

# Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 1- Similarity



For any clarifications or questions you can write to [info@indcareer.com](mailto:info@indcareer.com)

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# Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 1- Similarity

Class 10: Maths Chapter 1 solutions. Complete Class 10 Maths Chapter 1 Notes.

## Maharashtra Board Solutions for Class 10-Maths (Part 2): Chapter 1- Similarity

Maharashtra Board 10th Maths Chapter 1, Class 10 Maths Chapter 1 solutions

### Question 1.

**Base of a triangle is 9 and height is 5. Base of another triangle is 10 and height is 6. Find the ratio of areas of these triangles.**

**Solution:**

Let the base, height and area of the first triangle be  $b_1$ ,  $h_1$ , and  $A_1$  respectively.

Let the base, height and area of the second triangle be  $b_2$ ,  $h_2$  and  $A_2$  respectively.

$$\begin{aligned}\frac{A_1}{A_2} &= \frac{b_1 \times h_1}{b_2 \times h_2} \\ \frac{A_1}{A_2} &= \frac{9 \times 5}{10 \times 6} \\ &= \frac{45}{60} \\ \therefore \frac{A_1}{A_2} &= \frac{3}{4}\end{aligned}$$

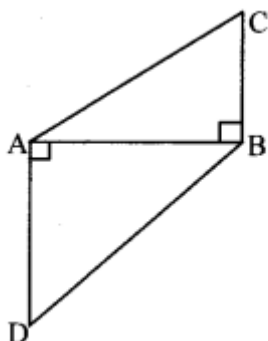
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[Since Ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights]

∴ The ratio of areas of the triangles is 3:4.

### Question 2.

In the adjoining figure,  $BC \perp AB$ ,  $AD \perp AB$ ,  $BC = 4$ ,  $AD = 8$ , then find  $A(\triangle ABC)/A(\triangle ADB)$



### Solution:

$\triangle ABC$  and  $\triangle ADB$  have same base AB.

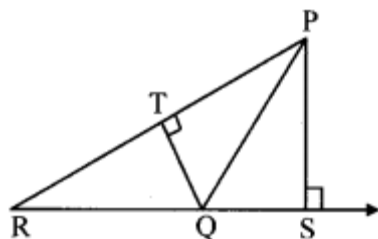
$$\begin{aligned}\therefore \frac{A(\triangle ABC)}{A(\triangle ADB)} &= \frac{BC}{AD} \\ &= \frac{4}{8} \\ \therefore \frac{A(\triangle ABC)}{A(\triangle ADB)} &= \frac{1}{2}\end{aligned}$$

[Since Triangles having equal base]

### Question 3.

In the adjoining figure,  $\text{seg } PS \perp \text{seg } RQ$ ,  $\text{seg } QT \perp \text{seg } PR$ . If  $RQ = 6$ ,  $PS = 6$  and  $PR = 12$ , then find QT.

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**Solution:**

In  $\triangle PQR$ , PR is the base and QT is the corresponding height.

Also, RQ is the base and PS is the corresponding height.

$A(\triangle PQR) = \frac{1}{2} \times PR \times QT = \frac{1}{2} \times RQ \times PS$  [Ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights]

$$\therefore 11 = \frac{1}{2} \times PR \times QT = \frac{1}{2} \times RQ \times PS$$

$$\therefore PR \times QT = RQ \times PS$$

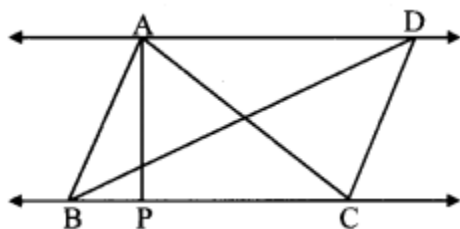
$$\therefore 12 \times QT = 6 \times 6$$

$$\therefore QT = \frac{36}{12}$$

$$\therefore QT = 3 \text{ units}$$

**Question 4.**

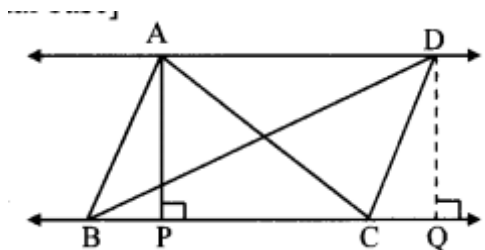
In the adjoining figure,  $AP \perp BC$ ,  $AD \parallel BC$ , then find  $A(\triangle ABC) : A(\triangle BCD)$ .



**Solution:**

Draw  $DQ \perp BC$ , B-C-Q.

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$AD \parallel BC$  [Given]

$\therefore AP = DQ$  (i) [Perpendicular distance between two parallel lines is the same]

$\triangle ABC$  and  $\triangle DCB$  have same base  $BC$ .

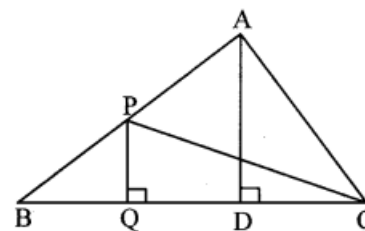
$$\begin{aligned} \therefore \frac{A(\triangle ABC)}{A(\triangle DCB)} &= \frac{AP}{DQ} && \text{[Triangles having equal base]} \\ &= \frac{AP}{AP} && \text{[From (i)]} \\ &= 1 \end{aligned}$$

$$\therefore A(\triangle ABC) : A(\triangle DCB) = 1 : 1$$

#### Question 5.

In the adjoining figure,  $PQ \perp BC$ ,  $AD \perp BC$ , then find following ratios.

- |                                                  |                                                 |
|--------------------------------------------------|-------------------------------------------------|
| i. $\frac{A(\triangle PQB)}{A(\triangle PBC)}$   | ii. $\frac{A(\triangle PBC)}{A(\triangle ABC)}$ |
| iii. $\frac{A(\triangle ABC)}{A(\triangle ADC)}$ | iv. $\frac{A(\triangle ADC)}{A(\triangle PQC)}$ |



#### Solution:

i.  $\triangle PQB$  and  $\triangle PBC$  have same height  $PQ$ .

$$\frac{A(\triangle PQB)}{A(\triangle PBC)} = \frac{BQ}{BC} \quad \text{[Triangles having equal height]}$$

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ii.  $\triangle PBC$  and  $\triangle ABC$  have same base BC.

$$\frac{A(\triangle PBC)}{A(\triangle ABC)} = \frac{PQ}{AD}$$

[Triangles having equal base]

iii.  $\triangle ABC$  and  $\triangle ADC$  have same height AD.

$$\frac{A(\triangle ABC)}{A(\triangle ADC)} = \frac{BC}{DC}$$

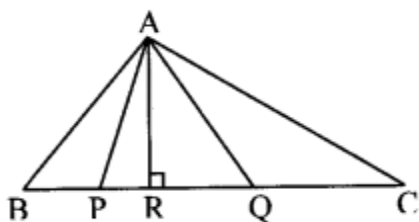
[Triangles having equal height]

iv.  $\frac{A(\triangle ADC)}{A(\triangle PQC)} = \frac{DC \times AD}{QC \times PQ}$

[Ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights]

**Question 1.**

Find  $A(\triangle ABC)A(\triangle APQ)$



**Solution:**

In  $\triangle ABC$ , BC is the base and AR is the height.

