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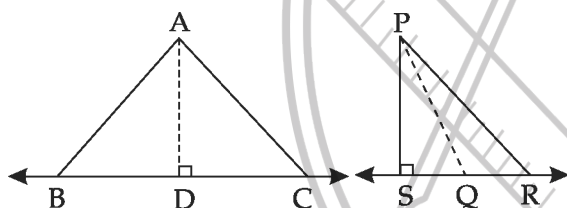
Similarity

... INDEX ...

Pr. S 1.1 - 1 Pg	6	Pr. S 1.2 - 4 Pg	10	Pr. S 1.3 - 1 Pg	16	Pr. S 1.3 - 9 Pg	17	PS 1 - 1 Pg	20	PS 1 - 9 Pg	13
Pr. S 1.1 - 2 Pg	7	Pr. S 1.2 - 5 Pg	13	Pr. S 1.3 - 2 Pg	16	Pr. S 1.4 - 1 Pg	19	PS 1 - 2 Pg	7	PS 1 - 10 Pg	12
Pr. S 1.1 - 3 Pg	7	Pr. S 1.2 - 6 Pg	12	Pr. S 1.3 - 3 Pg	15	Pr. S 1.4 - 2 Pg	19	PS 1 - 3 Pg	8	PS 1 - 11 Pg	16
Pr. S 1.1 - 4 Pg	7	Pr. S 1.2 - 7 Pg	13	Pr. S 1.3 - 4 Pg	17	Pr. S 1.4 - 3 Pg	19	PS 1 - 4 Pg	8	PS 1 - 12 Pg	18
Pr. S 1.1 - 5 Pg	8	Pr. S 1.2 - 8 Pg	12	Pr. S 1.3 - 5 Pg	16	Pr. S 1.4 - 4 Pg	19	PS 1 - 5 Pg	8	PS 1 - 13 Pg	18
Pr. S 1.2 - 1 Pg	11	Pr. S 1.2 - 9 Pg	12	Pr. S 1.3 - 6 Pg	17	Pr. S 1.4 - 5 Pg	19	PS 1 - 6 Pg	20		
Pr. S 1.2 - 2 Pg	11	Pr. S 1.2 - 10 Pg	11	Pr. S 1.3 - 7 Pg	17	Pr. S 1.4 - 6 Pg	20	PS 1 - 7 Pg	11		
Pr. S 1.2 - 3 Pg	12	Pr. S 1.2 - 11 Pg	13	Pr. S 1.3 - 8 Pg	16	Pr. S 1.4 - 7 Pg	20	PS 1 - 8 Pg	14		

**Points to Remember:****Ratio of Areas of Two Triangles**

- Property - 1 :** The ratio of areas of two triangles is equal to the ratio of the product of their bases and corresponding heights.



In ΔABC ,
seg AD is the height and seg BC is the base.

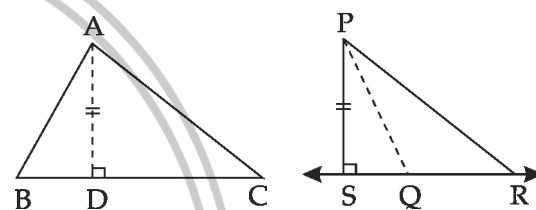
In ΔPQR ,
seg PS is the height and seg QR is the base.

$$\frac{A(\Delta ABC)}{A(\Delta PQR)} = \frac{BC \times AD}{QR \times PS}$$

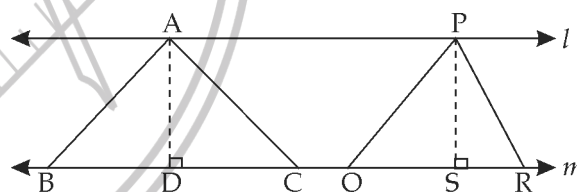
- To learn the next property, we have to first understand the meaning of Triangles with equal heights.

In theorems and problems we will come across three situations where two or more triangles have equal height.

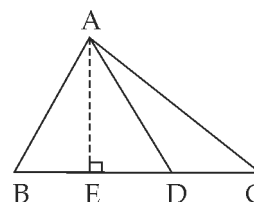
- In the following figure,
seg AD and seg PS are the heights of ΔABC and ΔPQR respectively.
If $AD = PS$ then ΔABC and ΔPQR are said to have equal height.



- In the following figure, line $l \parallel$ line m
 ΔABC and ΔPQR lie between the same two parallel lines l and m .
 $\therefore$ They are said to have equal heights.



- In the following figure,
 ΔABD and ΔADC and ΔABC have common vertex A and their bases BD, DC and BC lie on the same line BC.
Also, seg AE $\perp$ line BC.
 $\therefore$ seg AE is their common height.
 $\therefore$ These three triangles have same height.

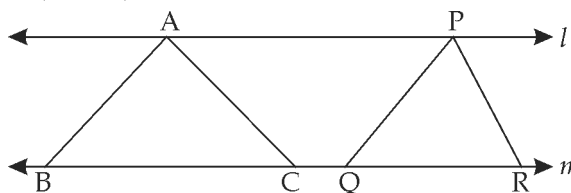


- Property - 2 :** The ratio of areas of two triangles with equal height is equal to the ratio of their corresponding bases.

- (1) In the following figure, $\triangle ABC$ and $\triangle PQR$ lie between the same two parallel lines l and m .

$\therefore$ Their heights are equal.

$$\therefore \frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{BC}{QR}$$



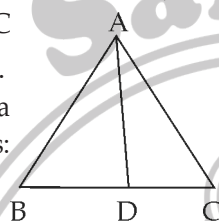
- (2) In the following figure, $\triangle ABD$, $\triangle ADC$ and $\triangle ABC$ have common vertex A, and their bases BD, CD and BC lie on the same line BC

Hence they have equal heights.

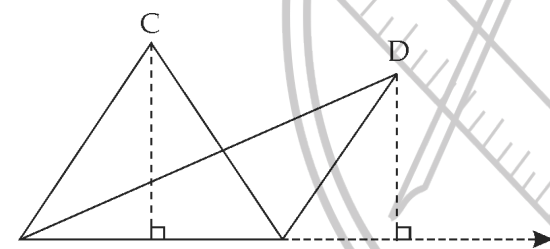
Considering two triangles at a time we get the following results:

$$(i) \frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{BD}{CD}$$

$$(ii) \frac{A(\triangle ABD)}{A(\triangle ABC)} = \frac{BD}{BC} \quad (iii) \frac{A(\triangle ADC)}{A(\triangle ABC)} = \frac{DC}{BC}$$



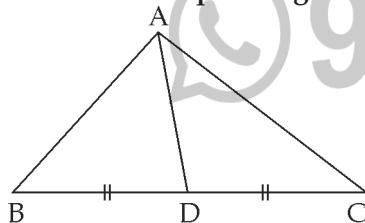
- Property - 3 :** The ratio of areas of two triangles having equal bases, is equal to the ratio of their corresponding heights.



In the above figure, $\triangle ABC$ and $\triangle ABD$ have the same base AB.

$$\frac{A(\triangle ABC)}{A(\triangle ABD)} = \frac{CP}{DQ}$$

- Property - 4 :** Areas of two triangles having equal bases and equal heights are equal.



In the above figure, $\triangle ABD$ and $\triangle ACD$ have common vertex A and their bases BD and CD lie on the same line BC.

$\therefore$ Their heights are equal.

Also, D is the midpoint of seg BC.

$\therefore BD = DC$.

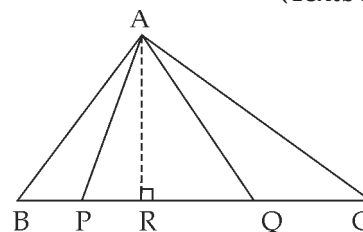
$\therefore$ Their bases are equal.

$\therefore A(\triangle ABD) = A(\triangle ACD)$

Activity : Fill in the blanks properly.

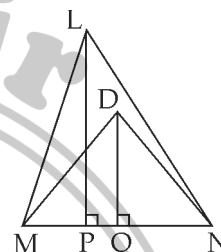
(i)

(Textbook page no. 3)



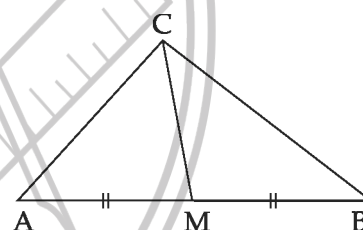
$$\frac{A(\triangle ABC)}{A(\triangle APQ)} = \frac{BC \times AR}{PQ \times AR} = \frac{BC}{PQ}$$

(ii)



$$\frac{A(\triangle LMN)}{A(\triangle DMN)} = \frac{MN \times LP}{MN \times DQ} = \frac{LP}{DQ}$$

- (iii) Point M is the midpoint of seg AB. Seg CM is the median of $\triangle ABC$.



$$\frac{A(\triangle AMC)}{A(\triangle BMC)} = \frac{AM}{BM}$$

...(Triangles with equal heights)

$$= \frac{AM}{AM} = 1$$

...($\because$ M is the midpoint of AB)

Area of two triangles having equal bases and equal heights are equal.

MASTER KEY QUESTION SET - 1

Practice Set - 1.1 (Textbook Page No. 5)

- (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. (2 marks)

Solution :

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

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

$$b_1 = 9, h_1 = 5, b_2 = 10 \text{ and } h_2 = 6 \quad \dots(\text{Given})$$

$$\frac{A_1}{A_2} = \frac{b_1 \times h_1}{b_2 \times h_2} \quad \dots(\text{Write the statement of property I})$$

$$\therefore \frac{A_1}{A_2} = \frac{9 \times 5}{10 \times 6}$$

$$\therefore \frac{A_1}{A_2} = \frac{3}{4}$$

$\therefore$ **The ratio of the areas of the triangles is 3 : 4**

(3) In the adjoining figure

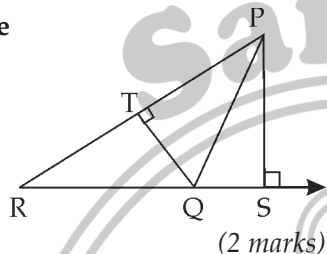
seg $PS \perp$ ray RQ ,

seg $QT \perp$ seg PR .

If $RQ = 6$,

$PS = 6$ and $PR = 12$

then find QT .



(2 marks)

Solution :

Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

$$A(\triangle PQR) = \frac{1}{2} \times RQ \times PS$$

$$= \frac{1}{2} \times 6 \times 6$$

$$A(\triangle PQR) = 18 \text{ sq. units}$$

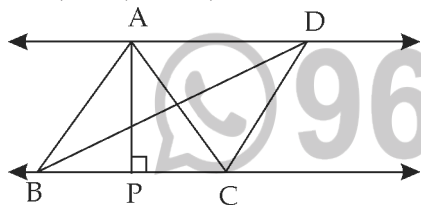
$$\text{Also, } A(\triangle PQR) = \frac{1}{2} \times PR \times QT$$

$$\therefore 18 = \frac{1}{2} \times 12 \times QT$$

$$QT = \frac{18 \times 2}{12}$$

$\therefore$ **QT = 3 units**

(4) In adjoining figure $AP \perp BC$, $AD \parallel BC$, then find $A(\triangle ABC) : A(\triangle BCD)$ (2 marks)



Solution :

line $AD \parallel$ line BC $\dots(\text{Given})$

$\therefore$ $\triangle ABC$ and $\triangle BCD$ lie between the same two parallel lines AD and BC .

$\therefore$ Their heights are equal.

Also, they have a common base BC

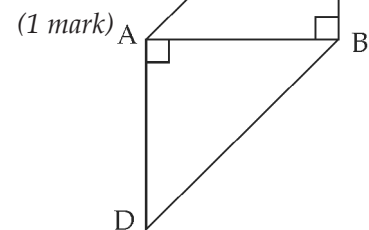
$\therefore A(\triangle ABC) = A(\triangle BCD)$ $\dots(\text{Triangles having equal base and equal height})$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle BCD)} = 1$$

(2) In figure $BC \perp AB$, $AD \perp AB$,

$BC = 4$, $AD = 8$ then

find $\frac{A(\triangle ABC)}{A(\triangle ADB)}$



(1 mark)

Solution

$$\frac{A(\triangle ABC)}{A(\triangle ADB)} = \frac{BC}{AD} \quad \dots(\text{Triangles with common base})$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle ADB)} = \frac{4}{8}$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle ADB)} = \frac{1}{2}$$

Problem Set - 1 (Textbook Page No. 27)

(2) In $\triangle ABC$, $B-D-C$ and

$BD = 7$, $BC = 20$.

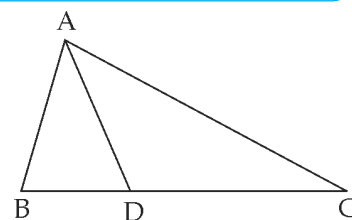
Then find the following ratio.

