SIMILAR TRIANGLES

1.1 SIMILAR GEOMETRIC FIGURES

Two geometric figures which are same in shape, such that one is simply a copy of the other on a smaller scale or a larger scale, are called similar geometric figures. Two geometric figures are said to be similar if and only if they have the same shape but not necessarily the same size.

Note: Two congruent geometric figures are always similar but converse may or may not be true.

1.2 SIMILAR POLYGONS

Two polygons of the same number of sides are similar,if

(i) Their corresponding angles are equal and

(ii) Their corresponding sides are in proportion or their corresponding sides are in the same ratio

Note : The same ratio of the corresponding sides is referred to as the representative fraction or the scale factor for the polygons.

1.3 SIMILAR TRIANGLES

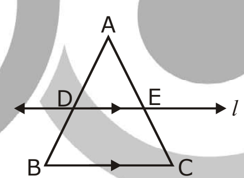
Two triangles are said to be similar, if

(i) Their corresponding angles are equal and

(ii) Their corresponding sides are in proportion (or are in the same ratio)

1.4 BASIC PROPORTIONALITY THEOREM (OR THALES THEOREM)

If a line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the same ratio.



If a line is drawn parallel to one side of a triangle, to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

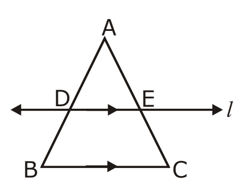
If in $\triangle ABC$, $l \parallel BC$, intersecting in D and E, then

(i) $\frac{AD}{DB} = \frac{AE}{EC}$ (ii) $\frac{AD}{AB} = \frac{AE}{AC}$ (iii) $\frac{DB}{AB} = \frac{EC}{AC}$

1.5 CONVERSE OF BASIC PROPORTIONALITY THEOREM

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

i.e., In $\triangle ABC$, if l intersects AB in D and AC in E, such



that $\frac{AD}{DB} = \frac{AE}{EC}$, then DE || BC

1.6 CRITERIA FOR SIMILARITY OF TRIANGLES

Two triangles are said to be similar, if

(i)Their corresponding angles are equal and

(ii)Their corresponding sides are in proportion (or are in the same ratio)

(i) AA or AAA Similarity Criterion :
If two angles of one triangle are equal to two corresponding angles of another triangle, then the triangles are similar.
If two angles of one triangle are respectively equal to the two angles of another triangle, then the third angles of the two triangles are necessarily equal, because the sum of three angles of a triangle is always 180°.

(ii) SAS Similarity criterion :
If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are in the same ratio, then the two triangles are similar.

OR

If two sides of a triangle are proportional to two corresponding sides of another triangle and the angles included between them are equal, then the triangles are similar.

(iii) SSS Similarity Criterion :
If in two triangles, sides of one triangle are proportional (or are in the same ratio) to the sides of the other triangle, then the triangles are similar.

Note : If $\Delta ABC \sim \Delta PQR$ by any one similarity criterion, then

$\angle A = \angle P, \angle B = \angle Q, \angle C = \angle R$ and $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$

i.e. A and P,B and Q,C and R are the corresponding vertices, also AB and PQ, BC and QR, CA and RP are the corresponding sides.

1.7 AREAS OF SIMILAR TRIANGLES

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

Note :

(i) The ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding medians.
(ii) The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding altitudes.
(iii) The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding angle bisectors.

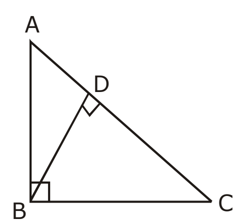
1.8 Pythagoras Theorem

In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

1.9 Converse of pythagoras Theorem

In a triangle, if square of one side is equal to the sum of the squares of the other two sides, then the angle opposite the first side is a right angle.

Note : If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and similar to each other. i.e., If in ΔABC, $\angle B = 90°$ and $BD \perp AC$, then

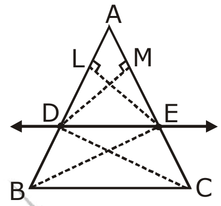


(i) $\Delta ADB \sim \Delta ABC$ (ii) $\Delta BDC \sim \Delta ABC$ (iii) $\Delta ADB \sim \Delta BDC$

1.10. Basic Proportionality theorem or thales theorem

If a line is drawn parallel to one side of a triangle, to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

Given : ΔABC and a line 'l' parallel to BC intersects AB at D and AC at E as shown in figure.



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

Const. : Join BE and CD Draw EL $\perp$ AB and DM $\perp$ AC.

