9th class Math Exercise 9.2

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

(i) $1:3$

Solution

Let A_1 and A_2 be areas of smaller and larger figures with corresponding lengths ℓ_1 and ℓ_2 respectively.

$$\ell_1:\ell_2 = 1:3$$

$$\Rightarrow \frac{\ell_1}{\ell_2} = \frac{1}{3}$$

$$\because \frac{\mathrm{A}_1}{\mathrm{A}_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\Rightarrow \frac{\mathrm{A}_1}{\mathrm{A}_2} = \left(\frac{3}{4}\right)^2$$

$$\frac{A_1}{A_2} = \frac{9}{16} = 9:16$$

(iii) $2:7$

Solution:

$$\ell_1:\ell_2 = 2:7$$

$$\Rightarrow \frac{\ell_1}{\ell_2} = \frac{2}{7}$$

$$\because \frac{\mathrm{A}_1}{\mathrm{A}_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\frac{\mathrm{A}_1}{\mathrm{A}_2} = \left(\frac{2}{7}\right)^2$$

$$\frac{A_1}{A_2} = \frac{4}{49} = 4:49$$

(iv) $8:9$

Solution:

$$\ell_1 : \ell_2 = 8 : 9$$
$$\Rightarrow \frac{\ell_1}{\ell_2} = \frac{8}{9}$$
$$\because \frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$
$$\because \frac{A_1}{A_2} = \left(\frac{8}{9}\right)^2$$
$$\frac{A_1}{A_2} = \frac{64}{81} = 64 : 81$$

(v) $6 : 5$

Solution:

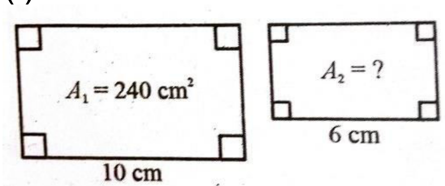
$$\ell_2 : \ell_1 = 6 : 5$$
$$\frac{\ell_2}{\ell_1} = \frac{5}{6}$$

(reciprocal)

$$\because \frac{A_2}{A_1} = \left(\frac{\ell_2}{\ell_1}\right)^2$$
$$\frac{A_2}{A_1} = \left(\frac{6}{5}\right)^2$$
$$\frac{A_1}{A_2} = \frac{36}{25} = 36 : 25$$

Q. 2 Find the unknowns in the following figures:

(i)



Solution:

From figures

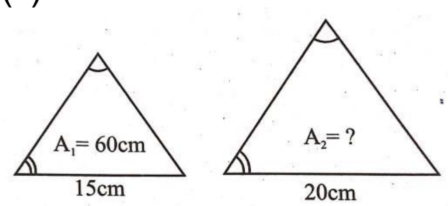
$$A_1 = 240\ \text{cm}^2,\ A_2 = ?$$
$$\ell_1 = 10\ \text{cm}, \ell_2 = 6\ \text{cm}$$

Since figures are similar,

So $\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$

$$\frac{240}{A_2} = \left(\frac{10}{6}\right)^2$$
$$\frac{240}{A_2} = \frac{100}{36}$$
$$\frac{A_1}{240} = \frac{36}{100} \text{ (reciprocal)}$$
$$A_2 = \frac{9}{25} \times 240$$
$$A_2 = 9 \times 9.6$$
$$A_2 = 86.4 \text{ cm}^2$$

(ii)



Solution

From figures

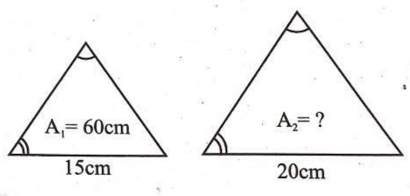
$$A_1 = 60 \text{ cm}_2, A_2 = ?$$
$$\ell_1 = 15 \text{ cm}, \ell_2 = 20 \text{ cm}$$

Since figures are similar,

So, $\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$

$$\frac{60}{A_2} = \left(\frac{15}{20}\right)^2$$
$$\Rightarrow \frac{60}{A_2} = \left(\frac{3}{4}\right)^2$$
$$\Rightarrow \frac{60}{A_2} = \frac{9}{16}$$
$$\Rightarrow \frac{A_2}{60} = \frac{16}{9} \text{ (reciprocal)}$$
$$\Rightarrow A_2 = \frac{16}{9} \times 60$$
$$\Rightarrow A_2 = 106.67 \text{ cm}^2$$

(iii)



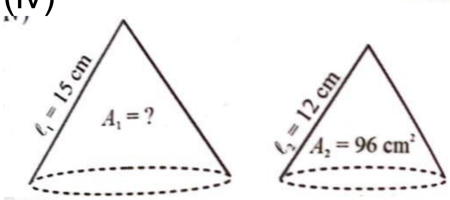
Solution

$$A_1 = ?,\ A_2 = 18\ \text{cm}^2$$
$$\ell_1 = 3.6\ \text{cm}\ \ell_2 = 5.76\ \text{cm}$$