(i) $\frac{A(\triangle ABD)}{A(\triangle ADC)}$

(ii) $\frac{A(\triangle ABD)}{A(\triangle ABC)}$

(iii) $\frac{A(\triangle ADC)}{A(\triangle ABC)}$

(3 marks)



Solution :

$$BC = BD + DC$$

$$\dots(B - D - C)$$

$$\therefore 20 = 7 + DC$$

$$\therefore 20 - 7 = DC$$

$$\therefore DC = 13 \text{ units.}$$

$\triangle ABD$, $\triangle ADC$ and $\triangle ABC$ have a common vertex A and their bases BD , DC and BC lie on the same line BC .

$\therefore$ their heights are equal.

(1) $\frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{BD}{DC} \quad \dots(\text{triangles with equal height})$

$$\frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{7}{13}$$

(2) $\frac{A(\triangle ABD)}{A(\triangle ABC)} = \frac{BD}{BC} \quad \dots(\text{triangles with equal height})$

$$\frac{A(\triangle ABD)}{A(\triangle ABC)} = \frac{7}{20}$$

(3) $\frac{A(\triangle ADC)}{A(\triangle ABC)} = \frac{DC}{BC} \quad \dots(\text{triangles with equal height})$

$$\frac{A(\triangle ADC)}{A(\triangle ABC)} = \frac{13}{20}$$

- (3) Ratio of areas of two triangles with equal height is 2 : 3. If base of smaller triangle is 6 cm then what is the corresponding base of the bigger triangles. (2 marks)

Solution :

Let the area and base of the smaller triangle be A_1 , and b_1 respectively.

Let the area and base of the bigger triangle be A_2 , and b_2 respectively.

Both the triangles have equal height ... (Given)

$$\therefore \frac{A_1}{A_2} = \frac{2}{3} \text{ and } b_1 = 6 \text{ cm} \quad \dots (\text{Given})$$

$$\therefore \frac{A_1}{A_2} = \frac{b_1}{b_2} \quad \dots (\text{Triangles with equal height})$$

$$\therefore \frac{2}{3} = \frac{6}{b_2}$$

$$\therefore b_2 = \frac{3 \times 6}{2}$$

$$\therefore b_2 = 9 \text{ cm}$$

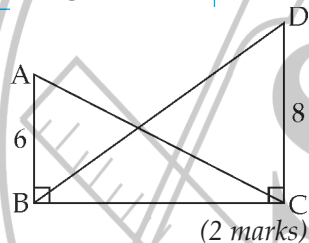
The base of the bigger triangle is 9 cm.

- (4) In the figure given

$$\angle ABC = \angle DCB = 90^\circ.$$

$$AB = 6, DC = 8.$$

$$\text{then } \frac{A(\triangle ABC)}{A(\triangle DCB)} = ?$$



(2 marks)

Solution :

$\triangle ABC$ and $\triangle DCB$ have a common base BC.

$$\frac{A(\triangle ABC)}{A(\triangle DCB)} = \frac{AB}{DC} \quad \dots (\text{Triangles with equal base})$$

$$\frac{A(\triangle ABC)}{A(\triangle DCB)} = \frac{6}{8}$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle DCB)} = \frac{3}{4}$$

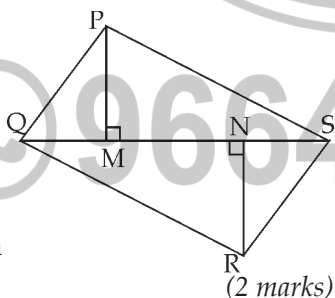
- (5) In the adjoining figure,

$$PM = 10 \text{ cm},$$

$$A(\triangle PQS) = 100 \text{ sq cm}$$

$$A(\triangle QRS) = 110 \text{ sq cm}$$

then find NR.



(2 marks)

Solution :

$\triangle PQS$ and $\triangle QRS$ have common base QS.

$$\frac{A(\triangle PQS)}{A(\triangle QRS)} = \frac{PM}{RN} \quad \dots (\text{triangles with equal base})$$

$$\therefore \frac{100}{110} = \frac{10}{RN}$$

$$\therefore RN = \frac{10 \times 110}{100}$$

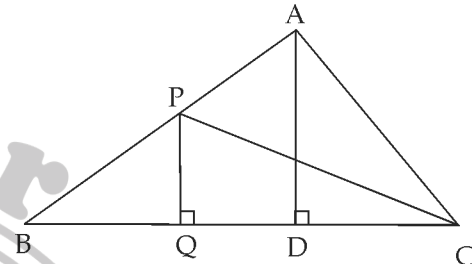
$$\therefore \text{RN} = 11 \text{ cm}$$

Practice set - 1.1 (Textbook Page No. 6)

- (5) In the adjoining figure, $PQ \perp BC$, $AD \perp BC$, then find the following ratios

$$(i) \frac{A(\triangle PQB)}{A(\triangle PBC)} \quad (ii) \frac{A(\triangle PBC)}{A(\triangle ABC)}$$

$$(iii) \frac{A(\triangle ABC)}{A(\triangle ADC)} \quad (iv) \frac{A(\triangle ADC)}{A(\triangle PQC)} \quad (2 \text{ marks})$$



Solution :

- (i) $\triangle PQB$ and $\triangle PBC$ have a common height PQ.

$$\therefore \frac{A(\triangle PQB)}{A(\triangle PBC)} = \frac{BQ}{BC} \quad \dots (\text{Triangles with equal height})$$

- (ii) $\triangle PBC$ and $\triangle ABC$ have a common base BC.

$$\therefore \frac{A(\triangle PBC)}{A(\triangle ABC)} = \frac{PQ}{AD} \quad \dots (\text{Triangles with equal base})$$

- (iii) $\triangle ABC$ and $\triangle ADC$ have a common height AD.

$$\therefore \frac{A(\triangle ABC)}{A(\triangle ADC)} = \frac{BC}{DC} \quad \dots (\text{Triangles with equal height})$$

- (iv) $\frac{A(\triangle ADC)}{A(\triangle PQC)} = \frac{DC \times AD}{QC \times PQ} \quad \dots (\text{The ratio of areas of two triangles is equal to the ratio of product of bases and their corresponding heights})$

Points to Remember:

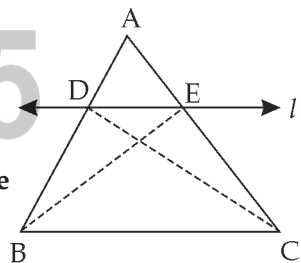
- Basic Proportionality Theorem (B. P. T.)

Statement : If a line parallel to a side of a triangle intersects the remaining sides in two distinct points, then the line divides those sides in the same proportion.

Given:

In $\triangle ABC$,

- line $l \parallel$ side BC
- Line l intersects sides AB and AC at points D and E respectively.



A-D-B, A-E-C

To Prove : $\frac{AD}{DB} = \frac{AE}{EC}$

Construction : Draw seg BE and seg CD.

Proof: $\triangle ADE$ and $\triangle BDE$ have a common vertex E and their bases AD and BD lie on the same line AB.

$\therefore$ Their heights are equal .

$$\frac{A(\triangle ADE)}{A(\triangle BDE)} = \frac{AD}{DB} \quad \dots(i)$$

(Triangles having equal height)

$\triangle ADE$ and $\triangle CDE$ have a common vertex D and their bases AE and EC lie on the same line AC.

$\therefore$ Their heights are equal.

$$\frac{A(\triangle ADE)}{A(\triangle CDE)} = \frac{AE}{CE} \quad \dots(ii)$$

(Triangles having equal height)

line $DE \parallel$ side BC ...(Given)

$\triangle BDE$ and $\triangle CDE$ are between the same two parallel lines DE and BC.

$\therefore$ Their heights are equal.

Also, they have same base DE.

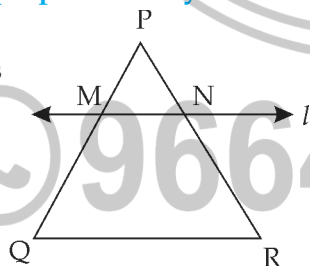
$\therefore A(\triangle BDE) = A(\triangle CDE) \quad \dots(iii)$
(Areas of two triangles having equal base and equal height are equal)

$$\frac{A(\triangle ADE)}{A(\triangle BDE)} = \frac{A(\triangle ADE)}{A(\triangle CDE)} \quad \dots(iv) \text{ [From (iii)]}$$

$$\frac{AD}{DB} = \frac{AE}{EC} \quad \dots[\text{From (i), (ii) and (iv)}]$$

• Converse of Basic proportionality theorem

Statement : If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.



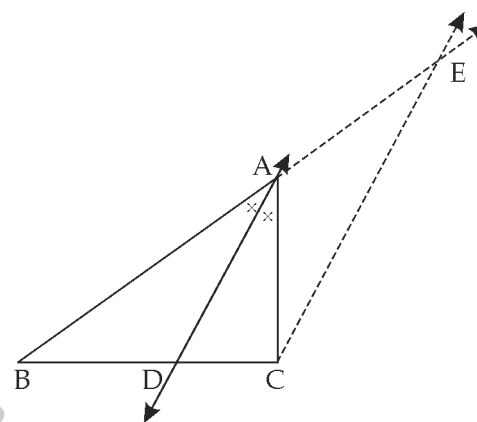
In $\triangle PQR$, line l intersects the side PQ and side PR in the points M and N respectively.

such that $\frac{PM}{MQ} = \frac{PN}{NR}$ and P-M-Q, P-N-R

$\therefore$ line $l \parallel$ side QR

• Property of an Angle Bisector of a Triangle

Statement : In a triangle, the angle bisector divides the side opposite to the angle in the ratio of the remaining sides. (4 marks)



Given :

In $\triangle ABC$, ray AD is the bisector of $\angle BAC$ such that B - D - C.

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

Construction : Draw a line passing through C, parallel to line AD and intersecting line BA at point E, B - A - E.

Proof : In $\triangle BEC$,
line $AD \parallel$ side CE ...(Construction)

$$\frac{BD}{DC} = \frac{AB}{AE} \quad \dots (i) \text{ (By Basic Proportionately Theorem)}$$

line $AD \parallel$ line CE ... (Construction)

$\therefore$ On transversal BE,
 $\angle BAD \cong \angle AEC \quad \dots(ii) \text{ (Corresponding angle theorem)}$

Also, on transversal AC,
 $\angle DAC \cong \angle ACE \quad \dots(iii) \text{ (alternate angle theorem)}$
But, $\angle BAD \cong \angle DAC \quad \dots(iv)$
($\because$ ray AD bisects $\angle BAC$)

In $\triangle AEC$, $\angle AEC \cong \angle ACE$
...[From (ii), (iii) and (iv)]

$\therefore$ seg $AC \cong$ seg AE ...(Converse of Isosceles triangle theorem)

$$\therefore AC = AE \quad \dots(v)$$

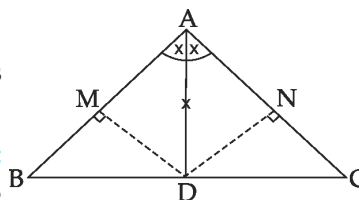
$$\therefore \frac{BD}{DC} = \frac{AB}{AC} \quad \dots[\text{From (i) and (v)}]$$

For more information:

Write another proof of the theorem.
(Textbook page no. 9)

Given : In $\triangle ABC$,
bisector $\angle A$ intersects side BC

Construction :
Draw $DM \perp AB$
and $DN \perp AC$



Proof: $\triangle ABC$ and $\triangle ADC$ have a common vertex A and their bases BD and DC lie on the same line BC.