In  $\triangle APQ$ , PQ is the base and AR is the height.

$$\therefore \frac{A(\triangle ABC)}{A(\triangle APQ)} = \frac{BC \times AR}{PQ \times AR}$$

[The ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights]

$$\therefore \frac{A(\triangle ABC)}{A(\triangle APQ)} = \frac{BC}{PQ}$$

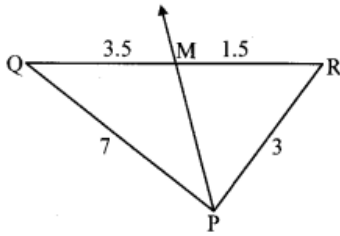
**Practice Set 1.2**

**Question 1.**

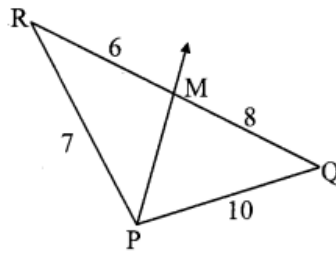
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Given below are some triangles and lengths of line segments. Identify in which figures, ray PM is the bisector of  $\angle QPR$ .

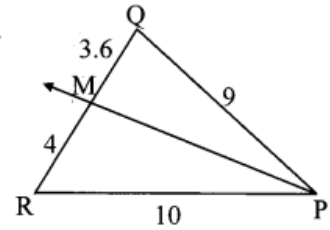
i.



ii.



iii.



**Solution:**

In  $\triangle PQR$ ,

$$\frac{PQ}{PR} = \frac{7}{3} \text{ (i)}$$

$$\frac{QM}{RM} = \frac{3.5}{1.5} = \frac{35}{15} = \frac{7}{3} \text{ (ii)}$$

$$\therefore \frac{PQ}{PR} = \frac{QM}{RM} \text{ [From (i) and (ii)]}$$

$\therefore$  Ray PM is the bisector of  $\angle QPR$ . [Converse of angle bisector theorem]

ii. In  $\Delta PQR$ ,

$$\frac{PQ}{PR} = \frac{10}{7} \text{ (i)}$$

$$\frac{QM}{RM} = \frac{8}{6} = \frac{4}{3} \text{ (ii)}$$

$$\therefore \frac{PQ}{PR} \neq \frac{QM}{RM} \text{ [From (i) and (ii)]}$$

$\therefore$  Ray PM is not the bisector of  $\angle QPR$

iii. In  $\Delta PQR$ ,

$$\frac{PQ}{PR} = \frac{9}{10} \text{ (i)}$$

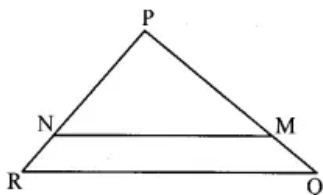
$$\frac{QM}{RM} = \frac{3.6}{4} = \frac{36}{40} = \frac{9}{10} \text{ (ii)}$$

$$\therefore \frac{PQ}{PR} = \frac{QM}{RM} \text{ [From (i) and (ii)]}$$

$\therefore$  Ray PM is the bisector of  $\angle QPR$  [Converse of angle bisector theorem]

Question 2.

In  $\Delta PQR$   $PM = 15$ ,  $PQ = 25$ ,  $PR = 20$ ,  $NR = 8$ . State whether line  $NM$  is parallel to side  $RQ$ . Give reason.



Solution:

$$PN + NR = PR \text{ [P - N - R]}$$

$$\therefore PN + 8 = 20$$

$$\therefore PN = 20 - 8 = 12$$

$$\text{Also, } PM + MQ = PQ \text{ [P - M - Q]}$$

$$\therefore 15 + MQ = 25$$

$$\therefore MQ = 25 - 15 = 10$$

$$\frac{PN}{NR} = \frac{12}{8}$$

$$\therefore \frac{PN}{NR} = \frac{3}{2}$$

$$\frac{PM}{MQ} = \frac{15}{10}$$

$$\therefore \frac{PM}{MQ} = \frac{3}{2}$$

In  $\triangle PQR$ ,

$$\frac{PN}{NR} = \frac{PM}{MQ}$$

(i)

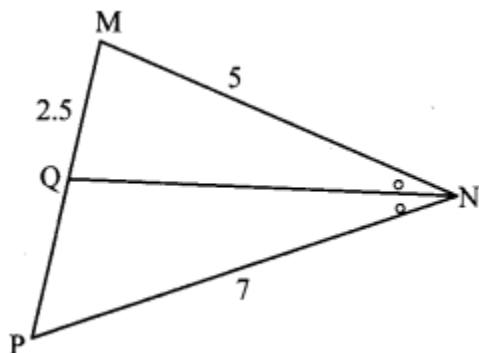
(ii)

[From (i) and (ii)]

$\therefore$  line  $NM \parallel$  side  $RQ$  [Converse of basic proportionality theorem]

### Question 3.

In  $\triangle MNP$ ,  $NQ$  is a bisector of  $\angle N$ . If  $MN = 5$ ,  $PN = 7$ ,  $MQ = 2.5$ , then find  $QP$ .



