

## Exercise 4.6

1. Triangles ABC and DEF are similar.

- (i) If area of  $(\Delta ABC) = 16 \text{ cm}^2$ , area  $(\Delta DEF) = 25 \text{ cm}^2$  and  $BC = 2.3 \text{ cm}$ , find EF.  
 (ii) If area  $(\Delta ABC) = 9 \text{ cm}^2$ , area  $(\Delta DEF) = 64 \text{ cm}^2$  and  $DE = 5.1 \text{ cm}$ , find AB.  
 (iii) If  $AC = 19 \text{ cm}$  and  $DF = 8 \text{ cm}$ , find the ratio of the area of two triangles.  
 (iv) If area of  $(\Delta ABC) = 36 \text{ cm}^2$ , area  $(\Delta DEF) = 64 \text{ cm}^2$  and  $DE = 6.2 \text{ cm}$ , find AB.  
 (v) If  $AB = 1.2 \text{ cm}$  and  $DE = 1.4 \text{ cm}$ , find the ratio of the area of two triangles.

**Solutions:**

As we know that, the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we get

$$(i) \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{BC}{EF}\right)^2 \frac{16}{25} = \left(\frac{2.3}{EF}\right)^2 \frac{4}{5} = \frac{2.3}{EF}$$

Therefore,  $EF = 2.875 \text{ cm}$

$$(ii) \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{AB}{DE}\right)^2 \frac{9}{64} = \left(\frac{AB}{5.1}\right)^2 \frac{3}{8} = \frac{AB}{5.1}$$

Therefore,  $AB = 1.9125 \text{ cm}$

$$(iii) \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{AC}{DF}\right)^2 \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{19}{8}\right)^2 \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{361}{64}\right)$$

Therefore, the ratio of the areas of the two triangles are 361:64

$$(iv) \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{AB}{DE}\right)^2 \frac{36}{64} = \left(\frac{AB}{6.2}\right)^2 \frac{6}{8} = \frac{AB}{6.2}$$

(iv)

Therefore,  $AB = 4.65 \text{ cm}$

$$(v) \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{AB}{DE}\right)^2 \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{1.2}{1.4}\right)^2 \frac{ar\Delta ABC}{ar\Delta DEF} = \left(\frac{36}{49}\right)$$

Therefore, the ratio of the areas of the two triangles are 36: 49

2. In the fig 4.178,  $\Delta ACB \sim \Delta APQ$ . If  $BC = 10 \text{ cm}$ ,  $PQ = 5 \text{ cm}$ ,  $BA = 6.5 \text{ cm}$ ,  $AP = 2.8 \text{ cm}$ , find CA and AQ. Also, find the area  $(\Delta ACB)$ : area  $(\Delta APQ)$ .

**Solution:**

Given:

$\Delta ACB$  is similar to  $\Delta APQ$

$BC = 10 \text{ cm}$

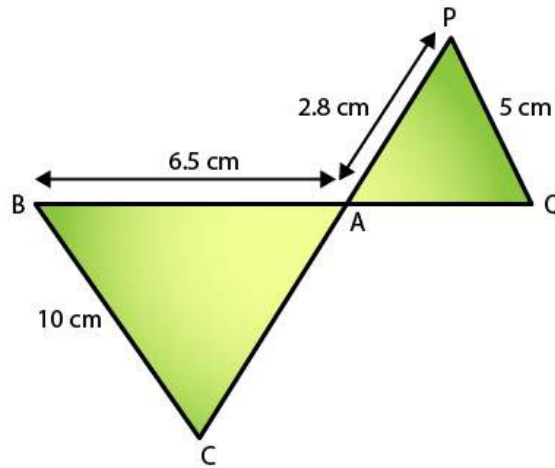
$PQ = 5 \text{ cm}$

$BA = 6.5 \text{ cm}$

$AP = 2.8 \text{ cm}$

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Required to Find: CA, AQ and that the area ( $\Delta ACB$ ): area ( $\Delta APQ$ ).



