Unit No. 9

Similar Figures

Exercise No. 9.2

Question No. 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

(i)

Given:

$l_1 : l_2 = 1 : 3$

To Find:

The ratio of the areas of similar figures = $A_1 : A_2$ = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / A_2 = (1 / 3)^2$

$A_1 / A_2 = 1 / 9$

$A_1 : A_2 = 1 : 9$

(ii)

Given:

$l_1 : l_2 = 3 : 9$

To Find:

The ratio of the areas of similar figures = $A_1 : A_2$ = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / A_2 = (3 / 4)^2$

$A_1 / A_2 = 9 / 16$

$A_1 : A_2 = 9 : 16$

(iii)

Given:

$l_1 : l_2 = 2 : 7$

To Find:

The ratio of the areas of similar figures = $A_1 : A_2$ = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / A_2 = (2 / 7)^2$

$A_1 / A_2 = 4 / 49$

$A_1 : A_2 = 4 : 49$

(iv)

Given:

$l_1 : l_2 = 8 : 9$

To Find:

The ratio of the areas of similar figures = $A_1 : A_2$ = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / A_2 = (8 / 9)^2$

$A_1 / A_2 = 64 / 81$

$A_1 : A_2 = 64 : 81$

(v)

Given:

$l_1 : l_2 = 6 : 5$

To Find:

The ratio of the areas of similar figures = $A_1 : A_2$ = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / A_2 = (6 / 5)^2$

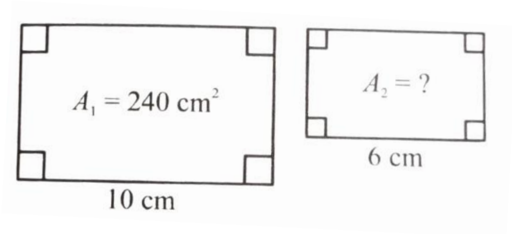
$A_1 / A_2 = 36 / 25$

$A_1 : A_2 = 36 : 25$

Question No. 2

Find the unknowns in the following figures:

(i)



Given:

$\boldsymbol{A_1 = 240\text{ cm}^2}$

Side 1 = $\boldsymbol{l_1}$ **= 10 cm**

Side 2 = $\boldsymbol{l_2}$ **= 6 cm**

To Find:

$\boldsymbol{A_2 = ?}$

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$240 / A_2 = (10 / 6)^2$

$240 / A_2 = 100 / 36$

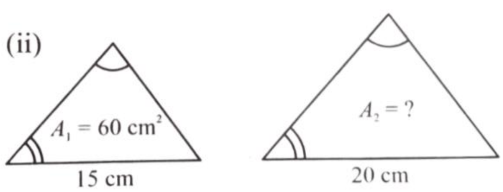
Cross-Multiplication:

$240 \times 36 = A_2 \times 100$

$A_2 = 8640 / 100$

$\boldsymbol{A_2 = 86.4\text{ cm}^2}$

(ii)



Given:

$\boldsymbol{A_1 = 60\text{ cm}^2}$

Side 1 = $\boldsymbol{l_1}$ **= 15 cm**

Side 2 = $\boldsymbol{l_2}$ **= 20 cm**

To Find:

$\boldsymbol{A_2 = ?}$

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$60 / A_2 = (15 / 20)^2$

$60 / A_2 = 225 / 400$

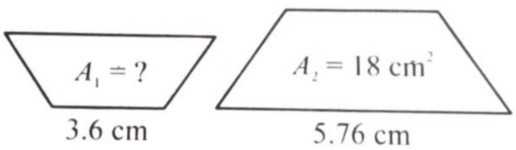
Cross-Multiplication:

$60 \times 400 = A_2 \times 225$

$A_2 = 24000 / 225$

$A_2 = 106.67\ cm^2$

(iii)



Given:

$A_2 = 18\ cm^2$

Side 1 = l_1 = 3.6 cm

Side 2 = l_2 = 5.76 cm

To Find:

$A_1 = ?$

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / 18 = (3.6 / 5.76)^2$

$A_1 / 18 = 12.96 / 33.1776$

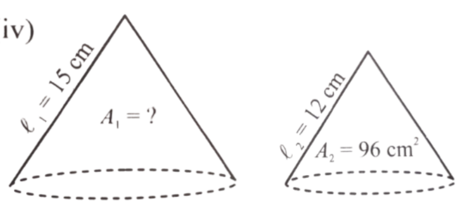
Cross-Multiplication:

$A_1 \times 33.1776 = 12.96 \times 18$

$A_1 = 233.28 / 33.1776$

$A_1 = 7.03125\ cm^2 = 7.03\ cm^2$

(iv)



Given:

$\ell_1 = 15$ cm

$\ell_2 = 12$ cm

$A_2 = 96\ cm^2$

To Find:

$A_1 = ?$

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$A_1 / 96 = (15 / 12)^2$

$A_1 / 96 = (5 / 4)^2$

$A_1 / 96 = 25 / 16$

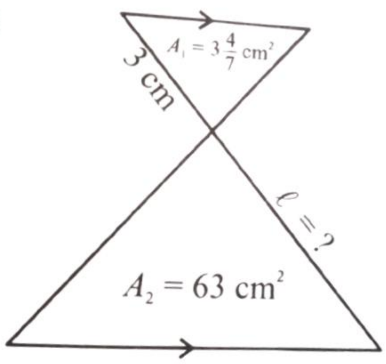
Cross-Multiplication:

$A_1 = 25 / 16 \times 96$

$A_1 = 25 \times 6$

$A_1 = 150\ cm^2$

(v)



Given:

$A_1 = 3\frac{4}{7}\ cm^2 = \frac{25}{7}\ cm^2 = 3.57\ cm^2$

Side = $\ell_1 = 3$ cm

$A_2 = 63\ cm^2$

To Find:

Side = $\ell_2 = ?$

Solution:

$(l_1 / l_2)^2 = A_1 / A_2$

By putting values:

$(3 / l_2)^2 = 3.57 / 63$

$(3 / l_2)^2 = 1 / 17.65$

$9 / (l_2)^2 = 0.05666$

$9 = 0.05666\ (l_2)^2$

$(l_2)^2 = 9 / 0.05666$

$(l_2)^2 = 158.84$

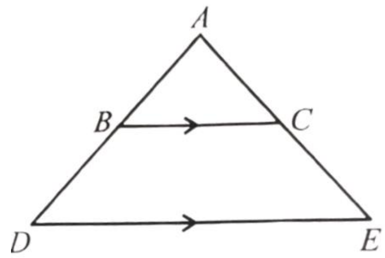
Taking Square root on both sides:

$(l_2) = 12.60$ cm

$l_2 = 12.60$ cm

Question No. 3

Given that area of $\triangle ABC = 36$ cm^2 and m $AB = 6$ cm, m $BD = 4$ cm.



Find:

(a) The area of $\triangle ADE$.

Given:

$A_1 = 36$ cm^2

m $AB = \ell_1 = 6$ cm

m $BD = 4$ cm

m $AD = \ell_2 = 4$ cm + 6 cm = 10 cm

To Find:

$A_2 = ?$

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$36 / A_2 = (6 / 10)^2$

$36 / A_2 = (3 / 5)^2$

$36 / A_2 = 9 / 25$

Cross-Multiplication:

$36 \times 25 = 9 \times A_2$

$A_2 = 36 / 9 \times 25$

$A_2 = 4 \times 25$

$A_2 = 100$ cm^2

(b) The area of trapezium $BCED$.

Solution:

The area of trapezium $BCED$ = Area of $\triangle ADE$ - Area of $\triangle ABC$

The area of trapezium $BCED$ = $A_2 - A_1 = 100 - 36$

The area of trapezium $BCED = 64\text{ cm}^2$

Question No. 4

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

Given:

$\Delta ABC \sim \Delta DEF$

Area of $\Delta ABC = A_1 = 50\text{ cm}^2$

Scale factor = $k = 3$

To Find:

Area of $\Delta DEF = A_2 = ?$

Solution:

We know that ratio of lengths of corresponding sides

$A_1 / A_2 = k^2$

By putting values:

$50 / A_2 = (3)^2$

$50 = 9 A_2$

$A_2 = 50 / 9$

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

Hence area of triangle $\Delta DEF = 5\frac{5}{9}\text{ cm}^2$

Question No. 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.