**Solution:**

In  $\triangle MNP$ ,  $NQ$  is the bisector of  $\angle N$ . [Given]

$$\therefore \frac{PN}{MN} = \frac{QP}{MQ} \text{ [Property of angle bisector of a triangle]}$$

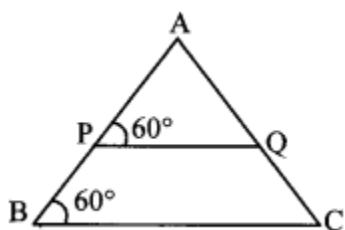
$$\therefore \frac{7}{5} = \frac{QP}{2.5}$$

$$\therefore QP = \frac{7 \times 2.5}{5}$$

$$\therefore QP = 3.5 \text{ units}$$

**Question 4.**

Measures of some angles in the figure are given. Prove that  $\angle APQ = \angle ABC$

**Solution:**

Proof

$$\angle APQ = \angle ABC = 60^\circ \text{ [Given]}$$

$$\therefore \angle APQ \cong \angle ABC$$

$\therefore$  side PQ || side BC (i) [Corresponding angles test]

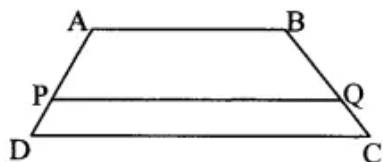
In  $\triangle ABC$ ,

side PQ || side BC [From (i)]

$$\therefore \frac{AP}{PB} = \frac{AQ}{QC} \text{ [Basic proportionality theorem]}$$

Question 5.

In trapezium ABCD, side AB || side PQ || side DC, AP = 15, PD = 12, QC = 14, find BQ.



Solution:

side AB || side PQ || side DC [Given]

$$\therefore \frac{AP}{PD} = \frac{BQ}{QC} \text{ [Property of three parallel lines and their transversals]}$$

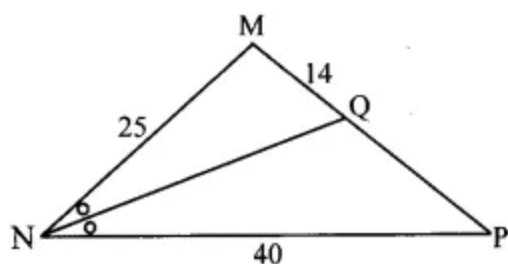
$$\therefore \frac{15}{12} = \frac{BQ}{14}$$

$$\therefore BQ = \frac{15 \times 14}{12}$$

$$\therefore BQ = 17.5 \text{ units}$$

### Question 6.

Find QP using given information in the figure.



Solution:

In  $\triangle MNP$ , seg  $NQ$  bisects  $\angle N$ . [Given]

$$\therefore \frac{PN}{MN} = \frac{QP}{MQ} \text{ [Property of angle bisector of a triangle]}$$

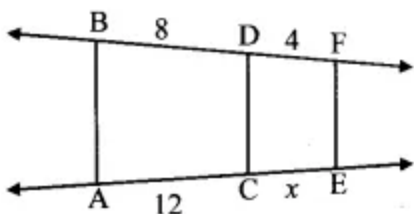
$$\therefore \frac{40}{25} = \frac{QP}{14}$$

$$\therefore QP = \frac{40 \times 14}{25}$$

$$\therefore QP = 22.4 \text{ units}$$

### Question 7.

In the adjoining figure, if  $AB \parallel CD \parallel FE$ , then find  $x$  and  $AE$ .



Solution:

line AB || line CD || line FE [Given]

$$\therefore \frac{BD}{DF} = \frac{AC}{CE} \text{ [Property of three parallel lines and their transversals]}$$

$$\therefore \frac{8}{4} = \frac{12}{X}$$

$$\therefore X = \frac{12 \times 4}{8}$$

$$\therefore X = 6 \text{ units}$$

Now, AE = AC + CE [A – C – E]

$$= 12 + x$$

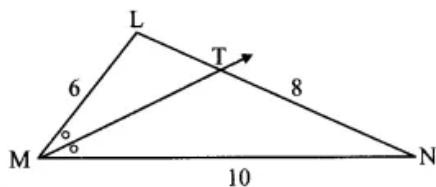
$$= 12 + 6$$

$$= 18 \text{ units}$$

$$\therefore x = 6 \text{ units and AE} = 18 \text{ units}$$

Question 8.

In  $\triangle LMN$ , ray  $MT$  bisects  $\angle LMN$ . If  $LM = 6$ ,  $MN = 10$ ,  $TN = 8$ , then find  $LT$ .



Solution:

In  $\triangle LMN$ , ray  $MT$  bisects  $\angle LMN$ . [Given]

$$\therefore \frac{LM}{MN} = \frac{LT}{TN} \text{ [Property of angle bisector of a triangle]}$$

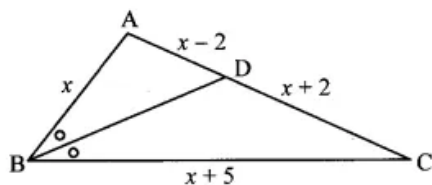
$$\therefore \frac{6}{10} = \frac{LT}{8}$$

$$\therefore LT = \frac{6 \times 8}{10}$$

$$\therefore LT = 4.8 \text{ units}$$

Question 9.

In  $\triangle ABC$ , seg  $BD$  bisects  $\angle ABC$ . If  $AB = x$ ,  $BC = x + 5$ ,  $AD = x - 2$ ,  $DC = x + 2$ , then find the value of  $x$ .



Solution:

In  $\triangle ABC$ , seg BD bisects  $\angle ABC$ . [Given]

$$\therefore \frac{AB}{BC} = \frac{AD}{CD} \text{ [Property of angle bisector of a triangle]}$$

$$\therefore \frac{x}{x+5} = \frac{x-2}{x+2}$$

$$\therefore x(x+2) = (x-2)(x+5)$$

$$\therefore x^2 + 2x = x^2 + 5x - 2x - 10$$

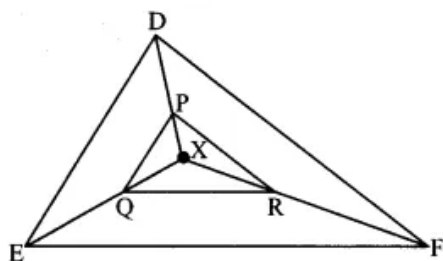
$$\therefore 2x = 3x - 10$$

$$\therefore 10 = 3x - 2x$$

$$\therefore x = 10$$

Question 10.

In the adjoining figure, X is any point in the interior of triangle. Point X is joined to vertices of triangle. Seg PQ  $\parallel$  seg DE, seg QR  $\parallel$  seg EF. Fill in the blanks to prove that, seg PR  $\parallel$  seg DF.