Since,  $\Delta ACB \sim \Delta APQ$

We know that,

$$AB/AQ = BC/PQ = AC/AP \text{ [Corresponding Parts of Similar Triangles]}$$

$$AB/AQ = BC/PQ$$

$$6.5/AQ = 10/5$$

$$\Rightarrow AQ = 3.25 \text{ cm}$$

Similarly,

$$BC/PQ = CA/AP$$

$$CA/2.8 = 10/5$$

$$\Rightarrow CA = 5.6 \text{ cm}$$

Next,

Since the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we have,

$$\text{ar}(\Delta ACB) : \text{ar}(\Delta APQ) = (BC/PQ)^2$$

$$= (10/5)^2$$

$$= (2/1)^2$$

$$= 4/1$$

Therefore, the ratio is 4:1.

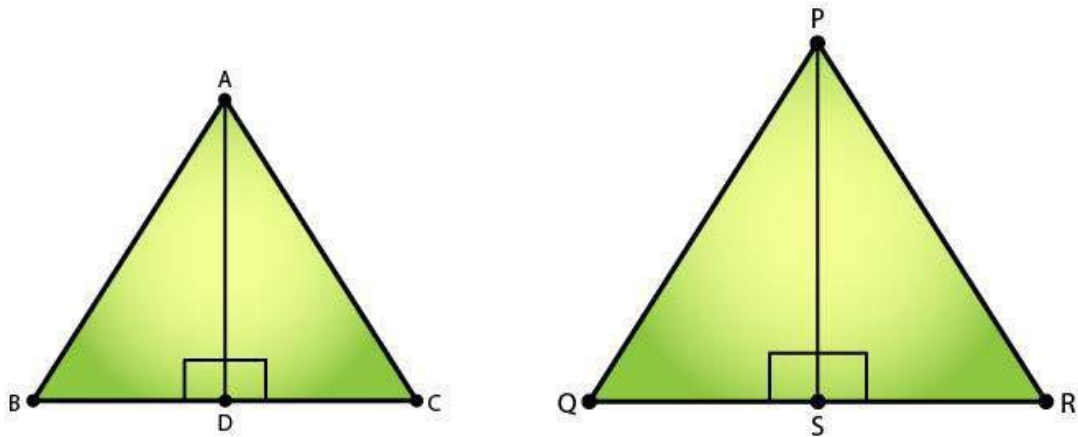
**3. The areas of two similar triangles are  $81 \text{ cm}^2$  and  $49 \text{ cm}^2$  respectively. Find the ration of their corresponding heights. What is the ratio of their corresponding medians?**

**Solution:**

Given: The areas of two similar triangles are  $81 \text{ cm}^2$  and  $49 \text{ cm}^2$ .

Required to find: The ratio of their corresponding heights and the ratio of their corresponding medians.

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Let's consider the two similar triangles as  $\triangle ABC$  and  $\triangle PQR$ ,  $AD$  and  $PS$  be the altitudes of  $\triangle ABC$  and  $\triangle PQR$  respectively.

So,

By area of similar triangle theorem, we have

$$\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle PQR)} = \frac{AB^2}{PQ^2}$$

$$\Rightarrow \frac{81}{49} = \frac{AB^2}{PQ^2}$$

$$\Rightarrow \frac{9}{7} = \frac{AB}{PQ}$$

In  $\triangle ABD$  and  $\triangle PQS$

$$\angle B = \angle Q$$

$$\angle ABD = \angle PSQ = 90^\circ$$

[Since  $\triangle ABC \sim \triangle PQR$ ]

$$\Rightarrow \triangle ABD \sim \triangle PQS \quad [\text{By AA similarity}]$$

Hence, as the corresponding parts of similar triangles are proportional, we have

$$\frac{AB}{PQ} = \frac{AD}{PS}$$

Therefore,

$$\frac{AD}{PS} = \frac{9}{7} \text{ (Ratio of altitudes)}$$

Similarly,

The ratio of two similar triangles is equal to the ratio of the squares of their corresponding medians also.