$\therefore$ their heights are equal.

$$\therefore \frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{BD}{DC} \quad \dots(i) \text{ (Triangles having equal heights)}$$

$$\text{Also, } \frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{AB \times DM}{AC \times DN} \quad \dots(ii) \text{ (Statement of property - I)}$$

Every point on the bisector of an angle is equidistant from the sides of the angle

$$DM = DN \quad \dots(iii)$$

$$\therefore \frac{A(\triangle ABD)}{A(\triangle ADC)} = \frac{AB}{AC} \quad \dots(iv) \text{ [From (ii) and (iii)]}$$

$$\therefore \frac{BD}{DC} = \frac{AB}{AC} \quad \dots[\text{From (i) and (iv)}]$$

$$\therefore \frac{AB}{AC} = \frac{BD}{DC} \quad \dots[\text{From (i) and (iv)}]$$

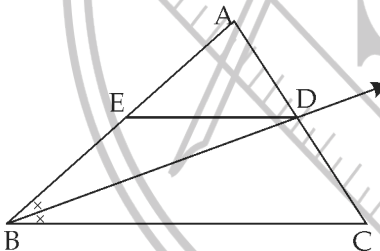
Converse of angle bisector property

If in $\triangle ABC$ point D on side BC

such that $\frac{AB}{AC} = \frac{BD}{DC}$, then ray AD bisects $\angle BAC$ (Textbook page no. 13)

Example :

In $\triangle ABC$,
ray BD bisects
 $\angle ABC$ A-D-C,
side DE || side BC,
A-E-B



then prove, $\frac{AB}{BC} = \frac{AE}{EB}$

Proof :

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

$$\therefore \frac{AB}{BC} = \frac{AD}{DC} \quad \dots(i) \text{ (angle bisector property of a triangle)}$$

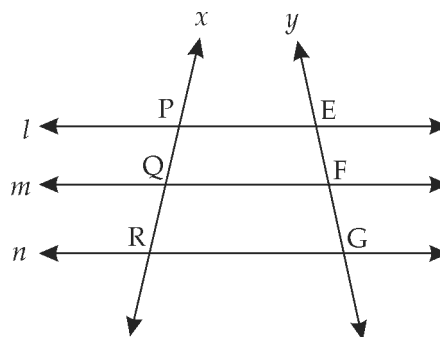
In $\triangle ABC$, DE || BC,

$$\frac{AE}{EB} = \frac{AD}{DC} \quad \dots(ii) \text{ (By basic proportionality theorem)}$$

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

• Property of Three Parallel Lines and their transversals

The ratio of the intercepts made on the transversal by three parallel lines is equal to the ratio of the corresponding intercepts made on any other transversal by the same parallel lines.



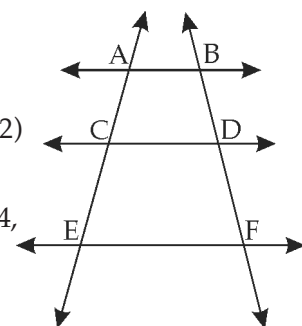
line $l \parallel$ line $m \parallel$ line n and lines l, m and n cut the transversal x in points P, Q and R respectively and lines l, m and n cut the transversal y in point E, F and G respectively.

$$\therefore \frac{PQ}{QR} = \frac{EF}{FG}$$

Activity :

(Textbook page no. 12)

In the adjoining figure,
 $AB \parallel CD \parallel EF$. If $AC = 5.4$,
 $CE = 9$, $BD = 7.5$, then
find DF.



Solution :

$AB \parallel CD \parallel EF$

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

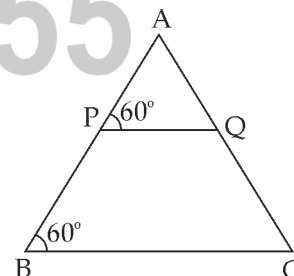
$$\frac{5.4}{9} = \frac{7.5}{DF}$$

$$\therefore DF = 12.5$$

... (Property of three parallel lines and their transversal)

Practice Set - 1.2 (Textbook Page No. 14)

(4) Measurements of the some angles in the figure are given. Prove that $\frac{AP}{PB} = \frac{AQ}{QC}$ (2 marks)



Solution :

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

$$\therefore \text{seg } PQ \parallel \text{side } BC \quad \dots(i)$$

(Corresponding angles test)

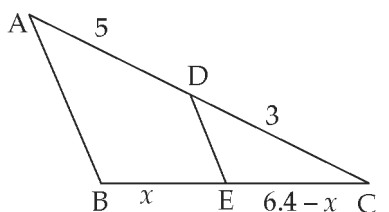
In $\triangle ABC$, seg $PQ \parallel$ side BC

...[From (i)]

$$\therefore \frac{AP}{PB} = \frac{AQ}{QC} \quad \dots(\text{By Basic Proportionality Theorem})$$

Problem Set - 1 (Textbook Page No. 28)

- (7) In the figure,
A - D - C and
B - E - C.
Seg DE || side
AB. If AD
= 5, DC = 3,
BC = 6.4 then find BE.



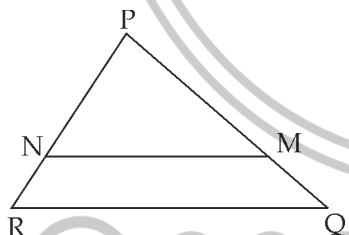
(2 marks)

Solution :

$$\begin{aligned} \text{Let } BE &= x \text{ units} && \dots(\text{Supposition}) \\ BC &= BE + EC && \dots(B - E - C) \\ \therefore 6.4 &= x + CE \\ \therefore CE &= (6.4 - x) \text{ units} \\ \text{In } \triangle ABC, \text{ seg } DE &\parallel \text{ side } AB && \dots(\text{Given}) \\ \therefore \frac{AD}{DC} &= \frac{BE}{EC} && \dots(\text{By Basic Proportionality theorem}) \\ \therefore \frac{5}{3} &= \frac{x}{6.4 - x} \\ \therefore 5(6.4 - x) &= 3x \\ \therefore (6.4 \times 5) - 5x &= 3x \\ \therefore 6.4 \times 5 &= 3x + 5x \\ \therefore \frac{6.4 \times 5}{8} &= x \\ \therefore x &= 4 \\ \therefore \boxed{BE = 4 \text{ units}} \end{aligned}$$

Practice Set - 1.2 (Textbook Page No. 13)

- (2) In $\triangle PQR$,
PM = 15,
PQ = 25,
PR = 20,
NR = 8
whether lin NM is parallel to side RQ? Give
reason. (3 marks)


Solution :

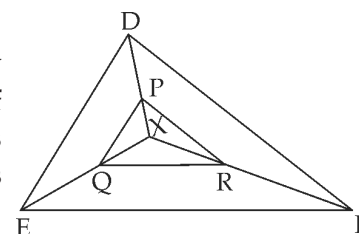
$$\begin{aligned} PQ &= PM + MQ && \dots(P - M - Q) \\ \therefore 25 &= 15 + MQ \\ \therefore MQ &= 25 - 15 \\ \therefore MQ &= 10 \\ PR &= PN + NR && \dots(P - N - R) \\ \therefore 20 &= PN + 8 \\ \therefore PN &= 20 - 8 \\ \therefore PN &= 12 \\ \text{Now, } \frac{PM}{MQ} &= \frac{15}{10} = \frac{3}{2} && \dots(i) \end{aligned}$$

$$\text{and } \frac{PN}{NR} = \frac{12}{8} = \frac{3}{2} \dots(ii)$$

$$\therefore \text{In } \triangle PQR, \frac{PM}{MQ} = \frac{PN}{NR} \dots[\text{From (i) and (ii)}]$$

$$\therefore \boxed{\text{seg } NM \parallel \text{ side } QR} \dots(\text{Converse of basic proportionality theorem})$$

- (10) In the adjoining
figure X is any
point in interior of
triangle. Point X is
joined to vertices
of triangle.



Seg PQ || DE,

seg QR || seg EF. Then fill in the blanks to prove
that, seg PR || seg DF. (3 marks)

Proof :

$$\text{In } \triangle XDE, PQ \parallel DE \dots(\text{Given})$$

$$\therefore \frac{XP}{PD} = \frac{XQ}{QE} \dots(i) \text{ (Basic proportionality theorem)}$$

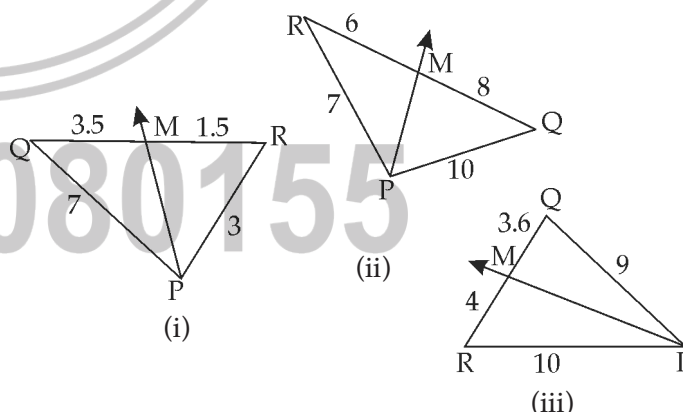
$$\text{In } \triangle XEF, \text{ seg } QR \parallel \text{ side } EF \dots(\text{Given})$$

$$\therefore \frac{XQ}{QE} = \frac{XR}{RF} \dots(ii) \text{ (Basic proportionality theorem)}$$

$$\therefore \frac{XP}{PD} = \frac{XR}{RF} \dots[\text{From (i) and (ii)}]$$

$$\therefore \text{seg } PR \parallel \text{ side } DF \dots(\text{Converse of Basic Proportionality theorem})$$

- (1) Given below some triangles and lengths of line
segments. Identity in which figures, Ray PM is
bisector of $\angle QPR$. (3 marks)


Solution :

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

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

$$\text{In } \triangle PQR, \frac{PQ}{PR} = \frac{QM}{RM} \dots[\text{From (i) and (ii)}]$$

$$\therefore \text{Ray } PM \text{ bisects } \angle QPR$$

$$(ii) \quad \frac{PQ}{PR} = \frac{10}{7} \quad \dots(i)$$

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

$$\text{In } \triangle PQR, \frac{PQ}{PR} \neq \frac{QM}{RM} \quad \dots[\text{From (i) and (ii)}]$$

$\therefore$ Ray PM does not bisect $\angle QPR$

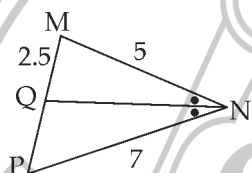
$$(iii) \quad \frac{PQ}{PR} = \frac{9}{10} \quad \dots(i)$$

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

$$\text{In } \triangle PQR, \frac{PQ}{PR} = \frac{QM}{RM} \quad \dots[\text{From (i) and (ii)}]$$

$\therefore$ Ray PM bisect $\angle QPR$

(3) In $\triangle MNP$, NQ is bisector of $\angle N$. If $MN = 5$, $PN = 7$, $MQ = 2.5$ then find QP. (2 marks)



Solution :

In $\triangle MNP$, NQ bisects $\angle MNP$ $\dots(\text{Given})$

$$\frac{MN}{PN} = \frac{MQ}{PQ} \quad \dots(\text{Angle bisector property of a triangle})$$

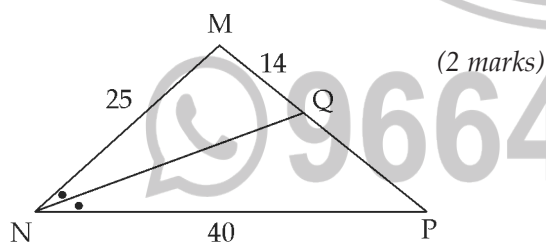
$$\therefore \frac{5}{7} = \frac{2.5}{PQ}$$

$$\therefore 5 \times PQ = 2.5 \times 7$$

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

$$\therefore \boxed{PQ = 3.5 \text{ units}}$$

(6) Find QP using given information in the figure.



Solution :

In $\triangle MNP$, NQ bisects $\angle MNP$ $\dots(\text{Given})$

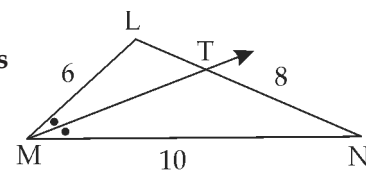
$$\therefore \frac{MN}{NP} = \frac{MQ}{QP} \quad \dots(\text{Angle bisector property of a triangle})$$

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

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

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

(8) In $\triangle LMN$,
Ray MT bisects $\angle LMN$,
 $LM = 6$, if
 $MN = 10$, $TN = 8$.
then find LT.



(2 marks)

Solution :

In $\triangle LMN$, Ray MT bisects $\angle LMN$ $\dots(\text{Given})$

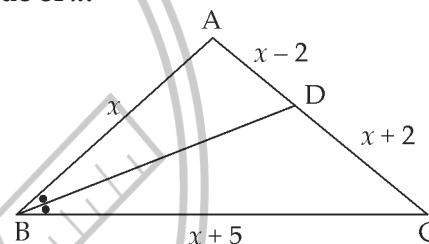
$$\therefore \frac{LM}{MN} = \frac{LT}{TN} \quad \dots(\text{Angle bisector property of a triangle})$$

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

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

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

(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 . (2 marks)



Solution :

In $\triangle ABC$, ray BD bisects $\angle ABC$ $\dots(\text{Given})$

$$\therefore \frac{AB}{BC} = \frac{AD}{DC} \quad \dots(\text{Angle bisector property of a triangle})$$

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

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

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

$$x^2 + 2x = x^2 + 3x - 10$$

$$x^2 + 2x - x^2 - 3x = -10$$

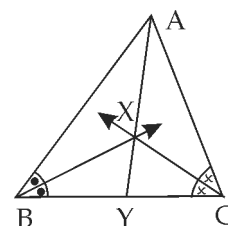
$$-x = -10$$

$$x = 10$$

$$\therefore \boxed{x = 10}$$

Problem Set - 1 (Textbook Page No. 29)

(10) In the adjoining figure, bisectors of $\angle B$ and $\angle C$ intersect each other in point X. Line AX intersects side BC in point Y. $AB = 5$, $AC = 4$, $BC = 6$ then find $\frac{AX}{XY}$.