Solution:

In  $\triangle XDE$ , PQ  $\parallel$  DE

$$\therefore \frac{XP}{PD} = \frac{XQ}{QE}$$

In  $\triangle XEF$ , QR  $\parallel$  EF

$$\therefore \frac{XR}{RF} = \frac{XQ}{QE}$$

$$\therefore \frac{XP}{PD} = \frac{XR}{RF}$$

$$\therefore \text{seg PR} \parallel \text{seg DF}$$

[Given]

(i) [Basic proportionality theorem]

[Given]

(ii) [Basic proportionality theorem]

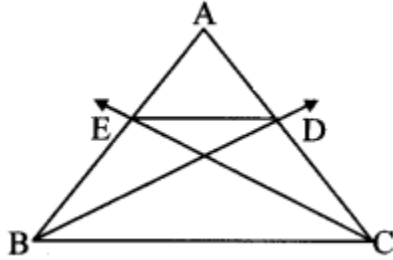
[From (i) and (ii)]

[Converse of basic proportionality theorem]

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**Question 11.**

In  $\triangle ABC$ , ray  $BD$  bisects  $\angle ABC$  and ray  $CE$  bisects  $\angle ACB$ . If  $\text{seg } AB = \text{seg } AC$ , then prove that  $ED \parallel BC$ .



**Solution:**

In  $\triangle ABC$ , ray  $BD$  bisects  $\angle ABC$ . [Given]

$$\therefore \frac{AB}{BC} = \frac{AE}{EB} \text{ (i) [Property of angle bisector of a triangle]}$$

Also, in  $\triangle ABC$ , ray CE bisects  $\angle ACB$ . [Given]

$$\therefore \frac{AC}{BC} = \frac{AE}{EB} \text{ (ii) [Property of angle bisector of a triangle]}$$

But, seg AB = seg AC (iii) [Given]

$$\therefore \frac{AB}{BC} = \frac{AE}{EB} \text{ (iv) [From (ii) and (iii)]}$$

$$\therefore \frac{AD}{DC} = \frac{AE}{EB} \text{ [From (i) and (iv)]}$$

$\therefore ED \parallel BC$  [Converse of basic proportionality theorem]

Question 1.

i. Draw a  $\triangle ABC$ .

ii. Bisect  $\angle B$  and name the point of intersection of AC and the angle bisector as D.

iii. Measure the sides.

$$AB = \boxed{4} \text{ cm, } BC = \boxed{4} \text{ cm,}$$

$$AD = \boxed{2} \text{ cm, } DC = \boxed{2} \text{ cm}$$

iv. Find ratios  $\frac{AB}{BC}$  and  $\frac{AD}{DC}$

v. You will find that both the ratios are almost equal.

vi. Bisect remaining angles of the triangle and find the ratios as above. Verify that the ratios are equal. (Textbook pg. no. 8)

Solution:

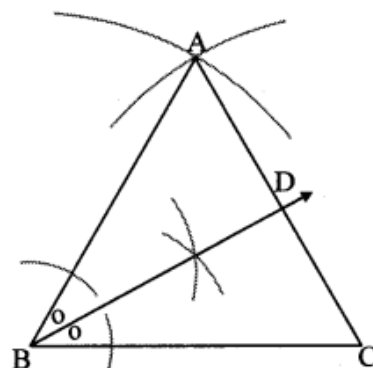
$$AB = \boxed{4} \text{ cm, } BC = \boxed{4} \text{ cm}$$

$$AD = \boxed{2} \text{ cm, } DC = \boxed{2} \text{ cm}$$

$$\frac{AB}{BC} = \frac{4}{4} = 1 \quad \dots(i)$$

$$\frac{AD}{DC} = \frac{2}{2} = 1 \quad \dots(ii)$$

$$\therefore \frac{AB}{BC} = \frac{AD}{DC} \quad \dots[\text{From (i) and (ii)}]$$



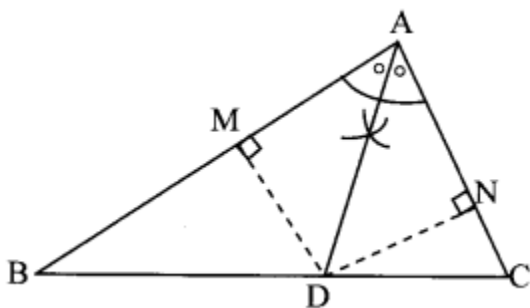
Note: Students should bisect the remaining angles and verify that the ratios are equal.

Question 2.

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**Write another proof of the above theorem (property of an angle bisector of a triangle). Use the following properties and write the proof.**

- i. The areas of two triangles of equal height are proportional to their bases.
- ii. Every point on the bisector of an angle is equidistant from the sides of the angle. (Textbook pg. no. 9)



Given: In  $\triangle CAB$ , ray  $AD$  bisects  $\angle A$ .

To prove:  $\frac{AB}{AC} = \frac{BD}{DC}$

Construction: Draw seg DM  $\perp$  seg AB A – M – B and seg DN  $\perp$  seg AC, A – N – C.

Solution:

Proof:

In  $\triangle ABC$ ,

Point D is on angle bisector of  $\angle A$ . [Given]

$\therefore DM = DN$  [Every point on the bisector of an angle is equidistant from the sides of the angle]

$\frac{A(\triangle ABD)}{A(\triangle ACD)} = \frac{AB \times DM}{AC \times DN}$  [Ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights]

$$\therefore \frac{A(\triangle ABD)}{A(\triangle ACD)} = \frac{AB}{AC} \text{ (ii) [From (i)]}$$

Also,  $\triangle ABD$  and  $\triangle ACD$  have equal height.

$$\therefore \frac{A(\triangle ABD)}{A(\triangle ACD)} = \frac{BD}{CD} \text{ (iii) [Triangles having equal height]}$$

$$\therefore \frac{AB}{AC} = \frac{BD}{DC} \text{ [From (ii) and (iii)]}$$

Question 3.

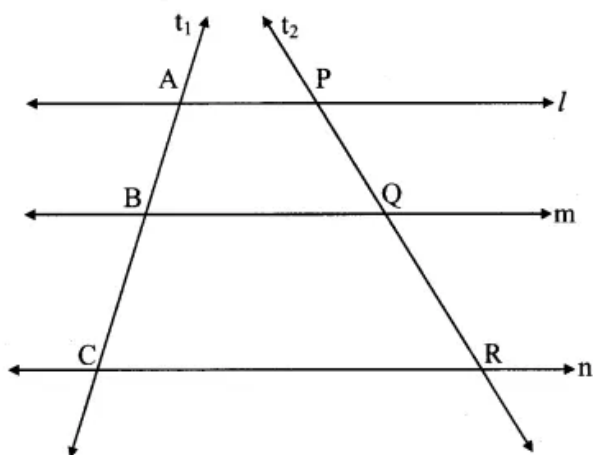
- i. Draw three parallel lines.
- ii. Label them as l, m, n.
- iii. Draw transversals  $t_1$  and  $t_2$ .
- iv. AB and BC are intercepts on transversal  $t_1$ .

v. PQ and QR are intercepts on transversal  $t_2$ .

vi. Find ratios  $\frac{AB}{BC}$  and  $\frac{PQ}{QR}$ . You will find that they are almost equal. Verify that they are equal.