Thus, ratio of altitudes = Ratio of medians =  $\frac{9}{7}$

**4. The areas of two similar triangles are  $169 \text{ cm}^2$  and  $121 \text{ cm}^2$  respectively. If the longest side of the larger triangle is  $26 \text{ cm}$ , find the longest side of the smaller triangle.**

**Solution:**

Given:

## R D Sharma Solutions For Class 10 Maths Chapter 4 - Triangles

The area of two similar triangles is  $169\text{cm}^2$  and  $121\text{cm}^2$ .

The longest side of the larger triangle is 26cm.

Required to find: the longest side of the smaller triangle

Let the longer side of the smaller triangle = x

We know that, the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we have

$$\frac{\text{ar}(\text{larger triangle})}{\text{ar}(\text{smaller triangle})} = \left(\frac{\text{side of the larger triangle}}{\text{side of the smaller triangle}}\right)^2$$
$$= 169/121$$

Taking square roots of LHS and RHS, we get

$$= 13/11$$

Since, sides of similar triangles are proportional, we can say

$$\frac{3}{11} = \frac{\text{(longer side of the larger triangle)}}{\text{(longer side of the smaller triangle)}}$$
$$\Rightarrow \frac{13}{11} = \frac{26}{x}$$
$$x = 22$$

Therefore, the longest side of the smaller triangle is 22 cm.

**5. The area of two similar triangles are  $25\text{ cm}^2$  and  $36\text{cm}^2$  respectively. If the altitude of the first triangle is 2.4 cm, find the corresponding altitude of the other.**

**Solution:**

Given: The area of two similar triangles are  $25\text{ cm}^2$  and  $36\text{cm}^2$  respectively, the altitude of the first triangle is 2.4 cm

Required to find: the altitude of the second triangle

We know that the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding altitudes, we have

$$\Rightarrow \frac{\text{ar}(\text{triangle1})}{\text{ar}(\text{triangle2})} = \left(\frac{\text{altitude1}}{\text{altitude2}}\right)^2$$
$$\Rightarrow \frac{25}{36} = \frac{(2.4)^2}{(\text{altitude2})^2}$$

Taking square roots of LHS and RHS, we get

$$\frac{5}{6} = \frac{2.4}{\text{altitude2}}$$
$$\Rightarrow \text{altitude2} = \frac{(2.4 \times 6)}{5} = 2.88\text{cm}$$

Therefore, the altitude of the second triangle is 2.88cm.

**6. The corresponding altitudes of two similar triangles are 6 cm and 9 cm respectively. Find the ratio of their areas.**

**Solution:**

Given:

The corresponding altitudes of two similar triangles are 6 cm and 9 cm.

Required to find: Ratio of areas of the two similar triangles

We know that the ratio of areas of two similar triangles is equal to the ratio of squares of their

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corresponding altitudes, we have

$$\begin{aligned}\text{ar}(\text{triangle1})/\text{ar}(\text{triangle2}) &= (\text{altitude1}/ \text{altitude2})^2 = (6/9)^2 \\ &= 36/ 81 \\ &= 4/9\end{aligned}$$

Therefore, the ratio of the areas of two triangles = 4: 9.