(3 marks)

Solution :

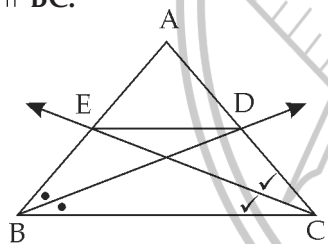
In $\triangle AXY$, ray BX bisects $\angle AXY$ $\dots(\text{Given})$

$$\begin{aligned} \therefore \frac{AB}{BY} &= \frac{AX}{XY} && \dots(i) \text{ (Angle bisector property of a triangle)} \\ \text{In } \triangle ACY, \text{ ray CX bisects } \angle ACY &&& \dots(\text{Given}) \\ \therefore \frac{AC}{CY} &= \frac{AX}{XY} && \dots(ii) \text{ (Angle bisector property of a triangle)} \\ \therefore \frac{AB}{BY} &= \frac{AC}{CY} = \frac{AX}{XY} && \dots[\text{From (i) and (ii)}] \\ \therefore \frac{AB+AC}{BY+CY} &= \frac{AX}{XY} && \dots(\text{By theorem on equal ratios}) \\ \therefore \frac{AB+AC}{BC} &= \frac{AX}{XY} && \dots(\because B-Y-C) \\ \therefore \frac{5+4}{6} &= \frac{AX}{XY} \\ \therefore \frac{AX}{XY} &= \frac{9}{6} \\ \therefore \frac{AX}{XY} &= \frac{3}{2} \end{aligned}$$

Practice Set - 1.2 (Textbook Page No. 15)

- * (11)** In $\triangle ABC$, Ray BD bisects $\angle ABC$ and Ray CE bisects $\angle ACB$. If seg AB $\cong$ seg AC, then prove that ED $\parallel$ BC. (3 marks)

Proof :



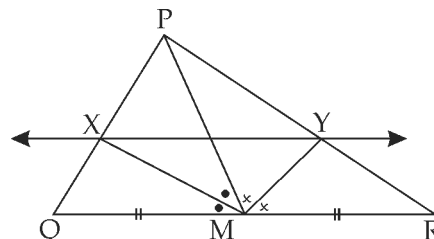
$$\begin{aligned} \text{In } \triangle ABC, \text{ ray BD bisects } \angle ABC &&& \dots(\text{Given}) \\ \therefore \frac{AB}{BC} &= \frac{AD}{DC} && \dots(i) \text{ (Angle bisector property of a triangle)} \\ \text{In } \triangle ABC, \text{ ray CE bisects } \angle ACB &&& \dots(\text{Given}) \\ \therefore \frac{AC}{BC} &= \frac{AE}{BE} && \dots(ii) \text{ (Angle bisector property of a triangle)} \\ \text{seg AB } \cong \text{ seg AC} &&& \dots(iii) \text{ (Given)} \\ \therefore \frac{AB}{BC} &= \frac{AE}{BE} && \dots(iv) [\text{From (ii) and (iv)}] \\ \therefore \text{In } \triangle ABC, \frac{AD}{DC} &= \frac{AE}{BE} && \dots[\text{From (i) and (iv)}] \\ \therefore \text{seg ED } \parallel \text{ side BC} &&& \dots(\text{Converse of Basic proportionality theorem}) \end{aligned}$$

Problem Set - 1 (Textbook Page No. 28)

- (9)** In $\triangle PQR$, seg PM is a median. Angle bisectors of $\angle PMQ$ and $\angle PMR$ intersect side PQ and side

PR in point X and Y respectively. Prove that XY $\parallel$ QR. (3 marks)

(Complete the proof by filling the boxes)

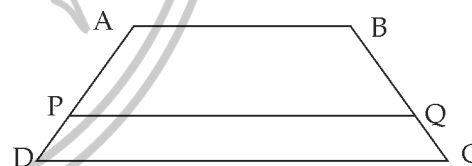


Proof :

$$\begin{aligned} \text{In } \triangle PMQ, \text{ ray MX bisects } \angle PMQ &&& \dots(\text{Given}) \\ \therefore \frac{PM}{MQ} &= \frac{PX}{XQ} && \dots(i) \text{ (Angle bisector property of a triangle)} \\ \text{In } \triangle PMR, \text{ ray MY bisects } \angle PMR &&& \dots(\text{Given}) \\ \therefore \frac{PM}{MR} &= \frac{PY}{YR} && \dots(ii) \text{ (Angle bisector property of a triangle)} \\ \text{But, } \frac{PM}{MQ} &= \frac{PM}{MR} && \dots(\because M \text{ is midpoint of seg QR, } \therefore MQ = MR) \\ \frac{PX}{XQ} &= \frac{PY}{YR} && \dots[\text{From (i) and (ii)}] \\ \therefore \text{seg XY } \parallel \text{ side QR} &&& \dots(\text{Converse of Basic proportionality theorem}) \end{aligned}$$

Practice set - 1.2 (Textbook Page No. 14)

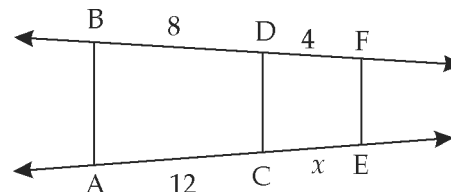
- (5)** In trapezium ABCD, side AB $\parallel$ side PQ $\parallel$ side DC. AP = 15, PD = 12, QC = 14. Find BQ. (2 marks)



Solution :

$$\begin{aligned} \text{seg AB } \parallel \text{ seg PQ } \parallel \text{ seg DC} &&& \dots(\text{Given}) \\ \therefore \frac{AP}{PD} &= \frac{BQ}{QC} && \dots(\text{Property of three parallel lines and their transversals}) \\ \therefore \frac{15}{12} &= \frac{BQ}{14} \\ \therefore BQ &= \frac{15 \times 14}{12} = \\ \therefore \text{BQ} &= 17.5 \text{ units} \end{aligned}$$

- (7)** In the adjoining figure AB $\parallel$ CD $\parallel$ EF. Find x and AE. (2 marks)



Solution :

seg AB || seg CD || seg EF ... (Given)

$$\therefore \frac{AC}{CE} = \frac{BD}{DF} \quad \dots (\text{Property of three parallel lines and their transversals})$$

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

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

$$\therefore x = 6$$

AE = AC + CE ... (A-C-E)

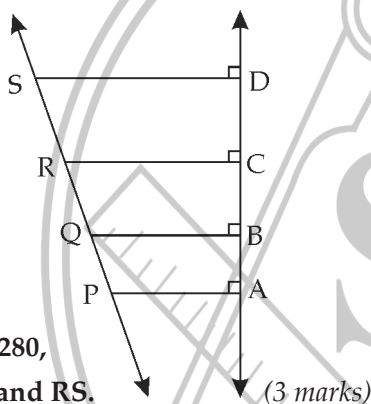
$$AE = 12 + 6$$

$$\therefore AE = 18 \text{ units}$$

Problem Set - 1 (Textbook Page No. 28)

- (8) In the figure given seg PA, seg QB, seg RC and seg SD are perpendicular to line AD.

AB = 60, BC = 70, CD = 80 and PS = 280, then find PQ, QR and RS.



(3 marks)

Solution :

seg PA ⊥ line AD
seg QB ⊥ line AD
seg RC ⊥ line AD
seg SD ⊥ line AD

... (Given)

∴ seg PA || seg QB || seg RC || seg SD

... (If two or more lines are perpendicular to the same line then they are parallel to each other)

∴ PQ : QR : RS = AB : BC : CD ... (Property of three parallel lines and their transversals)

$$\therefore PQ : QR : RS = 60 : 70 : 80$$

$$\therefore PQ : QR : RS = 6 : 7 : 8$$

Let the common multiple be x .

$$\therefore PQ = 6x, QR = 7x, RS = 8x$$

$$PS = PQ + QR + RS \quad \dots (P-Q-R-S)$$

$$\therefore 280 = 6x + 7x + 8x$$

$$\therefore 21x = 280$$

$$\therefore x = \frac{280}{21} = \frac{40}{3}$$

$$PQ = 6x = 6 \times \frac{40}{3} = 80 \text{ units}$$

$$QR = 7x = 7 \times \frac{40}{3} = \frac{280}{3} \text{ units}$$

$$RS = 8x = 8 \times \frac{40}{3} = \frac{320}{3} \text{ units}$$

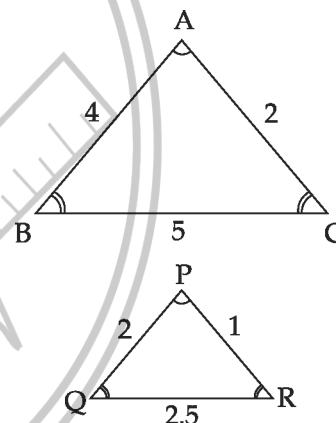


Points to Remember:

• Similarity of Triangles

Definition: For a given one - to - one correspondence between the vertices of two triangles, if

- their corresponding angles are congruent,
 - their corresponding sides are in proportion,
- then the correspondence is known as **similarity** and the triangles are said to be **Similar Triangles**.



In above figure, for correspondence $ABC \leftrightarrow PQR$

- $\angle A \cong \angle P, \angle B \cong \angle Q, \angle C \cong \angle R$ and

$$(ii) \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{2}{1}$$

Hence, $\triangle ABC$ and $\triangle PQR$ are similar triangles.

$\triangle ABC$ is similar to $\triangle PQR$ under $ABC \leftrightarrow PQR$, this statement is written symbolically as $\triangle ABC \sim \triangle PQR$.

Note

If two triangles are similar, then

- their corresponding angles are congruent
- their corresponding sides are in proportion.

If $\triangle ABC \sim \triangle PQR$, then

- $\angle A \cong \angle P, \angle B \cong \angle Q, \angle C \cong \angle R$

$$(ii) \frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$$



Points to Remember:

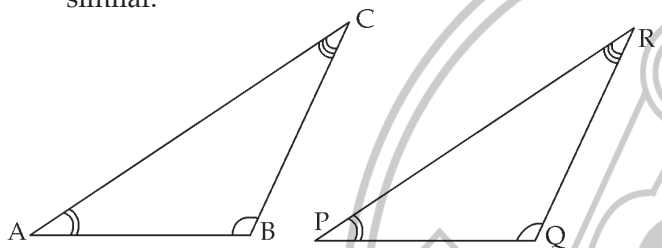
• Test of Similarity of Triangles

When two triangles are similar, then three pairs of corresponding angles are congruent and three pairs of corresponding sides are in proportion.

But to prove that two triangles are similar, we select only three conditions taken in proper order. These conditions are called **Tests of similarity**. There are three tests of similarity :

(1) A - A - A test (A - A test) :

For a given one - to - one correspondence between the vertices of two triangles, if the corresponding angles are congruent, then the two triangles are similar.



In the figure, for $ABC \leftrightarrow PQR$,

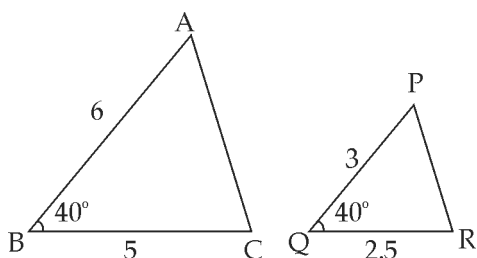
if, $\angle A \cong \angle P$, $\angle B \cong \angle Q$ and $\angle C \cong \angle R$, then $\triangle ABC \sim \triangle PQR$ by A-A-A test of similarity.

We know that sum of measures of three angles of a triangle is 180° . Because of this if two pairs of corresponding angles of two given triangles are congruent then remaining pair is also congruent, and thus the triangles become similar triangles. This is known as A - A test.

A - A Test : For a given one-one correspondence between the vertices of two triangles, if two angles of one triangle are congruent with the corresponding two angles of other triangle, then the two triangles are similar.

(2) S - A - S Test :

For a given one-one correspondence between the vertices of two triangles, if two sides of one triangle are proportional to the corresponding sides of the other triangle and angles included by them are congruent, then the two triangles are similar.