Proof : Area of ΔADE = $\frac{1}{2} \times AD \times EL$ ...(i) $\{\because$ Area of a $\Delta = \frac{1}{2}$ base$\times$ corresponding altitude$\}$

Area of ΔBDE = $\frac{1}{2} \times DB \times EL$ ....(ii) ,Now Dividing (i) and (ii), we have

$$\frac{\text{Area of}\Delta ADE}{\text{Area of }\Delta BDE} = \frac{\frac{1}{2}\times AD \times EL}{\frac{1}{2}\times DB \times EL} = \frac{AD}{DB} \quad ...(iii)$$

Similarly,

$$\frac{\text{Are of }\Delta ADE}{\text{Area of }\Delta CDE} = \frac{\frac{1}{2}\times AE \times DM}{\frac{1}{2}\times EC \times DM} = \frac{AE}{EC} \quad ...(iv)$$

Since, ΔBDE and ΔCDE are triangles on the same base DE and between the same parallels DE and BC

$\therefore$ Area of ΔBDE = Area of ΔCDE

From (iii) and (iv), we have $\frac{AD}{DB} = \frac{AE}{EC}$

Corollary : If in a ΔABC, a line DE || BC, intersects AB in D and AC in E, then

(i) $\frac{AB}{AD} = \frac{AC}{AE}$ (ii) $\frac{AB}{DB} = \frac{AC}{EC}$

Proof :

(i) From the Basic Proportionality Theorem (B.P.T), we have taking reciprocals of both sides adding 1 on both sides]

$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{DB}{AD} = \frac{EC}{AE}$$

$$\Rightarrow \quad 1 + \frac{DB}{AD} = 1 + \frac{EC}{AE}$$

$$\Rightarrow \quad \frac{AD + DB}{AD} = \frac{AE + EC}{AE}$$

$$\Rightarrow \quad \frac{AB}{AD} = \frac{AC}{AE}$$

(ii) Again, from B.P.T., We have

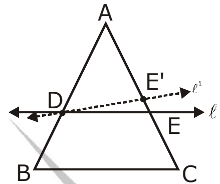
$$\frac{AD}{DB} = \frac{AE}{EC} \Rightarrow \frac{AD}{DB} + 1 = \frac{AE}{EC} + 1$$

$$\Rightarrow \quad \frac{AD + DB}{DB} = \frac{AE + EC}{EC} \Rightarrow \frac{AB}{DB} = \frac{AC}{EC}$$

1.11 Converse of Basic proportionality Theorem:
If a line divides any two sides of a triangle in the same ratio, the line is parallel to the third side.

Given : ΔABC and a line 'ℓ' intersects AB in D and AC in E, such that $\frac{AD}{DB} = \frac{AE}{EC}$

To Prove : Line l is parallel to BC or DE || BC



Proof : If possible, let the line ℓ is not parallel to BC. Through D, draw ℓ'|| BC intersecting AC in E' Now, by basic propotionlity theorem, we have

$\frac{AD}{DB} = \frac{AE'}{E'C}$ ...(i) But $\frac{AD}{DB} = \frac{AE}{EC}$ ....(ii)

From (i) and (ii), we have

$$\frac{AE}{EC} = \frac{AE'}{E'C}$$

Adding 1 to both sides, we have

$$\frac{AE}{EC} + 1 = \frac{AE'}{E'C} + 1$$

$\Rightarrow \frac{AE + EC}{EC} = \frac{AE' + E'C}{E'C}$ $\Rightarrow \frac{AC}{EC} = \frac{AC}{E'C} \Rightarrow EC = E'C$

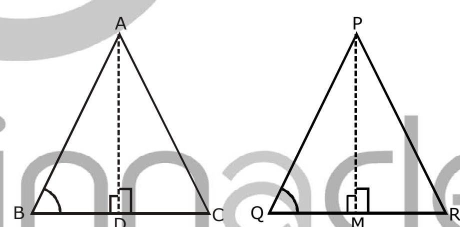
Which is only possible, if E and E' coincide. Hence, line ℓ is parallel to BC or DE || BC

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

Given : $\Delta ABC \sim \Delta PQR$

To prove :

$$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta PQR} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2}$$



Const : Draw $AD \perp BC$ and $PM \perp QR$.

Proof: $\Delta ABC \sim \Delta PQR$

$\Rightarrow \frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$

Also, $\angle B = \angle Q$ [$\because$ corresponding angles of similar triangles are equal]

and $\angle ADB = \angle PMQ$ [each = 90°]

$\Rightarrow \Delta ADB \sim \Delta PMQ \Rightarrow \frac{AD}{PM} = \frac{AB}{PQ}$

From (i) and (ii), we have $\frac{AD}{PM} = \frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$

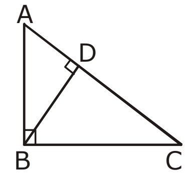
Now, $\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta PQR} = \frac{\frac{1}{2} \times BC \times AD}{\frac{1}{2} \times QR \times PM}$,

$$\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta PQR} = \frac{BC}{QR} \times \frac{AD}{PM} = \frac{BC}{QR} \times \frac{BC}{QR} = \frac{BC^2}{QR^2}$$

Also, from (i), we have $\frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2}$

Therefore, form (iv) and (v) we have $\frac{\text{Area of } \Delta ABC}{\text{Area of } \Delta PQR} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2}$

1.13 (Pythagoras' theorem) In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.