**7. ABC is a triangle in which  $\angle A = 90^\circ$ ,  $AN \perp BC$ ,  $BC = 12$  cm and  $AC = 5$  cm. Find the ratio of the areas of  $\Delta ANC$  and  $\Delta ABC$ .**

**Solution:**

**Given:**

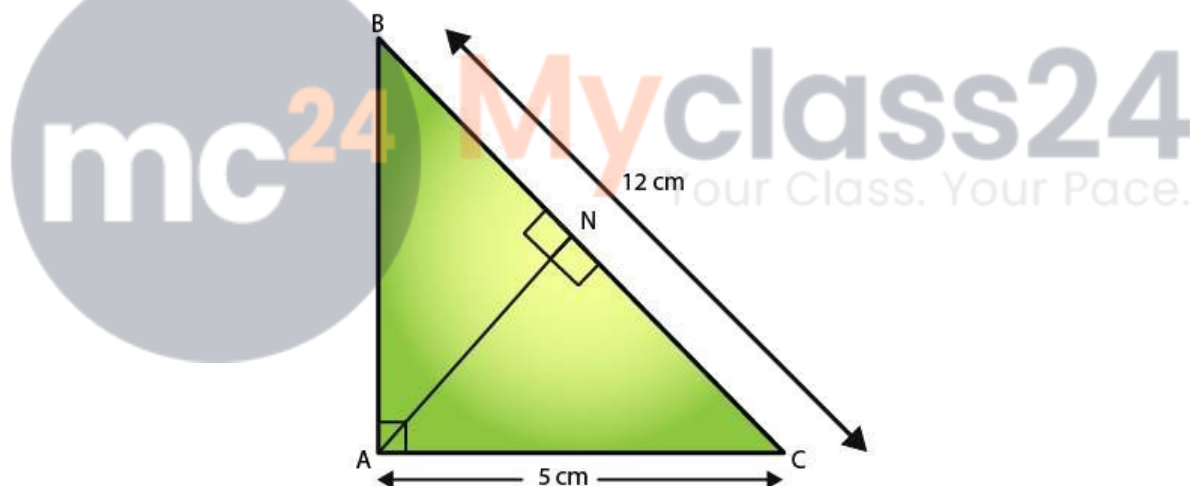
Given,

$$\Delta ABC, \angle A = 90^\circ, AN \perp BC$$

$$BC = 12 \text{ cm}$$

$$AC = 5 \text{ cm.}$$

Required to find:  $\text{ar}(\Delta ANC)/ \text{ar}(\Delta ABC)$ .



We have,

In  $\Delta ANC$  and  $\Delta ABC$ ,

$$\angle ACN = \angle ACB \quad [\text{Common}]$$

$$\angle A = \angle ANC \quad [\text{each } 90^\circ]$$

$$\Rightarrow \Delta ANC \sim \Delta ABC \quad [\text{AA similarity}]$$

Since the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we get have

$$\text{ar}(\Delta ANC)/ \text{ar}(\Delta ABC) = (AC/ BC)^2 = (5/12)^2 = 25/ 144$$

Therefore,  $\text{ar}(\Delta ANC)/ \text{ar}(\Delta ABC) = 25:144$

**8. In Fig 4.179, DE || BC**

**(i) If DE = 4m, BC = 6 cm and Area ( $\triangle ADE$ ) =  $16\text{cm}^2$ , find the area of  $\triangle ABC$ .**

**(ii) If DE = 4cm, BC = 8 cm and Area ( $\triangle ADE$ ) =  $25\text{cm}^2$ , find the area of  $\triangle ABC$ .**

**(iii) If DE: BC = 3: 5. Calculate the ratio of the areas of  $\triangle ADE$  and the trapezium BCED.**

**Solution:**

Given,

DE || BC.

In  $\triangle ADE$  and  $\triangle ABC$

We know that,

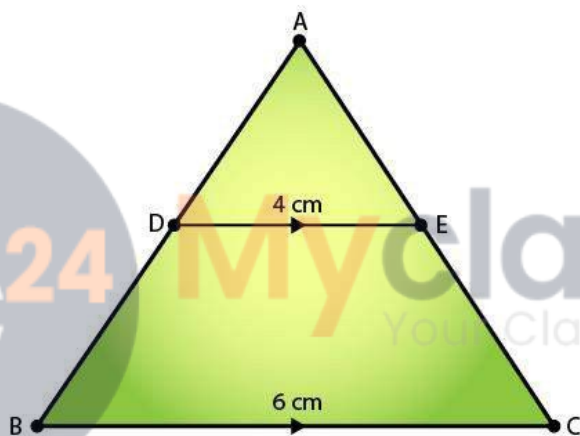
$$\angle ADE = \angle B$$

[Corresponding angles]

$$\angle DAE = \angle BAC$$

[Common]