(Textbook pg, no. 10)

Solution:



Here,  $AB = 1.5$  cm,  $BC = 2.1$  cm,

$PQ = 1.7$  cm,  $QR = 2.3$  cm

$$\frac{AB}{BC} = \frac{1.5}{2.1} = 0.714 \approx 0.7$$

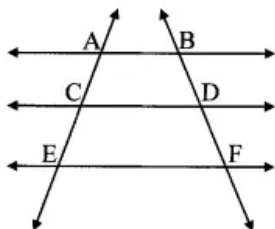
$$\frac{PQ}{QR} = \frac{1.7}{2.3} = 0.739 \approx 0.7$$

$$\therefore \frac{AB}{BC} = \frac{PQ}{QR}$$

(Students should draw figures similar to the ones given and verify the properties.)

Question 4.

In the adjoining figure,  $AB \parallel CD \parallel EF$ . If  $AC = 5.4$ ,  $CE = 9$ ,  $BD = 7.5$ , then find  $DF$ . (Textbook pg, no. 12)



Solution:

$$AB \parallel CD \parallel EF$$

$$\therefore \frac{AC}{CE} = \frac{BD}{DF}$$

$$\therefore \frac{5.4}{9} = \frac{7.5}{DF}$$

$$\therefore DF = \frac{7.5 \times 9}{5.4}$$

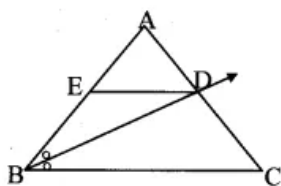
$$\therefore DF = 12.5 \text{ units}$$

[Given]

**Property of three parallel lines  
and their transversals**

Question 5.

In  $\triangle ABC$ , ray BD bisects  $\angle ABC$ .  $A - D - C$ , side  $DE \parallel$  side  $BC$ ,  $A - E - B$ , then prove that  $\frac{AB}{BC} = \frac{AE}{EB}$   
(Textbook pg, no. 13)



Solution:

In  $\triangle ABC$ , ray BD bisects  $\angle B$ .

$$\therefore \frac{AB}{BC} = \frac{AD}{DC}$$

In  $\triangle ABC$ ,  $DE \parallel BC$

$$\therefore \frac{AE}{EB} = \frac{AD}{DC}$$

$$\therefore \frac{AB}{BC} = \frac{AE}{EB}$$

[Given]

(i) [Angle bisector theorem]

[Given]

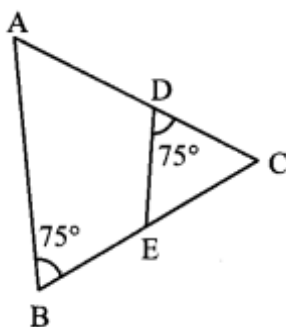
(ii) [Basic proportionality theorem]

[From (i) and (ii)]

### Practice Set 1.3

Question 1.

In the adjoining figure,  $\angle ABC = 75^\circ$ ,  $\angle EDC = 75^\circ$ . State which two triangles are similar and by which test? Also write the similarity of these two triangles by a proper one to one correspondence.



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**Solution:**

In  $\triangle ABC$  and  $\triangle EDC$ ,

$$\angle ABC \cong \angle EDC \text{ [Each angle is of measure } 75^\circ]$$

$$\angle ACB \cong \angle ECD \text{ [Common angle]}$$

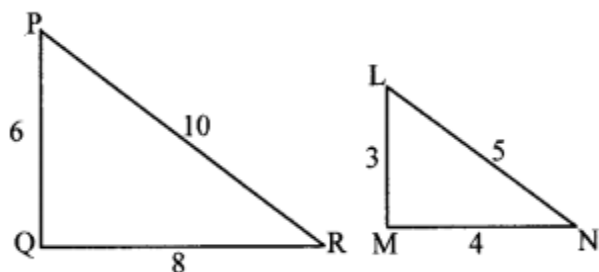
$$\therefore \triangle ABC \sim \triangle EDC \text{ [AA test of similarity]}$$

One to one correspondence is

$$ABC \leftrightarrow EDC$$

**Question 2.**

Are the triangles in the adjoining figure similar? If yes, by which test?

**Solution:**

In  $\triangle PQR$  and  $\triangle LMN$ ,

In  $\triangle PQR$  and  $\triangle LMN$ ,

$$\frac{PQ}{LM} = \frac{6}{3} = \frac{2}{1} \text{ (i)}$$

$$\frac{QR}{MN} = \frac{8}{4} = \frac{2}{1} \text{ (ii)}$$

$$\frac{PR}{LN} = \frac{10}{5} = \frac{2}{1} \text{ (iii)}$$

$$\therefore \frac{PQ}{LM} = \frac{QR}{MN} = \frac{PR}{LN} \text{ [From (i), (ii) and (iii)]}$$

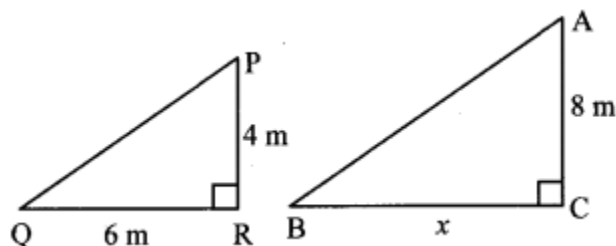
$$\therefore \triangle PQR \sim \triangle LMN \text{ [SSS test of similarity]}$$

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**Question 3.**

As shown in the adjoining figure, two poles of height 8 m and 4 m are perpendicular to the ground. If the length of shadow of smaller pole due to sunlight is 6 m, then how long will be the shadow of the bigger pole at the same time?

**Solution:**

Here,  $AC$  and  $PR$  represent the bigger and smaller poles, and  $BC$  and  $QR$  represent their shadows respectively.

