Exercise 9.2

1. Find the ratio of the areas of similar figures if the ratio of their corresponding lengths are:

(i) 1 : 3 (ii) 3 : 4 (iii) 2 : 7

(iv) 8 : 9 (v) 6 : 5

Sol: If the ratio of the length is $\frac{l_1}{l_2}$. Then ratio of their areas is

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$$

(i) Ratio in length is $1 : 3 = \frac{1}{3}$

Ratio in Areas $= \left(\frac{1}{3}\right)^2 = \frac{1}{3}$

Ratio is 1 : 9

(ii) Ratio 3 : 4 or $\frac{3}{4}$

Ratio in Areas $= \left(\frac{3}{4}\right)^2 = \frac{9}{16}$

Ratio in 9 : 16

(iii) Ratio in length $= 2 : 7 = \frac{2}{7}$

Ratio in Areas $= \left(\frac{2}{7}\right)^2 = \frac{4}{49}$

Ratio in 4 : 49

(iv) Ratio in length $= 8 : 9$ or $\frac{8}{9}$

Ratio in Areas $= \left(\frac{8}{9}\right)^2 = \frac{64}{81}$

Ratio = 64 : 81

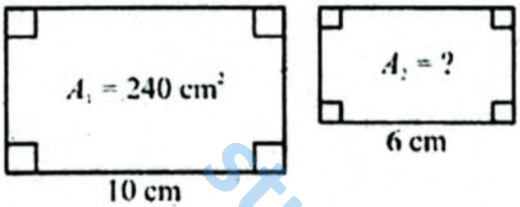
(v) Ratio in length = 6 : 5 or $\frac{6}{5}$

Ratio in Areas = $\left(\frac{6}{5}\right)^2 = \frac{36}{25}$

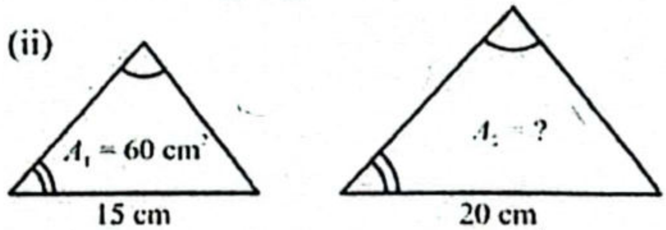
Ratio = 36 : 25

2. Find the unknowns in the following figures:

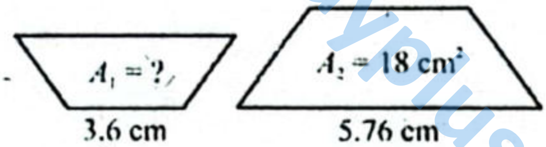
(i)



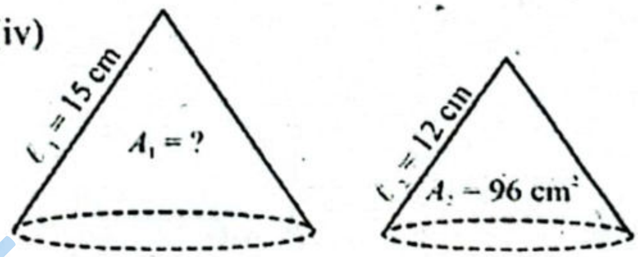
(ii)



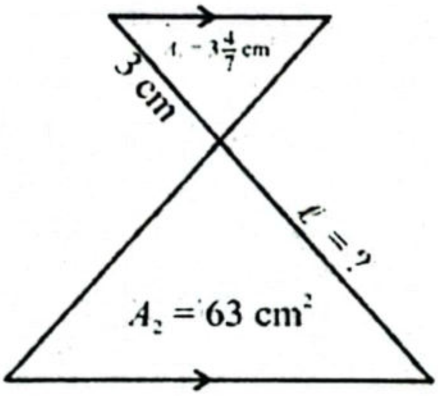
(iii)



(iv)



(v)