Hence,  $\triangle ADE \sim \triangle ABC$  (AA Similarity)



(i) Since the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we have,

$$\text{Ar}(\triangle ADE)/ \text{Ar}(\triangle ABC) = DE^2/ BC^2$$

$$16/ \text{Ar}(\triangle ABC) = 4^2/ 6^2$$

$$\Rightarrow \text{Ar}(\triangle ABC) = (6^2 \times 16)/ 4^2$$

$$\Rightarrow \text{Ar}(\triangle ABC) = 36 \text{ cm}^2$$

(ii) Since the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides, we have,

$$\text{Ar}(\triangle ADE)/ \text{Ar}(\triangle ABC) = DE^2/ BC^2$$

$$25/ \text{Ar}(\triangle ABC) = 4^2/ 8^2$$

$$\Rightarrow \text{Ar}(\triangle ABC) = (8^2 \times 25)/ 4^2$$

$$\Rightarrow \text{Ar}(\triangle ABC) = 100 \text{ cm}^2$$

(iii) According to the question,

$$\text{Ar}(\triangle ADE)/ \text{Ar}(\triangle ABC) = DE^2/ BC^2$$

$$\text{Ar}(\triangle ADE)/ \text{Ar}(\triangle ABC) = 3^2/ 5^2$$

$$\text{Ar}(\triangle ADE)/ \text{Ar}(\triangle ABC) = 9/25$$

## R D Sharma Solutions For Class 10 Maths Chapter 4 - Triangles

Assume that the area of  $\triangle ADE = 9x$  sq units

And, area of  $\triangle ABC = 25x$  sq units

So,

$$\begin{aligned}\text{Area of trapezium BCED} &= \text{Area of } \triangle ABC - \text{Area of } \triangle ADE \\ &= 25x - 9x \\ &= 16x\end{aligned}$$

$$\text{Now, } \frac{\text{Ar}(\triangle ADE)}{\text{Ar}(\text{trap BCED})} = \frac{9x}{16x}$$

$$\frac{\text{Ar}(\triangle ADE)}{\text{Ar}(\text{trap BCED})} = \frac{9}{16}$$

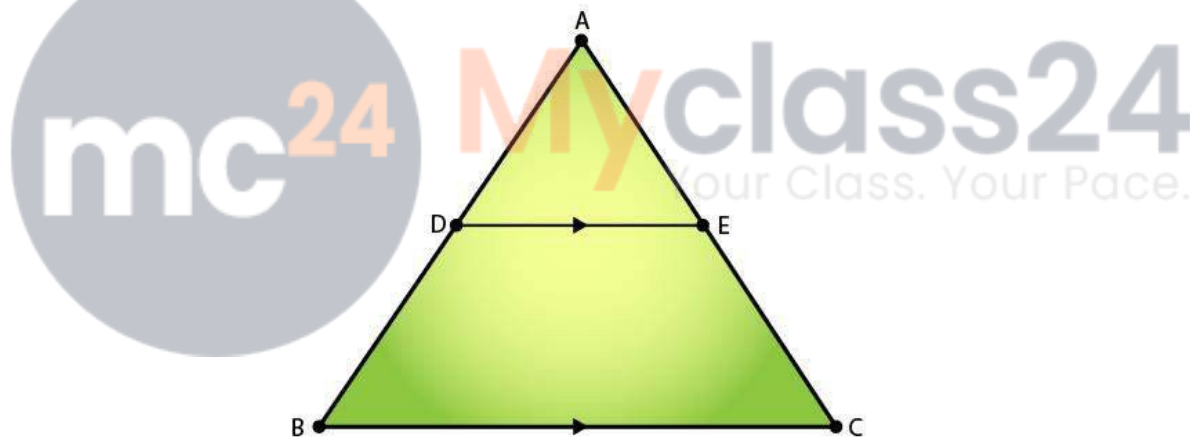
**9. In  $\triangle ABC$ , D and E are the mid-points of AB and AC respectively. Find the ratio of the areas  $\triangle ADE$  and  $\triangle ABC$ .**