Now,  $\triangle ACB \sim \triangle PRQ$  [  $\because$  Vertical poles and their shadows form similar figures ]

$$\therefore \frac{CB}{RQ} = \frac{AC}{PR} \text{ [Corresponding sides of similar triangles]}$$

$$\therefore \frac{x}{6} = \frac{8}{4}$$

$$\therefore x = \frac{8 \times 6}{4}$$

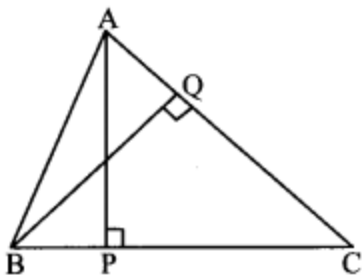
$$\therefore x = 12 \text{ m}$$

$\therefore$  The shadow of the bigger pole will be 12 metres long at that time.

**Question 4.**

In  $\triangle ABC$ ,  $AP \perp BC$ ,  $BQ \perp AC$ ,  $B - P - C$ ,  $A - Q - C$ , then prove that  $\triangle CPA \sim \triangle CQB$ . If  $AP = 7$ ,  $BQ = 8$ ,  $BC = 12$ , then find  $AC$ .

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**Solution:**

In  $\triangle CPA$  and  $\triangle CQB$ ,

$\angle CPA \cong \angle CQB$  [Each angle is of measure  $90^\circ$ ]

$\angle ACP \cong \angle BCQ$  [Common angle]

$\therefore \triangle CPA \sim \triangle CQB$  [AA test of similarity]

$$\therefore \frac{AC}{BC} = \frac{AP}{BQ} \text{ [Corresponding sides of similar triangles]}$$

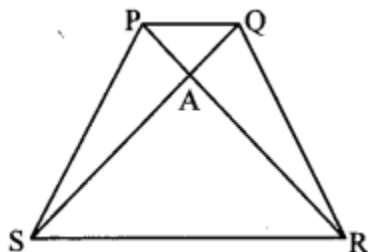
$$\therefore \frac{AC}{12} = \frac{7}{8}$$

$$\therefore AC = x = \frac{12 \times 7}{8}$$

$$\therefore AC = 10.5 \text{ Units}$$

**Question 5.**

Given: In trapezium PQRS, side  $PQ \parallel$  side  $SR$ ,  $AR = 5 AP$ ,  $AS = 5 AQ$ , then prove that  $SR = 5 PQ$ .



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**Solution:**

side PQ || side SR [Given]

and seg SQ is their transversal.

$\therefore \angle QSR = \angle SQP$  [Alternate angles]

$\therefore \angle ASR = \angle AQP$  (i) [Q – A – S]

In  $\triangle ASR$  and  $\triangle AQP$ ,

$\angle ASR = \angle AQP$  [From (i)]

$\angle SAR \cong \angle QAP$  [Vertically opposite angles]

$\triangle ASR \sim \triangle AQP$  [AA test of similarity]

$\therefore ASR = QP$  (ii) [Corresponding sides of similar triangles]

But, AS = 5 AQ [Given]

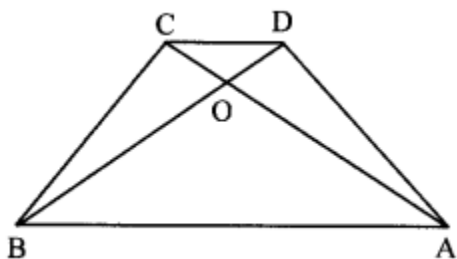
$\therefore ASR = 51$  (iii)

$\therefore QP = 51$  [From (ii) and (iii)]

$\therefore SR = 5 PQ$

**Question 6.**

In trapezium ABCD (adjoining figure), side AB || side DC, diagonals AC and BD intersect in point O. If AB = 20, DC = 6, OB = 15, then find OD.

**Solution:**

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side AB || side DC [Given]

and seg BD is their transversal.

$\therefore \angle DBA \cong \angle BDC$  [Alternate angles]

$\therefore \angle OBA \cong \angle ODC$  (i) [D – O – B]

In  $\triangle OBA$  and  $\triangle ODC$

$\angle OBA \cong \angle ODC$  [From (i)]

$\angle BOA \cong \angle DOC$  [Vertically opposite angles]

$\therefore \triangle OBA \sim \triangle ODC$  [AA test of similarity]

$$\therefore \frac{OB}{OD} = \frac{AB}{DC} \text{ [Corresponding sides of similar triangles]}$$

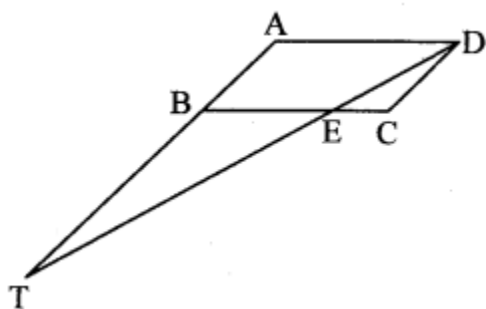
$$\therefore \frac{15}{OD} = \frac{20}{6}$$

$$\therefore OD = x = \frac{15 \times 6}{20}$$

$$\therefore OD = 4.5 \text{ units}$$

#### Question 7.

ABCD is a parallelogram. Point E is on side BC. Line DE intersects ray AB in point T. Prove that  $DE \times BE = CE \times TE$ .



**Solution:**

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Proof:

ABCD is a parallelogram. [Given]

$\therefore$  side AB  $\parallel$  side CD [Opposite sides of a parallelogram]

$\therefore$  side AT  $\parallel$  side CD [A – B – T]

and seg DT is their transversal.

$\therefore \angle ATD \cong \angle CDT$  [Alternate angles]

$\therefore \angle BTE \cong \angle CDE$  (i) [A – B – T, T – E – D]

In  $\triangle BTE$  and  $\triangle CDE$ ,

$\angle BTE \cong \angle CDE$  [From (i)]

$\angle BET \cong \angle CED$  [Vertically opposite angles]

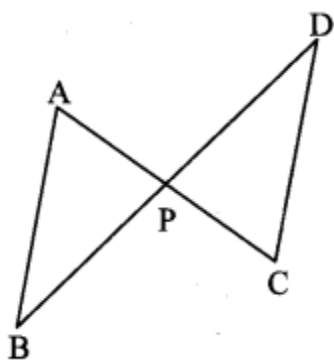
$\therefore \triangle BTE \sim \triangle CDE$ . [AA test of similarity]

$\therefore TE/DE = BE/CE$  [Corresponding sides of similar triangles]

$\therefore DE \times BE = CE \times TE$

#### Question 8.

In the adjoining figure, seg AC and seg BD intersect each other in point P and AP/CP = BP/DP. Prove that,  $\triangle ABP \sim \triangle CDP$



