$$

$$36 - 84 = -38x + 4x^2$$

$$-48 = -38x + 4x^2$$

$$4x^2 - 38x + 48 = 0 \Rightarrow 2x^2 - 19x + 24 = 0$$

$$\begin{array}{r} 019 \\ \times 2 \\ \hline 38 \end{array}$$

$$\begin{array}{r} 24 \\ \times 2 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 78 \rightarrow 14 \\ -36 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 784 \\ -36 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 38 \\ \times 3 \\ \hline 114 \\ \times 3 \\ \hline 48 \end{array}$$

$$(b) \quad 2x^2 - 19x + 24 = 0$$

$$2x^2 - 16x - 3x + 24 = 0$$

$$2x(x-8) - 3(x-8) = 0$$

$$x = \frac{3}{2} \quad x = 8$$

$x = 8$ will be neglected because if $x = 8$ the ~~width~~ ^{width of} sidewalk ~~will become~~ will become more than 16 but ~~it is~~ ^{they are} already given 7m and 12m ^{the dimensions}

$$\therefore \boxed{x = 1.5 \text{ m}}$$

Quest 4

(a) CSA of one cap = Square cm paper required for one cap

$$2\pi r = 44$$

$$2 \times \frac{22}{7} \times r = 44$$

$$r = \frac{44 \times 7}{2 \times 2} = 7 \text{ cm}$$

$$l^2 = h^2 + r^2$$

$$l^2 = 24^2 + 7^2$$

$$l^2 = 576 + 49$$

$$l^2 = 625$$

$$l = 25 \text{ cm}$$

$$\begin{array}{r} 48 \\ 1 \times 48 \\ 2 \times 24 \\ 3 \times 16 \\ \hline 156 \end{array}$$

$$\begin{array}{r} 0 \\ 24 \\ \times 27 \\ \hline 176 \\ 490 \\ \hline 648 \end{array}$$

CSA of one cap = $\pi r h$
 $= \frac{22}{7} \times 7 \times 25$
 $= 550 \text{ cm}^2$

CSA of four caps i.e. square cm paper required for four caps = 4×550
 $= 2200 \text{ cm}^2$

(b) Volume of cake = $\pi r^2 h$ | $d = 24 \text{ cm}$
 $= \frac{22}{7} \times 12 \times 12 \times 14$ | $r = \frac{d}{2} = 12 \text{ cm}$
 $= 6336 \text{ cm}^3$

$650 \text{ cm}^3 = 100 \text{ g}$ or 0.1 kg
 $6336 \text{ cm}^3 = \frac{0.1 \text{ kg} \times 6336}{650} = \frac{6336}{6500} = \frac{95.9}{100} = 0.95 \text{ kg}$

so they should order a 1 kg cake.

Handwritten calculations on the right side of the page:

- $25 \times 22 = 550$
- $550 \times 4 = 2200$
- $12 \times 12 = 144$
- $144 \times 22 = 3168$
- $3168 \times 2 = 6336$
- $6336 \div 650 = 9.747$
- $9.747 \times 100 = 974.7$
- $974.7 \div 1000 = 0.9747 \approx 0.95 \text{ kg}$