Since figures are similar, therefore

$$\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$
$$\Rightarrow \frac{A_1}{18} = \left(\frac{3.6}{5.76}\right)^2$$
$$\Rightarrow \frac{A_1}{18} = \left(\frac{5}{8}\right)^2$$
$$\Rightarrow \frac{A_1}{18} = \frac{25}{64}$$
$$\Rightarrow A_1 = \frac{25}{64} \times 18$$
$$A_1 = \frac{450}{64}$$
$$\Rightarrow A_1 = 7.03\ \text{cm}^2$$

(iv)



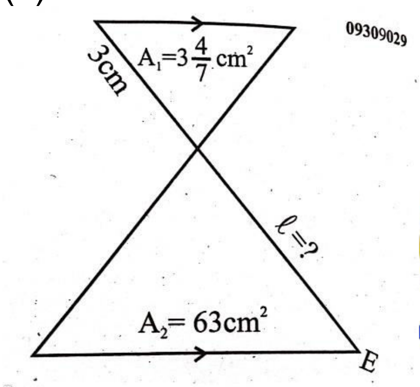
Solution:
From figures

$$A_1 = ?, A_2 = 96\ \text{cm}^2$$
$$\ell_1 = 15\ \text{cm}, \ell_2 = 12\ \text{cm}$$

Since figures are similar, therefore

$$\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$
$$\frac{A_1}{A_2} = \left(\frac{15\text{ cm}}{12\text{ cm}}\right)^2$$
$$\frac{A_1}{96} = \left(\frac{5}{4}\right)^2$$
$$\frac{A_1}{96} = \frac{25}{16}$$
$$A_1 = \frac{25}{16} \times 96$$
$$A_1 = 25 \times 6$$
$$A_1 = 150$$
$$A_1 = 150\text{ cm}^2$$

(v)



Solution:

$$A_1 = 3\frac{4}{7}, \ell_1 = 3\text{ cm}$$
$$A_1 = \frac{25}{7}\text{ cm}^2, \ell_2 = ?$$
$$A_3 = 63\text{ cm}$$

since figures are similar, therefore

$$\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\frac{\frac{25}{7}}{63} = \left(\frac{3}{\ell_2}\right)^2$$

$$\frac{25}{7 \times 63} = \frac{9}{\ell_2}$$

$$\frac{25}{441} = \frac{9}{\ell_2}$$

$$\Rightarrow \frac{441}{25} = \frac{\ell_2}{9}$$

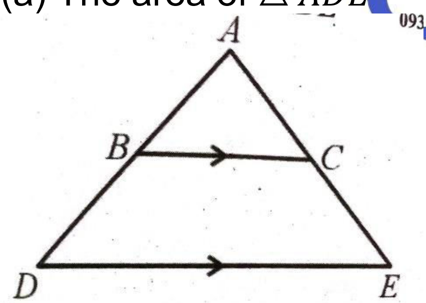
$$\frac{441}{25} \times 9 = \ell_2$$

$$\frac{3969}{25} = \ell_2$$

$$\sqrt{158.76}C_2$$

$$\ell_1 = 12.6 \text{ cm}$$

Q. 3 Given that area of $\triangle ABC = 36 \text{ cm}^3$ and $m\overline{AB} = 6 \text{ cm}$, $m\overline{BD} = 4 \text{ cm}$.
Find
(a) The area of $\triangle ADE$



Solution:
Area of $\triangle \text{ABC} = A_1 = 36 \text{ cm}^2$
Area of $\triangle \text{ADE} = A_2 = ?$
$\text{mAB} = 6 \text{ cm}$
$\text{m}\overline{\text{BD}} = 4 \text{ cm}$
$\text{mAD} = (6 + 40)\text{cm} = 10 \text{ cm}$
Since, $\triangle \text{ABC} \sim \triangle \text{ADE}$,
Therefore,

$$\frac{A_1}{A_2} = \left(\frac{m\overline{AB}}{mAD}\right)^2$$

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

$$\frac{36}{A_2} = \left(\frac{3}{5}\right)^2$$

$$\frac{36}{A_2} = \frac{9}{25} \text{ (Reciprocal)}$$

$$\frac{A_2}{36} = \frac{25}{9}$$

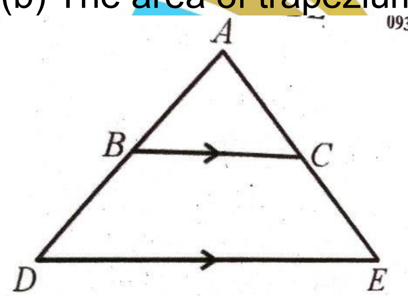
$$A_2 = \frac{25 \times 36^4}{\emptyset}$$

$$A_2 = 25 \times 4$$

$$A_2 = 100 \text{ cm}^2$$

Thus area of $\triangle \mathrm{ADE} = 100 \text{ cm}^2$

(b) The area of trapezium BCED



Solution:

We know that

Area of trapezium = Area of $\triangle \mathrm{ADE}$ − Area of $\triangle \mathrm{ABC}$

$$= 100 \text{ cm}^2 - 36 \text{ cm}^2$$

$$= 64 \text{ cm}^2$$

Q. 4 Given that $\triangle ABC$ and $\triangle DEF$ are similar, with a scale factor of $k = 3$. If the area of triangle $\triangle ABC$ is 50 cm^2, what is the area of triangle $\triangle DEF$?