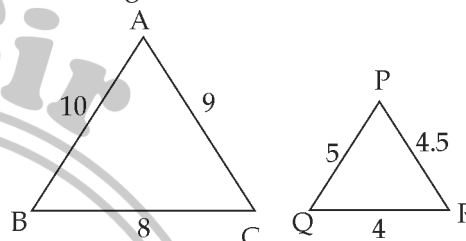
In the above figure, for $ABC \leftrightarrow PQR$,

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{2}{1}, \quad \angle B \cong \angle Q,$$

then $\triangle ABC \sim \triangle PQR$ by S - A - S test of similarity.

(3) S - S - S Test :

For a given one-one correspondence between the vertices of two triangles, if three sides of one triangle are proportional to the three corresponding sides of other triangle, then the two triangles are similar.



In the above figure, for $ABC \leftrightarrow PQR$,

$$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR} = \frac{2}{1}$$

then $\triangle ABC \sim \triangle PQR$

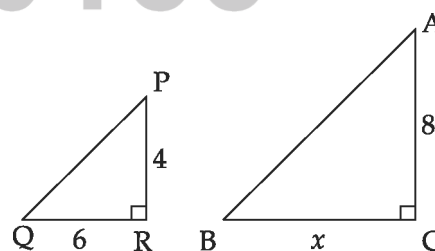
by S - S - S test of similarity.

Properties of similar triangles

- (1) $\triangle ABC \sim \triangle ABC$... (Reflexivity)
- (2) If $\triangle ABC \sim \triangle DEF$ then $\triangle DEF \sim \triangle ABC$... (Symmetry)
- (3) If $\triangle ABC \sim \triangle DEF$ and $\triangle DEF \sim \triangle GHI$ then $\triangle ABC \sim \triangle GHI$... (Transitivity)

PRACTICE SET - 1.3 (Textbook Page No.)

- (3) As shown in adjoining figure, two poles of height 8 m and 4 m are perpendicular to ground. If the length of shadow of smaller pole due to sunlight is 6 m then how long will be the shadow of bigger pole at the same time? (2 marks)



Solution :

Let PR and AC represent poles of length 4 m and 8 m respectively.

Let QR and BC represent the lengths cast by them of the poles at the same time.

Now $\triangle PQR \sim \triangle ABC$... (Shadow reckoning property)

$$\therefore \frac{PR}{AC} = \frac{QR}{BC} \quad \dots (\text{c.s.s.t.})$$

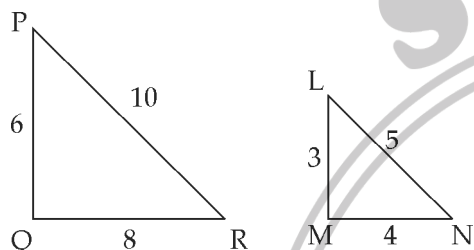
$$\therefore \frac{4}{8} = \frac{6}{BC} \quad \dots (\text{Given})$$

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

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

Length of the shadow casted by longer pole is 12 m.

(2) Are the triangles in the figure given similar? (2 marks)



Solution :

$$\therefore \frac{PQ}{LM} = \frac{6}{3} = \frac{2}{1} \quad \dots (i)$$

$$\therefore \frac{QR}{MN} = \frac{8}{4} = \frac{2}{1} \quad \dots (ii)$$

$$\therefore \frac{PR}{LN} = \frac{10}{5} = \frac{2}{1} \quad \dots (iii)$$

$\therefore$ In $\triangle PQR$ and $\triangle LMN$

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

$\therefore \triangle PQR \sim \triangle LMN$... (SSS test for similarity)

(8) In the figure seg AC and seg BD intersect each other at point P

$$\text{and } \frac{AP}{CP} = \frac{BP}{DP}$$

Then

Prove that $\triangle ABP \sim \triangle CDP$. (2 marks)

Proof :

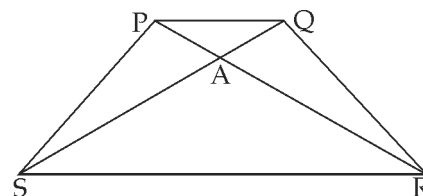
In $\triangle ABP$ and $\triangle CDP$

$$\frac{AP}{CP} = \frac{BP}{DP} \quad \dots (\text{Given})$$

$$\angle APB \cong \angle CPD \quad \dots (\text{vertically opposite angles})$$

$\therefore \triangle ABP \sim \triangle CDP$... (SAS test for similarity)

(5) In trapezium PQRS, side $PQ \parallel$ side SR. $AR = 5AP$ and $AS = 5AQ$. Prove that : $SR = 5PQ$ (3 marks)



Proof :

$$AR = 5AP \quad \dots (\text{Given})$$

$$\therefore \frac{AR}{AP} = \frac{5}{1} \quad \dots (i)$$

$$AS = 5AQ \quad \dots (\text{Given})$$

$$\therefore \frac{AS}{AQ} = \frac{5}{1} \quad \dots (ii)$$

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

$$\frac{AR}{AP} = \frac{AS}{AQ} \quad \dots [\text{From (i) and (ii)}]$$

$$\angle SAR \cong \angle QAP \quad \dots (\text{Vertically opposite angles})$$

$$\therefore \triangle ASR \sim \triangle AQP \quad \dots (\text{By SAS Test of similarity})$$

$$\therefore \frac{SR}{PQ} = \frac{AR}{AP} \quad \dots (\text{c.s.s.t.})$$

$$\therefore \frac{SR}{PQ} = \frac{5}{1} \quad \dots [\text{From (i)}]$$

$$\therefore SR = 5PQ$$

(1) In adjoining figure,

$$\angle ABC = 75^\circ,$$

$$\angle EDC = 75^\circ$$

state which two

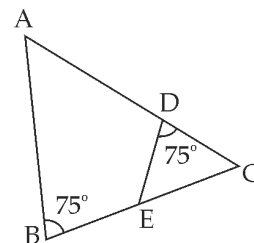
triangles are similar

and by which

test? Also triangles by a proper one to one

correspondence

(2 marks)



Solution :

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

$$\angle ABC \cong \angle EDC \quad \dots (\text{Each } 75^\circ)$$

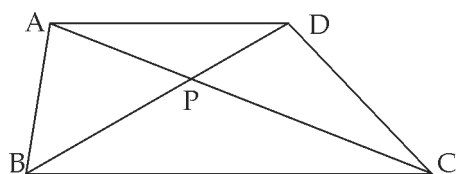
$$\angle C \cong \angle C \quad \dots (\text{Common angle})$$

$$\therefore \triangle ABC \sim \triangle EDC \quad \dots (\text{By AA test for similarity})$$

Problem Set - 1 (Textbook Page No. 29)

(11) In $\square ABCD$, seg $AD \parallel$ seg BC . Diagonal AC and diagonal BD intersect each other in point P. Then

show that $\frac{AP}{PD} = \frac{PC}{BP}$ (3 marks)

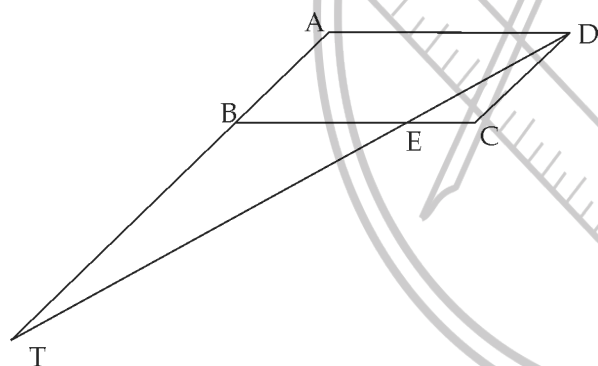


Proof :

seg AD || seg BC ... (Given)
 $\therefore \angle PAD \cong \angle PCB$... (i) (Alternate angles theorem)
 In $\triangle APD$ and $\triangle CPB$
 $\angle PAD \cong \angle PCB$... [From (i)]
 $\angle APD \cong \angle CPB$... (vertically opposite angles)
 $\therefore \triangle APD \sim \triangle CPB$... (By AA test for similarity)
 $\therefore \frac{AP}{PC} = \frac{PD}{BP}$
 $\therefore \frac{AP}{PD} = \frac{PC}{BP}$... (Alternendo)

Practice set - 1.3 (Textbook Page No. 22)

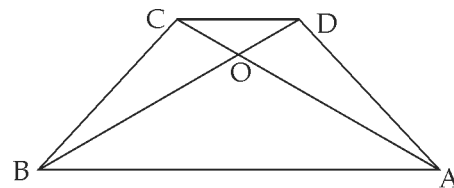
- (7) $\square ABCD$ is a parallelogram. Point E is on side BC, line DE intersects Ray AB in point T. Prove that : $DE \times BE = CE \times TE$. (3 marks)



Proof :

$\square ABCD$ is a parallelogram ... (Given)
 seg AB || seg CD ... (Opposite sides of a parallelogram)
 seg AT || seg CD ... (A - B - T)
 on transversal TD,
 $\therefore \angle ATD \cong \angle CDT$... (Alternate angles theorem)
 $\therefore \angle BTE \cong \angle CDE$... (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)
 $\therefore \triangle BTE \sim \triangle CDE$... (By AA test for similarity)
 $\therefore \frac{BE}{CE} = \frac{TE}{DE}$ (c.s.s.t.)
 $\therefore DE \times BE = CE \times TE$

- (6) In trapezium ABCD, side AB || side DC. Diagonals AC and BD intersect in O. If AB = 20, DC = 6, OB = 15. Find OD. (3 marks)

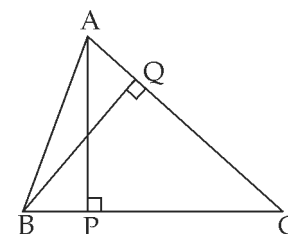


Solution :

side AB || side DC ... (Given)
 On transversal AC
 $\angle CAB \cong \angle ACD$ (Alternate angles theorem)
 $\therefore \angle OAB \cong \angle OCD$... (i)
 In $\triangle AOB$ and $\triangle COD$
 $\angle AOB \cong \angle COD$... (vertically opposite angles)
 $\angle OAB \cong \angle OCD$... [From (i)]
 $\therefore \triangle AOB \sim \triangle COD$... (By AA test for similarity)
 $\therefore \frac{AB}{DC} = \frac{OB}{OD}$... (c.s.s.t.)
 $\therefore \frac{20}{6} = \frac{15}{OD}$
 $\therefore OD = \frac{15 \times 6}{20}$

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

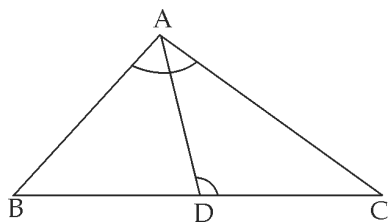
- (4) In $\triangle ABC$, $AP \perp BC$, $BQ \perp AC$, B - P - C, A - Q - C, then prove that $\triangle CPA \sim \triangle CQB$. If $AP = 7$, $BQ = 8$, $BC = 12$ then find AC. (3 marks)



Proof and Solution :

In $\triangle CPA$ and $\triangle CQB$
 $\angle C \cong \angle C$... (Common angle)
 $\angle APC \cong \angle BQC$... (Each is 90°)
 $\therefore \triangle CPA \sim \triangle CQB$... (By AA test for similarity)
 $\therefore \frac{AP}{BQ} = \frac{AC}{BC}$... (c.s.s.t.)
 $\therefore \frac{7}{8} = \frac{AC}{12}$
 $\therefore \frac{7 \times 12}{8} = AC$
 $AC = 10.5 \text{ units}$

- (9) In the figure, in $\triangle ABC$, point D on side BC is such that, $\angle BAC \cong \angle ADC$, then prove that, $CA^2 \cong CB \times CD$. (3 marks)

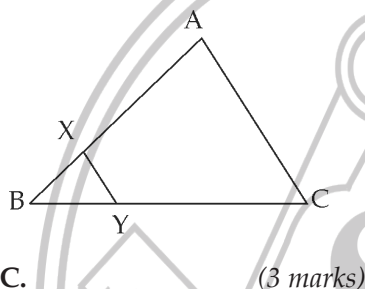


Proof :

In $\triangle ABC$ and $\triangle DAC$,
 $\angle BAC \cong \angle ADC$... (Given)
 $\angle BCA \cong \angle ACD$... (Common Angle)
 $\therefore \triangle ABC \sim \triangle DAC$... (By AA test of similarity)
 $\therefore \frac{CA}{CD} = \frac{CB}{CA}$... (c.s.s.t.)
 $CA^2 = CB \times CD$

Problem Set - 1 (Textbook Page No. 29)

- (12) In the adjoining figure, $XY \parallel$ seg AC . If $2AX = 3 \times BX$ and $XY = 9$. Complete the activity to find the value of AC .