Given:

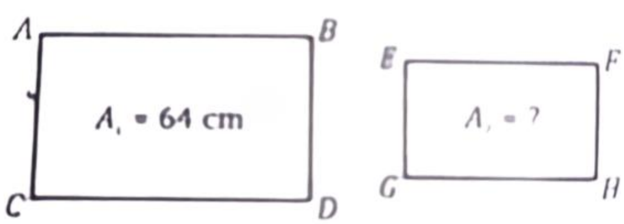
$ABCD \sim EFGH$

Area of quad. $ABCD = A_1 = 64\text{ cm}^2$

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

To Find:

Area of quad. EFGH = ?



Solution:

$A_1 / A_2 = k^2$

By putting values:

$64 / A_2 = (\frac{1}{4})^2$

$64 = \frac{1}{16} A_2$

$A_2 = 64 \times 16$

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

Hence area of quad. EFGH = 1024 cm²

Question No. 6

The areas of two similar triangles are 16 cm² and 25 cm². What is the ratio of a pair of corresponding sides?

Given:

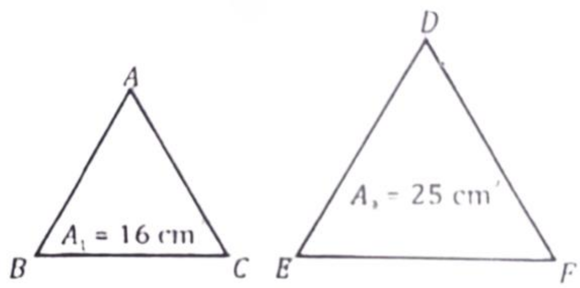
$\Delta ABC \sim \Delta DEF$

Area of $\Delta ABC = A_1 = 16 \text{ cm}^2$

Area of $\Delta ABC = A_2 = 25 \text{ cm}^2$

To Find:

Scale factor = k = ?



Solution:

We know that ratio of lengths of corresponding sides

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$16 / 25 = (l_1 / l_2)^2$

Taking Square Root on both sides:

$4 / 5 = (l_1 / l_2)$

$l_1 / l_2 = 4 / 5$

$\boldsymbol{l_1 : l_2 = 4 : 5}$

Question No. 7

The areas of two similar triangles are 144 cm² and 81 cm². If the base of the large triangle is 30 cm, find the corresponding base of the smaller triangle.

Given:

$\Delta ABC \sim \Delta DEF$

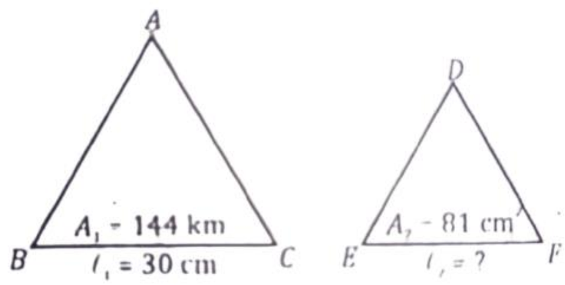
Area of $\Delta ABC = A_1 = 144\ cm^2$

Area of $\Delta DEF = A_2 = 81\ cm^2$

Side = $l_1 = 30$ cm

To Find:

Side = l_2 = ?



Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$144 / 81 = (30 / l_2)^2$

$16 / 9 = (30 / l_2)^2$

Taking Square Root on both Sides:

$4 / 3 = 30 / l_2$

Cross-Multiplication:

$4 \times l_2 = 30 \times 3$

$l_2 = 90 / 4$

$l_2 = 22.5$ cm

Hence the corresponding base of smaller ΔDEF is 22.5 cm.

Question No. 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.

Given:

Let;

Side of smaller regular heptagon = l_1 = x

Given condition:

Side of larger regular heptagon = l_2 = 1.7 x

Area of smaller regular heptagon = A_1 = 100 cm^2

To Find:

Area of larger regular heptagon = A_2 = ?

Solution:

$A_1 / A_2 = (l_1 / l_2)^2$

By putting values:

$100 / A_2 = (x / 1.7x)^2$

$100 / A_2 = (1 / 1.7)^2$

$100 / A_2 = 1 / 2.89$

Cross-Multiplication:

$100 \times 2.89 = 1 \times A_2$

$A_2 = 289\ cm^2$

Hence the Area of larger regular heptagon is 289 cm^2.