Solution:

Scale factor $= \mathrm{k} = 3$

Area of $\triangle \mathrm{ABC} = \mathrm{A}_1 = 50 \text{ cm}^2$

Area of $\triangle \mathrm{EF} = \mathrm{A}_2 =$?

By scale factor =

$$K=\frac{\ell_1}{\ell_2}=3$$

Since $\triangle \mathrm{ABC} \sim \triangle \mathrm{DEF}$,

So, $\frac{A_1}{A_2}=\left(\frac{\ell_1}{\ell_2}\right)^2$

$$\frac{50}{A_2}=(3)^2$$

$$\frac{50}{A_2}=9$$

$\Rightarrow \frac{A_2}{50}=\frac{1}{9}$ (reciprocal)

$$A_2=\frac{50}{9}$$

$\Rightarrow A_2=5\frac{5}{9}\ \mathrm{cm}^2$

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

Solution:

Q. 6 The areas of two similar triangles are $16\ \mathrm{cm}^2$ and $25\ \mathrm{cm}^2$. What is the ratio of a pair of corresponding sides?

Solution:

Area of smaller figure $=A_1=16$

Area of larger figure $=A_2=25$

Let ℓ_1 and ℓ_2 be the corresponding lengths of smaller and larger figure respectively. Since triangles are similar

So,

$$\because \frac{A}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2}\right)^2 = \frac{A_1}{A_2}$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2}\right)^2 = \frac{16}{25}$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2}\right)^2 = \frac{4^2}{5^2}$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2}\right)^2 = \left(\frac{4}{5}\right)^2 \quad \because \frac{a^2}{b^2} = \left(\frac{a}{b}\right)^2$$

Taking square roots.
Taking square roots.

$$\sqrt{\left(\frac{\ell_1}{\ell_2}\right)^2} = \sqrt{\left(\frac{4}{5}\right)^2}$$

$$\frac{\ell_1}{\ell_2} = \frac{4}{5}$$

$$\Rightarrow \ell_1 : \ell_2 = 4:5 = \frac{4}{5}$$

Q. 7 The areas of two similar triangles are $144\ \text{cm}^2$ and $81\ \text{cm}^2$. If the base of the large triangleis 30 cm , find the corresponding base of the smaller triangle.

Solution:

Area of larger $\Delta = A_1 = 144$
Area of smaller $\Delta = A_2 = 81$
Base length of larger $\Delta = \ell_1 = 30$
Base length of smaller $\Delta = \ell_2 = ?$
Since triangles are similar,
So,

$$\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\Rightarrow \left(\frac{\ell_1}{\ell_2}\right)^2 = \frac{A_1}{A_2}$$

$$\Rightarrow \left(\frac{30}{\ell_2}\right)^2 = \frac{144}{81}$$

$$\Rightarrow \sqrt{\left(\frac{30}{\ell_2}\right)} = \sqrt{\frac{144}{81}}$$

$$\Rightarrow \frac{30}{\ell_2} = \frac{12}{9}$$

$$\frac{\ell_2}{30} = \frac{9}{12} \text{ (reciprocal)}$$

$$\ell_2 = \frac{9}{12} \times 30$$

$$\ell_2 = \frac{270}{12}$$

$$\ell_2 = 22.5 \text{ cm}$$

Thus base of smaller Δ is 22.5 cm

Thus base of smaller Δ is 22.5 cm .

Q. 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 cm^2, find the area of the larger heptagon.

Solution:

Let length of each side of regular heptagon be

$$\ell_1 = x$$

Length of each side of enlarged heptagon $= \ell_2 = 1.7x$

Area of smaller regular heptagon $= A_1 = 100 \text{ cm}^2$

Area of larger regular heptagon $= A_2 = ?$

Since, both regular heptagons are similar. So,

$$\frac{A_1}{A_2} = \left(\frac{\ell_1}{\ell_2}\right)^2$$

$$\frac{100}{A_2} = \left(\frac{x}{1.7x}\right)^2$$

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

$$\frac{100}{A_2} = \frac{1}{2.89}$$

$$\Rightarrow 100 \times 2.89 = A_2$$

$$\Rightarrow 289 = A_2$$

$$A_2 = 289 \text{ cm}^2$$

Thus area of larger regular heptagon is 289 cm^2.