Activity :

$$2AX = 3BX \therefore \frac{AX}{BX} = \frac{3}{2}$$

$$\therefore \frac{AX + BX}{BX} = \frac{3 + 2}{2} \quad \dots (\text{By componendo})$$

$$\therefore \frac{AB}{BX} = \frac{5}{2} \quad \dots (i)$$

$$\therefore \triangle ABC \sim \triangle BYX \quad \dots (\text{By AA test for similarity})$$

$$\therefore \frac{BA}{BX} = \frac{AC}{XY} \quad \dots (\text{c.s.s.t.})$$

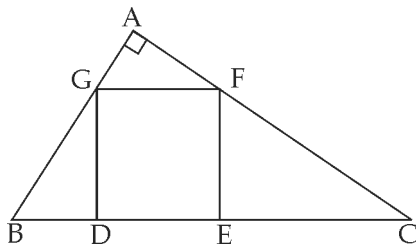
$$\therefore \frac{5}{2} = \frac{AC}{9} \quad \dots [\text{From (i)}]$$

$$\therefore AC = 22.5 \text{ units}$$

- (13) In the adjoining figure, $\square DEFG$ is a square. In $\triangle ABC$, $\angle A = 90^\circ$. Then prove that $DE^2 = BD \times EC$ (Hint : $\triangle GBD$ is similar to $\triangle CFE$).

Use $GD = FE = DE$

(4 marks)



Proof :

$\square DEFG$ is a square.

$$\therefore DE = EF = GF = DG \quad \dots (i) \quad (\text{Sides of a square})$$

on transversal AB
 $\therefore \text{seg } GF \parallel \text{seg } DE$... (Opposite sides of a square are parallel.)

$\therefore \text{seg } GF \parallel \text{side } BC$... (B-D-E-C)

on transversal AC

$\therefore \angle AGF \cong \angle ABC$... (ii)

on transversal AC } ... (Corresponding angles theorem)
 $\angle AFG \cong \angle ACB$... (iii)

In $\triangle AGF$ and $\triangle DBG$,

$\angle AGF \cong \angle GBD$... [From (ii) and A-G-B, B-D-C]

$\angle GAF \cong \angle BDG$... (Each is 90°)

$\therefore \triangle AGF \sim \triangle DBG$... (iv) (By AA Test for similarity)

In $\triangle AGF$ and $\triangle EFC$,

$\angle AFG \cong \angle FCE$... [From (iii) and A-F-C, C-E-A]

$\angle GAF \cong \angle FEC$... (Each is 90°)

$\therefore \triangle AGF \sim \triangle EFC$... (v) (AA Test for similarity)

$\therefore \triangle DBG \sim \triangle EFC$... [From (iv) and (v)]

$$\therefore \frac{BD}{EF} = \frac{DG}{EC} \quad \dots (\text{c.s.s.t.})$$

$$\therefore BD \times EC = EF \times DG$$

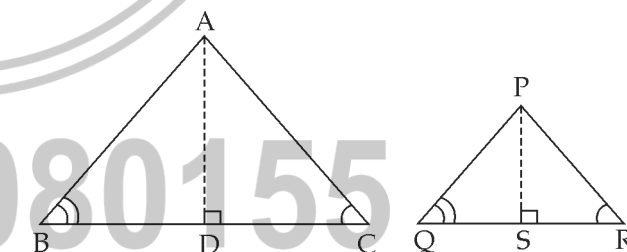
$$\therefore BD \times EC = DE \times DE \quad \dots [\text{From (i)}]$$

$$\therefore DE^2 = BD \times EC$$

Points to Remember:

Theorem of Areas of Similar Triangles

Statement : The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides. (5 marks)



Given : $\triangle ABC \sim \triangle PQR$.

To Prove :

$$\frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$$

Construction :

(i) Draw seg $AD \perp$ side BC , B - D - C

(ii) Draw seg $PS \perp$ side QR , Q - S - R

Proof :

$$\frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{BC \times AD}{QR \times PS}$$

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

$$\frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{BC}{QR} \times \frac{AD}{PS} \quad \dots(i)$$

$$\triangle ABC \sim \triangle PQR \quad \dots \text{(Given)}$$

$$\therefore \frac{AB}{PQ} = \frac{BC}{QR} \quad \dots(ii) \text{ (c.s.s.t.)}$$

$$\text{Also, } \angle B \cong \angle Q \quad \dots(iii) \text{ (c.a.s.t.)}$$

In $\triangle ADB$ and $\triangle PSQ$,

$$\angle ADB \cong \angle PSQ \quad \dots(\text{Each is a right angle})$$

$$\angle B \cong \angle Q \quad \dots[\text{From (iii)}]$$

$$\therefore \triangle ADB \sim \triangle PSQ \quad (\text{By A-A test of similarity})$$

$$\therefore \frac{AD}{PS} = \frac{AB}{PQ} \quad \dots(iv) \text{ (c.s.s.t.)}$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{AB}{PQ} \times \frac{AB}{PQ} \quad \dots[\text{From (i), (ii) and (iv)}]$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{AB^2}{PQ^2} \quad \dots(vi)$$

Similarly we can prove,

$$\therefore \frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2} \quad \dots(vii)$$

$$\therefore \frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2} \quad \dots[\text{From (vi) and (vii)}]$$

$$\therefore \frac{A_1}{A_2} = \left(\frac{3}{5}\right)^2$$

$$\therefore \frac{A_1}{A_2} = \frac{9}{25}$$

The ratio of the areas of two similar triangles is 9 : 25

- (3) If $\triangle ABC \sim \triangle PQR$, $A(\triangle ABC) = 80$, $A(\triangle PQR) = 125$, then fill in the blanks. (1 mark)

$$\frac{A(\triangle ABC)}{A(\triangle PQR)} = \frac{80}{125} \quad \therefore \frac{AB}{PQ} = \frac{4}{5}$$

- (4) $\triangle LMN \sim \triangle PQR$, $9 \times A(\triangle PQR) = 16 \times A(\triangle LMN)$. If $QR = 20$, then find MN . (2 marks)

Solution :

$$9 \times A(\triangle PQR) = 16 \times A(\triangle LMN) \quad \dots(\text{Given})$$

$$\therefore \frac{9}{16} = \frac{A(\triangle LMN)}{A(\triangle PQR)}$$

$$\text{i.e. } \frac{A(\triangle LMN)}{A(\triangle PQR)} = \frac{9}{16} \quad \dots(i)$$

$$\text{In } \triangle LMN \text{ and } \triangle PQR, \quad \dots(\text{Given})$$

$$\frac{A(\triangle LMN)}{A(\triangle PQR)} = \frac{MN^2}{QR^2} \quad \dots(\text{Theorem on areas of similar triangles})$$

$$\therefore \frac{9}{16} = \frac{MN^2}{20^2}$$

$$\therefore \frac{3}{4} = \frac{MN}{20} \quad \dots(\text{Taking square roots})$$

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

$$\therefore MN = 15$$

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

- (5) Areas two similar triangles are 225 sq. cm, 81 sq. cm. If a side of the smaller triangles is 12 cm, then find corresponding side of bigger triangle. (3 marks)

Solution :

Let the areas of two similar triangles be A_1 and A_2 and their corresponding sides S_1 and S_2 respectively.

$$A_1 = 225 \text{ cm}^2, A_2 = 81 \text{ cm}^2, S_2 = 12 \text{ cm} \quad \dots(\text{Given})$$

$$\text{Both the triangles are similar} \quad \dots(\text{Given})$$

$$\therefore \frac{A_1}{A_2} = \frac{S_1^2}{S_2^2} \quad \dots(\text{Theorem on areas of similar triangles})$$

$$\therefore \frac{225}{81} = \frac{S_1^2}{(12)^2}$$

$$\therefore \frac{15}{9} = \frac{S_1}{12} \quad \dots(\text{Taking square roots})$$

Practice Set - 1.4 (Textbook Page No. 25)

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

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

- (1) Ratio of corresponding sides of two similar triangles is 3 : 5, then find ratio of their area. (2 marks)

Solution :

Let the areas of two similar triangles be A_1 and A_2 and their corresponding sides S_1 and S_2 respectively.

$$\frac{S_1}{S_2} = \frac{3}{5} \quad \dots(\text{Given})$$

$$\text{Both the triangles are similar} \quad \dots(\text{Given})$$

$$\therefore \frac{A_1}{A_2} = \frac{S_1^2}{S_2^2} \quad \dots(\text{Theorem on areas of similar triangles})$$

$$\frac{A_1}{A_2} = \left(\frac{S_1}{S_2}\right)^2$$

$$\therefore S_1 = \frac{15 \times 12}{9}$$

$$\therefore S_1 = 20 \text{ cm}$$

The corresponding side of the bigger triangle is 20 cm

- (6) $\triangle ABC$ and $\triangle DEF$ are equilateral triangles. $A(\triangle ABC) : A(\triangle DEF) = 1 : 2$ and $AB = 4$ find DE .
(3 marks)

Solution :

$\triangle ABC$ and $\triangle DEF$ are equilateral triangles.
Equilateral triangles are always similar.

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

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

...(Theorem on areas of similar triangles)

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

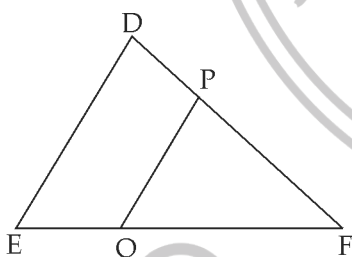
$$\therefore \frac{1}{\sqrt{2}} = \frac{4}{DE}$$

...(Taking square roots)

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

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

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



Solution :

$$A(\triangle PQF) = 20 \text{ sq units.}$$

$$PF = 2DP$$

$$\text{Let us assume } DP = x \text{ units} \quad \therefore PF = 2x$$

$$DF = DP + PF = x + 2x = 3x$$

In $\triangle FDE$ and $\triangle FPQ$,

$$\angle FDE = \angle FPQ \quad \dots (\text{Corresponding angles theorem})$$

$$\angle FED = \angle FQP \quad \dots (\text{Corresponding angles theorem})$$

$$\therefore \text{In } \triangle FDE \sim \triangle FPQ \quad \dots (\text{By AA test of similarity})$$

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

$$A(\triangle FDE) = \frac{9}{4} A(\triangle FPQ) = \frac{9}{4} \times 20 = 45 \text{ sq units}$$

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

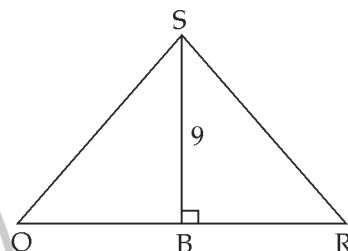
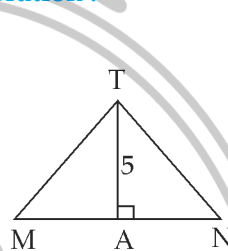
$$= 45 - 20$$

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

Problem Set - 1 (Textbook Page No. 27)

- (6) $\triangle MNT \sim \triangle QRS$: Length of altitude drawn from vertex T is 5 and length of altitude drawn from vertex S is 9. Find $\frac{A(\triangle MNT)}{A(\triangle QRS)}$
(3 marks)

Solution :



$$\triangle MNT \sim \triangle QRS$$

...(Given)

$$\therefore \angle M \cong \angle Q \quad \dots (i)$$

(c.a.s.t.)

$$\text{In } \triangle MAT \text{ and } \triangle QBS$$

$$\therefore \angle M \cong \angle Q$$

...[From (i)]

$$\angle MAT \cong \angle QBS$$

...(Each 90°)

$$\triangle MAT \sim \triangle QBS$$

...(By AA test of similarity)

$$\frac{TM}{SQ} = \frac{TA}{SB} \quad \dots (ii)$$

(c.s.s.t.)

$$\frac{A(\triangle TMN)}{A(\triangle SQR)} = \frac{TM^2}{SQ^2}$$

...(Theorem on areas of similar triangles)

$$\frac{A(\triangle TMN)}{A(\triangle SQR)} = \frac{TA^2}{SB^2}$$

...[From (ii)]

$$\frac{A(\triangle TMN)}{A(\triangle SQR)} = \frac{TA^2}{SB^2}$$

...[From (ii)]

$$\frac{A(\triangle TMN)}{A(\triangle SQR)} = \frac{5^2}{9^2}$$

...[From (ii)]

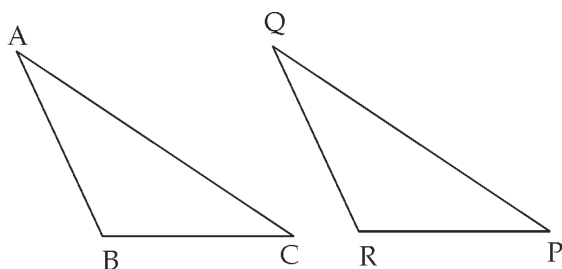
$$\frac{A(\triangle TMN)}{A(\triangle SQR)} = \frac{25}{81}$$

...[From (i)]

Problem Set - 1 (Textbook Page No. 27)

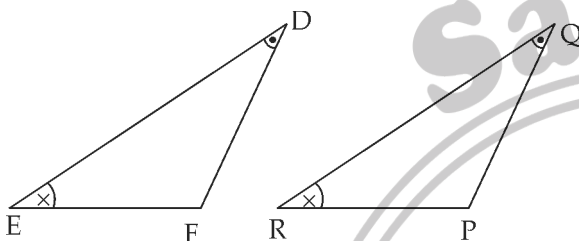
MCQ's

- Q.1. Choose correct alternative for each of the following questions.** (1 mark each)
- (1) If in $\triangle ABC$ and $\triangle PQR$ for some one-one correspondence if $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$ then



- (A) $\triangle PQR \sim \triangle ABC$ (B) $\triangle PQR \sim \triangle CAB$
(C) $\triangle CBA \sim \triangle PQR$ (D) $\triangle BCA \sim \triangle PQR$

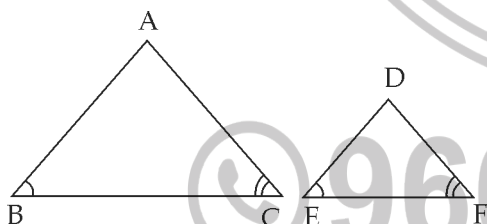
- (2) If in $\triangle DEF$ and $\triangle PQR$, $\angle D \cong \angle Q$, $\angle R \cong \angle E$, then which of the following statement is false?