**Solution:**

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Proof:

In  $\triangle ABP$  and  $\triangle CDP$ ,

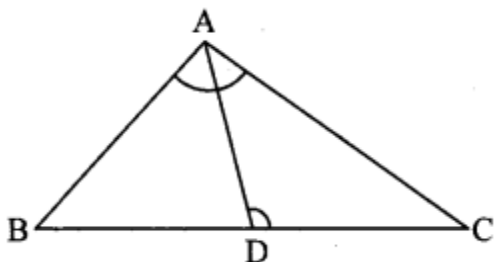
$APCP = BPDP$  [Given]

$\angle APB \cong \angle CPD$  [Vertically opposite angles]

$\therefore \triangle ABP \sim \triangle CDP$  [SAS test of similarity]

**Question 9.**

In the adjoining figure, in  $\triangle ABC$ , point D is on side BC such that,  $\angle BAC = \angle ADC$ . Prove that,  $CA^2 = CB \times CD$ ,



**Solution:**

Proof:

In  $\triangle BAC$  and  $\triangle ADC$ ,

$\angle BAC \cong \angle ADC$  [Given]

$\angle BCA \cong \angle ACD$  [Common angle]

$\therefore \triangle BAC \sim \triangle ADC$  [AA test of similarity]

$\therefore CA/CD = CB/CA$  [Corresponding sides of similar triangles]

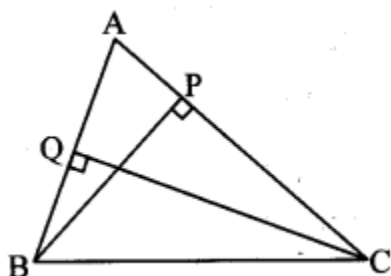
$\therefore CA \times CA = CB \times CD$

$\therefore CA^2 = CB \times CD$

**Question 1.**

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In the adjoining figure,  $BP \perp AC$ ,  $CQ \perp AB$ ,  $A - P - C$ ,  $A - Q - B$ , then prove that  $\triangle APB$  and  $\triangle AQC$  are similar. (Textbook pg. no. 20)

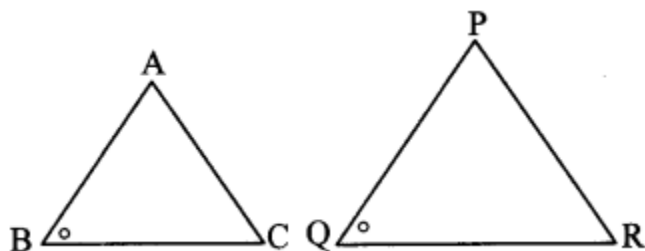


**Solution:**

|                                               |                         |
|-----------------------------------------------|-------------------------|
| In $\triangle APB$ and $\triangle AQC$ ,      |                         |
| $\angle APB = 90^\circ$                       | (i)                     |
| $\angle AQC = 90^\circ$                       | (ii)                    |
| $\therefore \angle APB \cong \angle AQC$      | [From (i) and (ii)]     |
| $\angle PAB \cong \angle QAC$                 | [Common angle]          |
| $\therefore \triangle APB \sim \triangle AQC$ | [AA test of similarity] |

2. SAS test for similarity of triangles:

For a given correspondence, if two pairs of corresponding sides are in the same proportion and the angle between them is congruent, then the two triangles are similar.

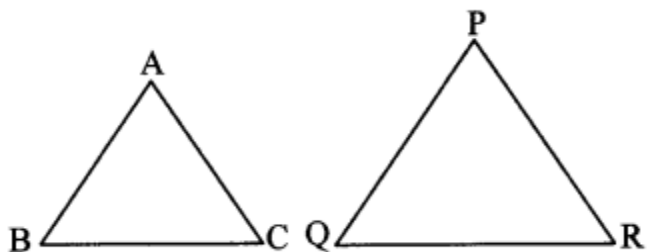


In the given figure, if  $AB/PQ = BC/QR$ , and  $\angle B \cong \angle Q$ , then  $\triangle ABC \sim \triangle PQR$

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### 3. SSS test for similarity of triangles:

For a given correspondence, if three sides of one triangle are in proportion with the corresponding three sides of the another triangle, then the two triangles are similar.



In the given figure, if  $ABPQ = BCQR = ACPR$ , then  $\triangle ABC \sim \triangle PQR$

Properties of similar triangles:

1. Reflexivity:  $\triangle ABC \sim \triangle ABC$
2. Symmetry : If  $\triangle ABC \sim \triangle DEF$ , then  $\triangle DEF \sim \triangle ABC$ .
3. Transitivity: If  $\triangle ABC \sim \triangle DEF$  and  $\triangle DEF \sim \triangle GHI$ , then  $\triangle ABC \sim \triangle GHI$ .

### Practice Set 1.4

#### Question 1.

The ratio of corresponding sides of similar triangles is 3 : 5, then find the ratio of their areas.

**Solution:**

Let the corresponding sides of similar triangles be  $S_1$  and  $S_2$ .

Let  $A_1$  and  $A_2$  be their corresponding areas.

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$$\therefore s_1 : s_2 = 3 : 5$$

$$\therefore \frac{s_1}{s_2} = \frac{3}{5}$$

$$\frac{A_1}{A_2} = \frac{s_1^2}{s_2^2}$$

$$= \left( \frac{s_1}{s_2} \right)^2$$

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

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

(i)

[Theorem of areas of similar triangles]

[From (i)]

$\therefore$  Ratio of areas of similar triangles = 9 : 25

#### Question 2.

If  $\triangle ABC \sim \triangle PQR$  and  $AB : PQ = 2:3$ , then fill in the blanks.

**Solution:**

$$\frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{AB^2}{PQ^2} = \frac{2^2}{3^2} = \frac{4}{9}$$

[Theorem of areas of similar triangles]

#### Question 3.

If  $\triangle ABC \sim \triangle PQR$ ,  $A(\triangle ABC) = 80$ ,  $A(\triangle PQR) = 125$ , then fill in the blanks.

**Solution:**

|                                                                        |                                              |
|------------------------------------------------------------------------|----------------------------------------------|
| $\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{80}{125} = \frac{16}{25}$ | (i) [Given]                                  |
| $\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{AB^2}{PQ^2}$              | (ii) [Theorem of areas of similar triangles] |
| $\therefore \frac{AB^2}{PQ^2} = \frac{16}{25}$                         | [From (i) and (ii)]                          |
| $\therefore \frac{AB}{PQ} = \frac{\boxed{4}}{\boxed{5}}$               | [Taking square root of both sides]           |

Question 4.