**Solution:**

Given:

In  $\triangle ABC$ , D and E are the midpoints of AB and AC respectively.

Required to find: Ratio of the areas of  $\triangle ADE$  and  $\triangle ABC$



Since, D and E are the midpoints of AB and AC respectively.

We can say,

$$DE \parallel BC \quad (\text{By converse of mid-point theorem})$$

$$\text{Also, } DE = \left(\frac{1}{2}\right) BC$$

In  $\triangle ADE$  and  $\triangle ABC$ ,

$$\angle ADE = \angle B \quad (\text{Corresponding angles})$$

$$\angle DAE = \angle BAC \quad (\text{common})$$

$$\text{Thus, } \triangle ADE \sim \triangle ABC \quad (\text{AA Similarity})$$

Now, we know that

The ratio of areas of two similar triangles is equal to the ratio of square of their corresponding sides, so

## R D Sharma Solutions For Class 10 Maths Chapter 4 - Triangles

$$\text{Ar}(\triangle ADE)/\text{Ar}(\triangle ABC) = AD^2/AB^2$$

$$\text{Ar}(\triangle ADE)/\text{Ar}(\triangle ABC) = 1^2/2^2$$

$$\text{Ar}(\triangle ADE)/\text{Ar}(\triangle ABC) = 1/4$$

Therefore, the ratio of the areas  $\triangle ADE$  and  $\triangle ABC$  is 1:4

**10. The areas of two similar triangles are  $100\text{ cm}^2$  and  $49\text{ cm}^2$  respectively. If the altitude of the bigger triangles is 5 cm, find the corresponding altitude of the other.**

**Solution:**

Given: The area of the two similar triangles is  $100\text{ cm}^2$  and  $49\text{ cm}^2$ . And the altitude of the bigger triangle is 5cm.

Required to find: The corresponding altitude of the other triangle

We know that,

The ratio of the areas of the two similar triangles is equal to the ratio of squares of their corresponding altitudes.

$\text{ar}(\text{bigger triangle})/\text{ar}(\text{smaller triangle}) = (\text{altitude of the bigger triangle}/\text{altitude of the smaller triangle})^2$

$$(100/49) = (5/\text{altitude of the smaller triangle})^2$$

Taking square root on LHS and RHS, we get

$$(10/7) = (5/\text{altitude of the smaller triangle}) = 7/2$$

Therefore, altitude of the smaller triangle = 3.5cm

**11. The areas of two similar triangles are  $121\text{ cm}^2$  and  $64\text{ cm}^2$  respectively. If the median of the first triangle is 12.1 cm, find the corresponding median of the other.**

**Solution:**

Given: the area of the two triangles is  $121\text{ cm}^2$  and  $64\text{ cm}^2$  respectively and the median of the first triangle is 12.1cm

Required to find: the corresponding median of the other triangle

We know that,

The ratio of the areas of the two similar triangles are equal to the ratio of the squares of their medians.

$$\text{ar}(\text{triangle1})/\text{ar}(\text{triangle2}) = (\text{median of triangle 1}/\text{median of triangle 2})^2$$

$$121/64 = (12.1/\text{median of triangle 2})^2$$

Taking the square roots on both LHS and RHS, we have

$$11/8 = (12.1/\text{median of triangle 2}) = (12.1 \times 8)/11$$

Therefore, Median of the other triangle = 8.8cm