- (A) $\frac{EF}{PR} = \frac{DF}{PQ}$ (B) $\frac{DE}{PQ} = \frac{EF}{RP}$
(C) $\frac{DE}{QR} = \frac{DF}{PQ}$ (D) $\frac{EF}{RP} = \frac{DE}{QR}$

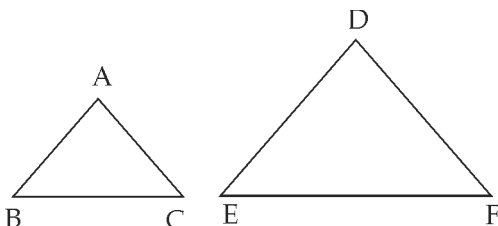
- (3) In $\triangle ABC$ and $\triangle DEF$, $\angle B \cong \angle E$, $\angle F \cong \angle C$ and $AB = 3 DE$, then which statement regarding two triangles is true?

- (A) The triangles are not congruent and not similar.
(B) The triangles are similar but not congruent.
(C) The triangles are congruent and similar.
(D) None of the statements above is true.



- (4) $\triangle ABC$ and $\triangle DEF$ both are equilateral triangles. $A(\triangle ABC) : A(\triangle DEF) = 1 : 2$. If $AB = 4$, then what is the length of DE ?

- (A) $2\sqrt{2}$ (B) 4 (C) 8 (D) $4\sqrt{2}$.



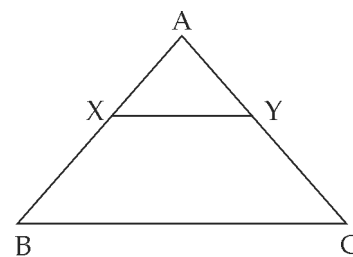
- (5) In the figure seg $XY \parallel$ seg BC , then which of the following statement is true?

$$(A) \frac{AB}{AC} = \frac{AX}{AY}$$

$$(B) \frac{AX}{XB} = \frac{AY}{AC}$$

$$(C) \frac{AX}{YC} = \frac{AY}{XB}$$

$$(D) \frac{AB}{YC} = \frac{AC}{XB}$$



- (6) In $\triangle ABC$, $AB = 3$ cm, $BC = 2$ cm and $AC = 2.5$ cm. $\triangle DEF \sim \triangle ABC$, $EF = 4$ cm. What is the perimeter of $\triangle DEF$?

- (A) 30 cm (B) 22.5 cm (C) 15 cm (D) 7.5 cm

- (7) The sides of two similar triangles are 4 : 9. What is the ratio of their area?

- (A) 2 : 3 (B) 4 : 9 (C) 81 : 16 (D) 16 : 81

- (8) The areas of two similar triangles are 18 cm² and 32 cm² respectively. What is the ratio of their corresponding sides?

- (A) 3 : 4 (B) 4 : 3 (C) 9 : 16 (D) 16 : 9

- (9) $\triangle ABC \sim \triangle PQR$, $AB = 6$ cm, $BC = 8$ cm, $CA = 10$ cm and $QR = 6$ cm. What is the length of side PR ?

- (A) 8 cm (B) 10 cm (C) 4.5 cm (D) 7.5 cm

- (10) In $\triangle XYZ$, ray YM is the bisector of $\angle XYZ$ where $XY = YZ$ and $X - M - Z$, then which of the relation is true?

- (A) $XM = MZ$ (B) $XM \neq MZ$
(C) $XM > MZ$ (D) None

- (11) In $\triangle ABC$, $AB = 6$ cm, $BC = 8$ cm and $AC = 10$ cm. $\triangle ABC$ is enlarged to $\triangle PQR$ such that the largest side is 12.5 cm. What is the length of the smallest side of $\triangle PQR$?

- (A) 7.5 cm (B) 9 cm (C) 8 cm (D) 10 cm

- (12) In $\triangle ABC$, $B - D - C$ and $BD = 6$ cm, $DC = 4$ cm. What is the ratio of $A(\triangle ABC)$ to $A(\triangle ACD)$?

- (A) 2 : 3 (B) 5 : 2 (C) 3 : 2 (D) 5 : 3

- (13) In $\triangle XYZ$, $PQ \parallel YZ$, $X - P - Y$ and $X - Q - Z$.

If $\frac{XP}{PY} = \frac{4}{13}$ and $XQ = 4.8$ cm. What is XZ ?

- (A) 15.6 cm (B) 20.4 cm
(C) 7.8 cm (D) 10.2 cm

- (14) In $\triangle ABC$, P is a point on side BC such that $BP = 4$ cm and $PC = 7$ cm.

$A(\triangle APC) : A(\triangle ABC) = \dots\dots\dots$

- (A) 11 : 7 (B) 7 : 11 (C) 4 : 7 (D) 7 : 4

- (15) In $\triangle PQR$, seg RS is the bisector of $\angle PRQ$, $PS = 8$, $SQ = 6$, $PR = 20$ then $QR = \dots\dots\dots$
 (a) 10 (b) 15 (c) 30 (d) 40
- (16) In $\triangle ABC$, line $PQ \parallel$ side BC , $AP = 3$, $BP = 6$, $AQ = 5$ then the value of CQ is $\dots\dots\dots$
 (a) 20 (b) 10 (c) 5 (d) 16

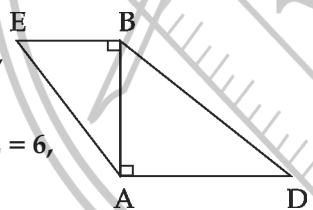
ANSWERS

- (1) (B) $\triangle PQR \sim \triangle CAB$ (2) (B) $\frac{DE}{PQ} = \frac{EF}{RP}$
- (3) (B) Both triangles are similar but not congruent.
- (4) (D) $4\sqrt{2}$ (5) (A) $\frac{AB}{AC} = \frac{AX}{AY}$
- (6) (C) 15 cm (7) (D) 16 : 81
- (8) (A) 3 : 4 (9) (D) 7.5 cm
- (10) (A) $XM = MZ$ (11) (A) 7.5 cm
- (12) (B) 5 : 2 (13) (B) 20.4 cm
- (14) (B) 7 : 11 (15) (B) 15 units
- (16) (B) 10

PROBLEMS FOR PRACTICE

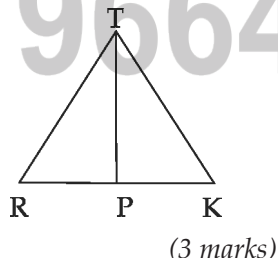
Based on Practice Set 1.1

- (1) In the adjoining figure, seg $BE \perp$ seg AB and seg $BA \perp$ seg AD . If $BE = 6$, $AD = 9$, then find $A(\triangle ABE) : A(\triangle BAD)$ (1 mark)



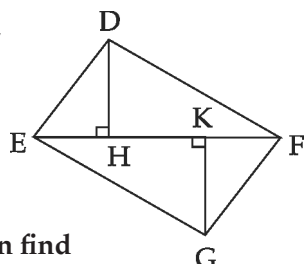
- (2) The ratio of the areas of two triangles with the common base is 6 : 5. Height of the larger triangles is 9 cm. Then find the corresponding height of the smaller triangle. (1 mark)

- (3) In the adjoining figure, $RP : PK = 3 : 2$, then find the value of



- (i) $A(\triangle TRP) : A(\triangle TPK)$
 (ii) $A(\triangle TRK) : A(\triangle TPK)$
 (iii) $A(\triangle TRP) : A(\triangle TRK)$

- (4) In the adjoining figure, seg $DH \perp$ seg EF , seg $GK \perp$ seg EF . If $DH = 12$ cm, $GK = 20$ cm and $A(\triangle DEF) = 300\text{ cm}^2$, then find

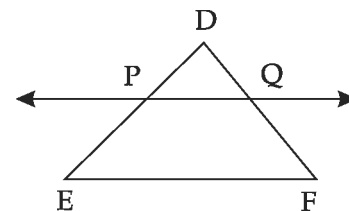


- (i) EF
 (ii) $A(\triangle GEF)$ (3 marks)

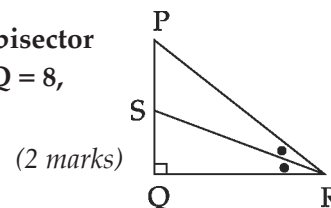
- (5) The ratio of the areas of two triangles with equal height is 3 : 2. The base of the larger triangle is 18 cm. Find the corresponding base of the smaller triangle. (2 marks)

Based on Practice set 1.2

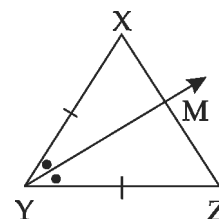
- (6) In $\triangle DEF$, line $PQ \parallel$ side EF . $DQ = 1.8$, $QF = 5.4$, $PE = 7.2$. Find DE . (2 marks)



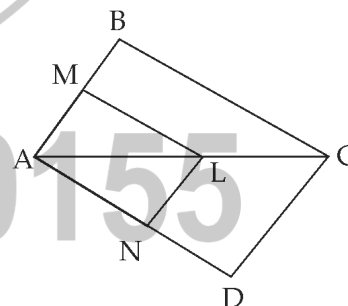
- (7) In $\triangle PQR$, seg RS is bisector of $\angle PRQ$. $PS = 6$, $SQ = 8$, $PR = 15$. Find QR . (2 marks)



- (8) In $\triangle XYZ$, $XY = YZ$. Ray YM bisects $\angle XYZ$. $X-M-Z$. Prove that M is midpoint of seg XZ . (2 marks)

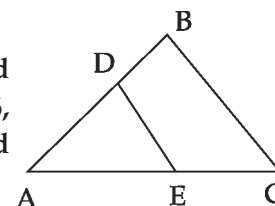


- (9) In the adjoining figure, seg $ML \parallel$ seg BC , seg $NL \parallel$ seg DC . Prove that $AM : AB = AN : AD$. (3 marks)



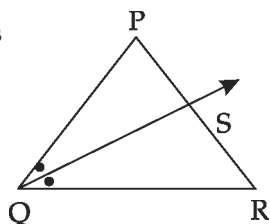
- (10) $\square ABCD$ is a trapezium in which $AB \parallel DC$ and its diagonals intersect each other at point O . Show that $AO : BO = CO : DO$. (3 marks)

- (11) Point D and E are the points on sides AB and AC such that $AB = 5.6$, $AD = 1.4$, $AC = 7.2$ and $AE = 1.8$.