Sol: Ratio between lengths = $\frac{10}{6}$

(i) 1^{st} Area $A_1 = 240$

2^{nd} Area $A_2 = ?$

$$\frac{A_1}{A_2} = \left(\frac{10}{6}\right)^2$$

$$\frac{240}{A_2} = \frac{100}{36}$$

$$A_2 = \frac{240 \times 36}{100} \text{ cm}^2$$

$= 86.4\ cm^2$

(ii) $l_1 = 15, l_2 = 20$

$A_1 = 60 \quad , \quad A_2 = ?$

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2 = \left(\frac{15}{20}\right)^2 = \frac{225}{400}$$

$$\frac{60}{A_2} = \frac{225}{400}, \quad A2 = \frac{60 \times 400}{225}\ cm^2$$

$A_2 = 106.67$

(iii) $l_1 = 3.6 A_1 = ?$

$A_2 = 18\ cm^2 \qquad l_2 = 5.76$

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$$

$$A_1 = \left(\frac{l_1}{l_2}\right)^2 \therefore A_2$$

$$= \left(\frac{3.6}{5.76}\right)^2 \times 18$$

$A_1 = (.643)^2 \times 18$

$= 7.44$

(iv) $A_1 = ?\ ;\ l_1 = 15, l_2 = 12$

$A_2 = 96$

$$\frac{A_1}{A_2} = \left(\frac{15}{12}\right)^2 \quad \therefore \quad A_1 = \left(\frac{15}{12}\right)^2 \times 96$$

$A_1 = 107.88$

(v) $A_1 = 3\frac{4}{7}\ cm^2 \quad , \qquad A_2 = 63\ cm^2$

$l_2 = 3cm \quad , \qquad l_1 = ?$

$$\left(\frac{l_1}{l_2}\right)^2 = \frac{\frac{25}{7}}{63} = \frac{25}{7 \times 63}$$

$$\frac{l_1^2}{9} = \frac{25}{7 \times 63}$$

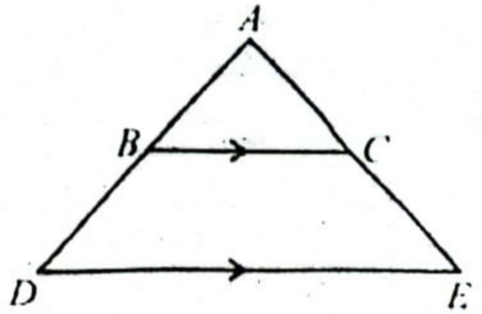
$$l_1^2 = \frac{25 \times 9}{7 \times 63_7} = \frac{25}{7 \times 7}$$

$$l_1 = \sqrt{\frac{25}{49}} = \frac{5}{7}\text{cm}$$

3. Given that area of ΔABC = 36 cm^2 and $m\overline{AB} = 6$ cm, $m\overline{BD} = 4$ cm. Find

(a) the area of ΔADE

(b) the area of trapezium $BCED$



Sol: Area of ΔBC = 36cm^2 = A_1.

Measure of AB = l_1 = 6cm

Measure of BD = l_2 = 4cm

Find (a) Area of ADE Δ Area of Trap. DBCE.

Length of AD = l_2

= AB + BD

= 6 + 4 = 10

$\because$ $\overline{BC} \parallel DE$

$\therefore$ $\Delta ABC \approx \Delta ADE$

Hence $\frac{A_1}{A_2} = \left[\frac{l_1}{l_2}\right]^2$

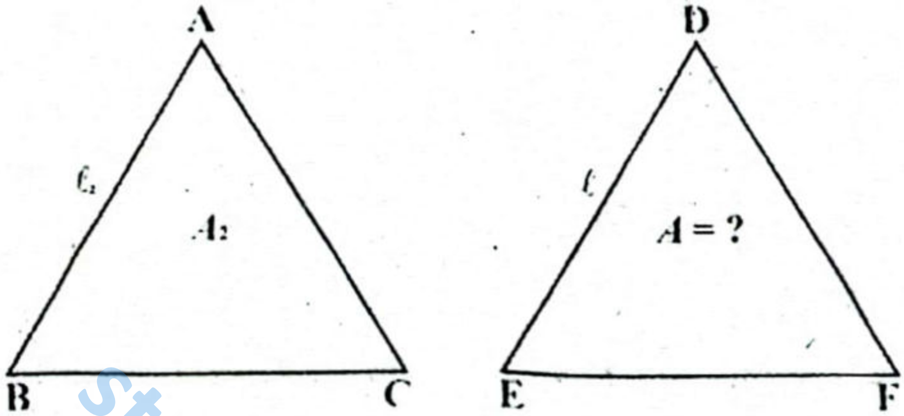
$$\frac{36}{A_2} = \left(\frac{6}{10}\right)^2 = \frac{36}{100}$$