$\Delta LMN \sim \Delta PQR$ ,  $9 \times A(\Delta PQR) = 16 \times A(\Delta LMN)$ . If  $QR = 20$ , then find  $MN$ .

Solution:

$$9 \times A(\Delta PQR) = 16 \times A(\Delta LMN) \text{ [Given]}$$

$$\therefore \frac{A(\Delta LMN)}{A(\Delta PQR)} = \frac{9}{16} \text{ (i)}$$

Now,  $\Delta LMN \sim \Delta PQR$  [Given]

$$\therefore \frac{A(\Delta LMN)}{A(\Delta PQR)} = \frac{MN^2}{QR^2} \text{ (ii) [Theorem of areas of similar triangles]}$$

$$\therefore \frac{MN^2}{QR^2} = \frac{9}{16} \text{ [From (i) and (ii)]}$$

$$\therefore \frac{MN}{QR} = \frac{3}{4} \text{ [Taking square root of both sides]}$$

$$\therefore \frac{MN}{20} = \frac{3}{4}$$

$$\therefore MN = \frac{20 \times 3}{4}$$

$$\therefore MN = 15 \text{ units}$$

Question 5.

Areas of two similar triangles are 225 sq. cm. and 81 sq. cm. If a side of the smaller triangle is 12 cm, then find corresponding side of the bigger triangle.

Solution:

Let the areas of two similar triangles be  $A_1$  and  $A_2$ .

$$A_1 = 225 \text{ sq. cm. } A_2 = 81 \text{ sq. cm.}$$

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Let the corresponding sides of triangles be  $S_1$  and  $S_2$  respectively.

$$S_1 = 12 \text{ cm}$$

$$\frac{A_1}{A_2} = \frac{s_1^2}{s_2^2}$$

[Theorem of areas of similar triangles]

$$\therefore \frac{225}{81} = \frac{s_1^2}{12^2}$$

$$\therefore s_1^2 = \frac{225 \times 12^2}{81}$$

$$\therefore s_1 = \frac{15 \times 12}{9}$$

[Taking square root of both sides]

$$\therefore s_1 = 20 \text{ cm}$$

$\therefore$  The length of the corresponding side of the bigger triangle is 20 cm.

#### Question 6.

$\triangle ABC$  and  $\triangle DEF$  are equilateral triangles. If  $A(\triangle ABC): A(\triangle DEF) = 1:2$  and  $AB = 4$ , find  $DE$ .

**Solution:**

In  $\triangle ABC$  and  $\triangle DEF$ ,

$$\left. \begin{array}{l} \angle A \cong \angle D \\ \angle B \cong \angle E \end{array} \right\}$$

[Each angle is of measure  $60^\circ$ ]

$$\therefore \triangle ABC \sim \triangle DEF$$

[AA test of similarity]

$$\therefore \frac{A(\triangle ABC)}{A(\triangle DEF)} = \frac{AB^2}{DE^2}$$

[Theorem of areas of similar triangles]

$$\therefore \frac{1}{2} = \frac{4^2}{DE^2}$$

$$\therefore DE^2 = 4^2 \times 2$$

$$\therefore DE = 4\sqrt{2} \text{ units}$$

[Taking square root of both sides]

#### Question 7.

In the adjoining figure, seg  $PQ \parallel$  seg  $DE$ ,  $A(\triangle PQF) = 20$  sq. units,  $PF = 2 DP$ , then find  $A(\triangle DPQE)$  by completing the following activity.

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**Solution:**

$A(\Delta PQF) = 20 \text{ sq. units}$ ,  $PF = 2 DP$ , [Given]

Let us assume  $DP = x$ .

$\therefore PF = 2x$

$$DF = DP + \boxed{PF} = \boxed{x} + \boxed{2x} = 3x$$

[D – P – F]

In  $\Delta FDE$  and  $\Delta FPQ$ ,

$$\angle FDE \cong \angle FPQ$$

[Corresponding angles]

$$\angle FED \cong \angle FQP$$

[Corresponding angles]

$$\therefore \Delta FDE \sim \Delta FPQ$$

[AA test of similarity]

$$\therefore \frac{A(\Delta FDE)}{A(\Delta FPQ)} = \frac{\boxed{DF^2}}{\boxed{PF^2}} = \frac{(3x)^2}{(2x)^2} = \frac{9}{4}$$

[Theorem of areas of similar triangles]

$$\therefore A(\Delta FDE) = \frac{9}{4} \times A(\Delta FPQ)$$

$$= \frac{9}{4} \times \boxed{20} = \boxed{45 \text{ sq. units}}$$

$$A(\square DPQE) = A(\Delta FDE) - A(\Delta FPQ)$$

$$= \boxed{45} - \boxed{20}$$

$$= \boxed{25 \text{ sq. units}}$$



# Maharashtra Board Solutions

## Class 10 Maths (Part 2)

- Chapter 1- Similarity
- Chapter 2- Pythagoras Theorem
- Chapter 3- Circle
- Chapter 4- Geometric Constructions
- Chapter 5- Co-ordinate Geometry
- Chapter 6- Trigonometry
- Chapter 7- Mensuration

<https://www.indcareer.com/schools/maharashtra-board-solutions-for-class-10-maths-part-2-chapter-1-similarity/>

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The Maharashtra State Board of Secondary and Higher Secondary Education or MSBSHSE (Marathi: महाराष्ट्र राज्य माध्यमिक आणि उच्च माध्यमिक शिक्षण मंडळ), is an **autonomous and statutory body established in 1965**. The board was amended in the year 1977 under the provisions of the Maharashtra Act No. 41 of 1965.

The Maharashtra State Board of Secondary & Higher Secondary Education (MSBSHSE), Pune is an independent body of the Maharashtra Government. There are more than 1.4 million students that appear in the examination every year. The Maha State Board conducts the board examination twice a year. This board conducts the examination for SSC and HSC.

The Maharashtra government established the Maharashtra State Bureau of Textbook Production and Curriculum Research, also commonly referred to as Ebalbharati, in 1967 to take up the responsibility of providing quality textbooks to students from all classes studying under the Maharashtra State Board. MSBHSE prepares and updates the curriculum to provide holistic development for students. It is designed to tackle the difficulty in understanding the concepts with simple language with simple illustrations. Every year around 10 lakh students are enrolled in schools that are affiliated with the Maharashtra State Board.

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