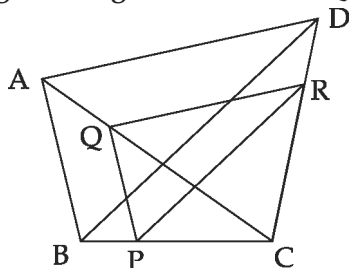


Show that $DE \parallel BC$. (3 marks)

- (12) In $\triangle PQR$, ray QS bisects $\angle PQR$. P-S-R. Show that $\frac{A(\triangle PQS)}{A(\triangle QRS)} = \frac{PQ}{QR}$. (3 marks)

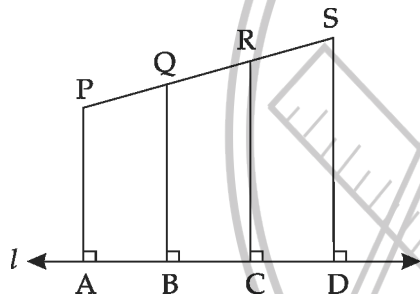


- (13) In the adjoining figure, seg $PQ \parallel$ seg AB . Seg $PR \parallel$ seg BD . Prove that $QR \parallel AD$. (3 marks)



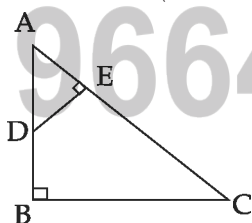
Based on Practice Set 1.3

- (14) In the adjoining figure, seg PA , seg QB , seg RC and seg SD are $\perp$ to line l . $AB = 6$, $BC = 9$, $CD = 12$ and $PS = 36$, then find PQ , QR and RS . (3 marks)



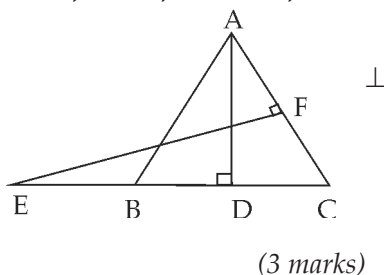
- (15) A vertical pole of a length 6 m casts a shadow of 4 m long on the ground. At the same time a tower casts a shadow 28 m long. Find the height of the tower. (2 marks)
- (16) In $\triangle ABC$, $AB = 5$, $BC = 6$, $AC = 7$. $\triangle PQR \sim \triangle ABC$. Perimeter of $\triangle PQR$ is 360. Find PQ , QR and PR . (3 marks)

- (17) In $\triangle ABC$, $\angle B = 90^\circ$, seg $DE \perp$ side AC . $AD = 6$, $AB = 12$, $AC = 18$, then find AE . (3 marks)



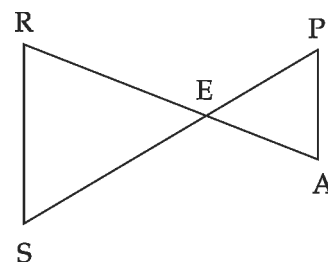
- (18) E is a point on side CB , C-B-E, In $\triangle ABC$, $AB = AC$. If

seg $AD \perp$ BC, B-D-C and seg $EF \perp$ side AC, A-F-C. Prove that $\triangle ABD \sim \triangle ECF$.



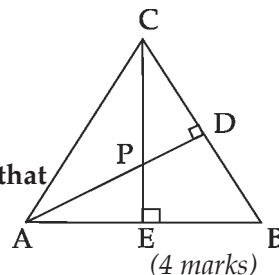
- (19) D is a point on side BC of $\triangle ABC$ such that, $\angle ADC = \angle BAC$. Show that $AC^2 = BC \times DC$. (3 marks)

- (20) In $\triangle RES$, $RE = 15$, $SE = 10$. In $\triangle PEA$, $PE = 8$, $AE = 12$. Prove that $\triangle RES \sim \triangle AEP$ (3 marks)

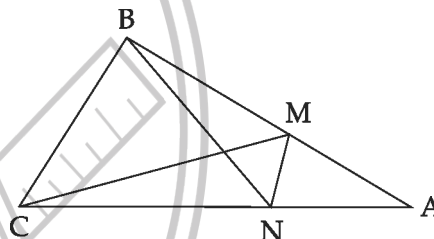


- (21) In the adjoining figure, seg $CE \perp$ side AB , seg $AD \perp$ side BC . Prove that

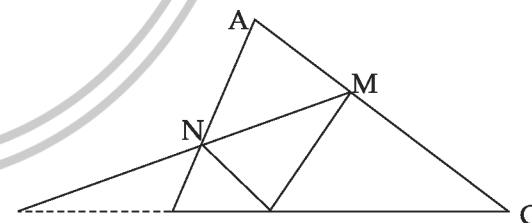
- (i) $\triangle AEP \sim \triangle CDP$
(ii) $\triangle AEP \sim \triangle ADB$



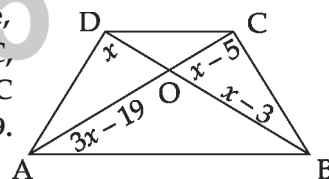
- (22) In the adjoining figure, if $\triangle ABN \cong \triangle ACM$, show that $\triangle AMN \sim \triangle ABC$. (4 marks)



- (23) Let X be any point on side BC of $\triangle ABC$. seg $XM \parallel$ side AB and seg $XN \parallel$ side CA . M-N-T, T-B-X. Prove that: $TX^2 = TB \cdot TC$. (2 marks)



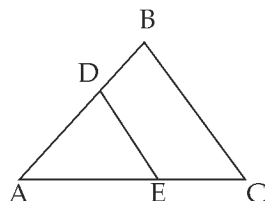
- (24) In the adjoining figure, seg $AB \parallel$ side DC , $OD = x$, $OB = x - 3$, $OC = x - 5$, $OA = 3x - 19$. Find the value of x . (4 marks)



Based on Practice set 1.4

- (25) $\triangle DEF \sim \triangle MNK$, If $DE = 5$ and $MN = 6$, then find the value of $A(\triangle DEF) : A(\triangle MNK)$ (2 marks)
- (26) If $\triangle ABC \sim \triangle DEF$ such that the area of $\triangle ABC$ is 9 cm^2 and the area of $\triangle DEF$ is 16 cm^2 . If $BC = 2.1 \text{ cm}$. Find length of EF . (2 marks)

- (27) In the adjoining figure, seg $DE \parallel$ side BC . If $DE : BC = 3 : 5$, then find $A(\triangle ADE) : A(\triangle DBCE)$ (3 marks)



- (28) In $\triangle ABC$, PQ is a line segment intersecting AB at point P and AC at point Q . $PQ \parallel BC$. If PQ divides $\triangle ABC$ into two equal parts equal in area, find $BP : AB$. (3 marks)

- (29) In $\triangle ABC$, $\angle ABC = 90^\circ$. $\triangle PAB$, $\triangle QAC$ and $\triangle RBC$ are the equilateral triangles constructed on sides AB , AC and BC respectively.

Prove that : $A(\triangle PAB) + A(\triangle RBC) = A(\triangle QAC)$.

(4 marks)

- (30) In $\triangle ABC$, seg $DE \parallel$ side BC . If $2A(\triangle ADE) = A(\square DBCE)$. Show that $BC = \sqrt{3} \times DE$. (4 marks)

ANSWERS

- (1) 2 : 3 (2) 7.5 cm (3) (i) 3 : 2 (ii) 5 : 2 (iii) 3 : 5
 (4) (i) 50 cm (ii) 500 cm² (5) 12 cm (6) 9.6 units
 (7) 20 units (14) $PQ = 8$, $QR = 12$, $RS = 16$ (15) 42 m
 (16) 100 units, 120 units, 140 units (17) 4 units
 (24) $x = 8$, $x = 9$ (25) 25 : 36 (26) 2.8 (27) 9 : 16
 (28) $\frac{\sqrt{2}-1}{\sqrt{2}}$



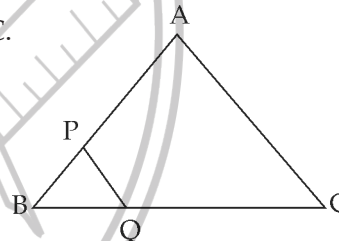
ASSIGNMENT - 1

Time : 1 Hr.

Marks : 20

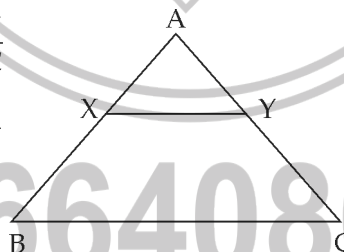
Q.1. (A) Choose the proper alternative answer for the question given below: (2)

- (1) Select the appropriate alternative in the adjoining figure, $PQ \parallel AC$.
 $BP = 6$, $PA = 8$, $BQ = 9$, then $QC = \dots\dots\dots$
 (A) 15 (B) 12 (C) 18 (D) 20



- (2) In the figure seg $XY \parallel$ seg BC , then which of the following statement is true?

- (A) $\frac{AB}{AC} = \frac{AX}{AY}$ (B) $\frac{AX}{XB} = \frac{AY}{YC}$
 (C) $\frac{AX}{YC} = \frac{AY}{XB}$ (D) $\frac{AB}{YC} = \frac{AC}{XB}$

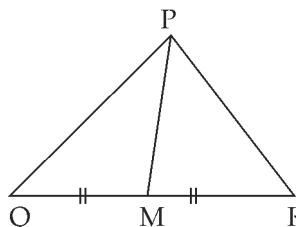


Q.1. (B) Solve the following questions: (2)

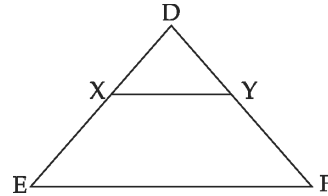
- (1) $\triangle ABC \sim \triangle PQR$ $A(\triangle ABC) : A(\triangle PQR) = 9 : 16$. Find $BC : QR$.
 (2) $\triangle PQR$, seg RS is the bisector of $\angle PRQ$. $PS = 8$, $SQ = 6$, $PR = 20$, then find QR .

Q.2. Perform any one of the following activities: (2)

- (1) In the adjoining figure, seg PM is a median.
 Prove that $A(\triangle PQM) = A(\triangle PRM)$



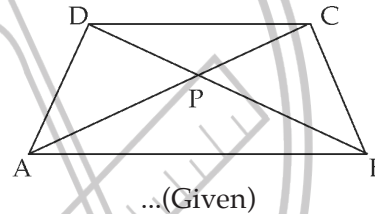
- (2) In the adjoining figure, $DX = 4$, $DE = 8$, $FY = 6$, $OF = 12$. Complete the following activity to prove that $\text{seg } XY \parallel \text{seg } EF$.



Proof : $XE = \boxed{} - \boxed{} = \boxed{} - \boxed{} = \boxed{}$...[D - X - E]
 $DY = \boxed{} - \boxed{} = \boxed{} - \boxed{} = \boxed{}$...[D - Y - F]
 $\frac{DX}{XE} = \frac{\boxed{}}{\boxed{}} = \boxed{}$...[i]
 $\frac{DY}{YE} = \frac{\boxed{}}{\boxed{}} = \boxed{}$...[ii]
 In $\triangle DEF$, $\frac{\boxed{}}{\boxed{}} = \frac{\boxed{}}{\boxed{}}$...[From (i) and (ii)]
 $\therefore \text{Seg } XY \parallel \text{seg } EF$...[By]

Q.3. Attempt any Two of the following:

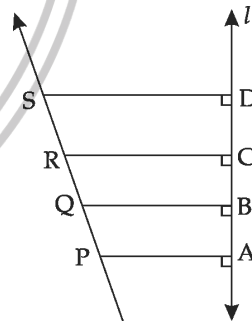
- (1) In $\square ABCD$, $\text{seg } AB \parallel \text{seg } CD$. Diagonals AC and BD intersect each other at point P .



Prove : $\frac{A(\triangle ABP)}{A(\triangle CPD)} = \frac{AB^2}{CD^2}$

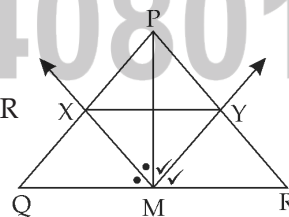
$AB \parallel CD$

- (2) D is a point on side BC of $\triangle ABC$ such that $\angle ADC = \angle BAC$. Show that $AC^2 = BC \times DC$.
 (3) In the adjoining figure, $\text{seg } PA$, $\text{seg } QB$, $\text{seg } RC$ and $\text{seg } SD$ are $\perp$ line l .
 $AB = 60$, $BC = 70$, $CD = 80$. If $PS = 280$ then find PQ , QR , RS .



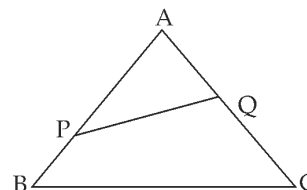
Q.4. Attempt any two of the following:

- (1) In $\triangle PQR$, ray MX and ray MY bisect $\angle PMQ$ and $\angle PMR$ respectively. $P - X - Q$, $P - Y - R$.
 Seg PM is a median, prove that $\text{seg } XY \parallel \text{seg } QR$



- (2) In the adjoining figure, in $\triangle ABC$, $A - P - B$ and $A - Q - C$

prove that $\frac{A(\triangle APQ)}{A(\triangle ABC)} = \frac{AP \times AQ}{AB \times AC}$



- (3) Prove: In a triangle the angle bisector divides the side opposite to the angle in the ratio of the remaining sides.