$\therefore$ $A_2 = \frac{36 \times 100}{36} = 100$

Now, A_1 + BCED = 100

$\therefore$ Area BCED $= 100 - 36 = 64$

4. **Given that ΔABC and ΔDEF are similar, with a scale factor of $k = 3$. If the area of $EABC$ is $50cm^2$, find the area of triangle ΔDEF?**



Sol: $l_1 = 3l_2$

$$A_2 = 50 \text{ cm}^2$$

$$A_1 = ?$$

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2 = (3)^2$$

$$\frac{A_1}{A_2} = \left(\frac{3\cancel{l_2}}{\cancel{l_2}}\right)^2 = (3)^2$$

$$A_1 = 9\ A_2 = 9 \times 50 = 450 \text{ cm}^2$$

5. **Quadrilaterals $ABCD$ and $EFGH$ are similar, with a scale factor of $k = \frac{1}{4}$. If the area of quadrilateral $ABCD$ is 64 cm^2, find the area of quadrilateral $EFGH$.**

Sol: Area ABCD $= 64 \text{ cm}^2 = A_1$

Area EFGH $= A_2 = ?$

Scale factor $k = \frac{1}{4}$

$$\therefore \quad \frac{A_1}{A_2} = k^2$$

$\therefore \quad A_1 = \left(\frac{1}{4}\right)^2 = A_2$

or $\quad A_2 = 16\,A_1 = 64 \times 16$

$A_2 = 1024\ \text{cm}^2$

6. **The areas of two similar triangles are 16cm^2 and 25cm^2. What is the ratio of a pair of corresponding sides?**

Sol: $A_1 = 16\ \text{cm}^2$; $A_2 = 25\ \text{cm}^2$

Let the corresponding lengths be l_1 and l_2

$$\left(\frac{l_1}{l_2}\right)^2 = \frac{16}{25} \quad \text{or} \quad \frac{l_1}{l_2} = \frac{4}{5}$$

Hence, scale factor $= \frac{4}{5}$.

7. **The areas of two similar triangles are $144cm^2$ and $81cm^2$. If the base of the large triangle is $30cm$, find the corresponding base of the smaller triangle.**

Sol: Area $\quad A_1 = 144$

$A_2 = 81$

Let the K factor $= x = \frac{l_1}{l_2}$

$$\frac{A_1}{A_2} = x^2$$

or $\quad x^2 = \frac{144}{81}$

$$x = \frac{12}{9} = \frac{l_1}{l_2}$$

Hence, scale factor is $\frac{12}{9}$.

$l_1 = 30$

$\therefore \quad \frac{l_1}{l_2} = 30 \quad \text{or} \quad l_2 = \frac{9l_1}{12}$

or $$l_2 = \frac{{}^{3}\not{9} \times \not{30}^{15}}{\not{12}_{\not{4}\,2}} = \frac{45}{2}$$

$$= 22.5 \text{ cm}$$

8. A regular heptagon is inscribed in a larger regular heptagon and each side of the larger heptagon is 1.7 times the side of the smaller heptagon. If the area of the smaller heptagon is known to be 100 cm², find the area of the larger heptagon.

Sol: Let the side of the smaller heptagon = l_1 =

side of the larger heptagon = $1.7\, l_1$

$$l_2 = 1.7\, l_1$$

Area of smaller heptagon $A_1 = 100$

Then Area of bigger heptagon $= A_2$

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2 = \left(\frac{\not{l_1}}{1.7\not{l_1}}\right)^2 = \left(\frac{1}{1.7}\right)^2$$

$$A_2 = \frac{A_1}{\left(\frac{1}{1.7}\right)^2} = 100 \times (1.7)^2$$

$$= 100 \times 2.89$$

$$= 289 \text{ cm}^2$$