Given: A $\triangle ABC$ in which $\angle ABC = 90^\circ$.

To Prove: $AC^2 = AB^2 + BC^2$.

Consturction: Draw $BD \perp AC$.

Proof: In $\triangle ADB$ and $\triangle ABC$, we have:

$\angle A = \angle A$ (common) $\angle ADB = \angle ABC$

$\therefore \quad \triangle ADB \sim \triangle ABC \quad \Rightarrow \quad \dfrac{AD}{AB} = \dfrac{AB}{AC}$

$\Rightarrow \quad AD \times AC = AB^2$ ...(i)

In $\triangle BDC$ and $\triangle ABC$, we have

$\angle C = \angle C$ (COMMON)

$\triangle BDC = \angle ABC$ [each equal to 90º]

$\therefore \quad \triangle BDC \sim \triangle ABC$ [by AA - similarity]

$\Rightarrow \quad \dfrac{DC}{BC} = \dfrac{BC}{AC} \quad \Rightarrow \quad DC \times AC = BC^2$ ...(ii)

From (i) and (ii), we get

$AD \times AC + DC \times AC = (AB^2 + BC^2)$

$\Rightarrow \quad (AD + DC) \times AC = (AB^2 + BC^2)$

$\Rightarrow \quad AC \times AC = (AB^2 + BC^2)$

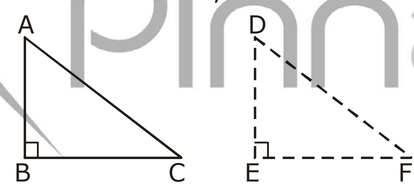
$\Rightarrow \quad AC^2 = (AB^2 + BC^2)$

1.14 (Converse of Pythagoras' theorem) In a triangle, if the square of one side is equal to the sum of the squares of the other two sides then the angle opposite to the first side is a right angle.

Given: A $\triangle ABC$ in which $AC^2 = AB^2 + BC^2$.

To Prove: $\angle B = 90^\circ$.

Construction: Draw a $\triangle DEF$ such that $DE = AB$, $EF = BC$ and $\angle E = 90^\circ$.



Proof: In $\triangle DEF$, we have : $\angle E = 90^\circ$. So, by Pythagora's theorem, we have :

$DF^2 = DE^2 + EF^2 \quad \Rightarrow \quad DF^2 = AB^2 + BC^2$ ......(i)

[$\because$ DE = AB and EF = BC]

But, $AC^2 = AB^2 + BC^2$ ...... (ii)

[given]

From (i) and (ii), we get:

$AC^2 = DF^2 \quad \Rightarrow \quad AC = DF$.

Now, in $\triangle ABC$ and $\triangle DEF$, we have

$AB = DE$, $BC = EF$ and $AC = DF \quad \therefore \quad \triangle ABC \cong \triangle DEF$

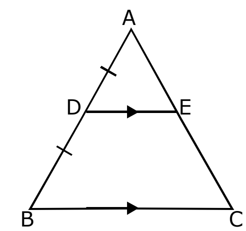
Hence, $\angle B = \angle E = 90^\circ$.

SOLVED PROBLEMS

Ex.1 Prove that the line drawn from the mid-point of one side of a triangle, parallel to another side, bisects the third side.

Sol. ΔABC in which D is the mid-point of side AB and the line DE is drawn parallel to BC, meeting AC in E.

To Prove : E is the mid-point of AC i.e, AE = EC.



Proof : In ΔABC, we have DE || BC.

$\therefore \quad \frac{AD}{DB} = \frac{AE}{EC}$ ..... (i)

But D is the mid-point of AB.

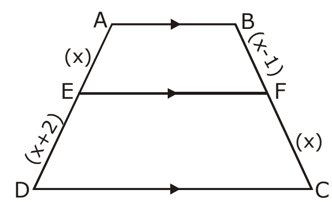
$\therefore \quad AD = DB \Rightarrow \frac{AD}{DB} = 1$ ..... (ii)

From (i) and (ii), we get

$\frac{AE}{EC} = 1 \Rightarrow AE = EC$

Hence, E is the mid-point of AC.

Ex.2 In figure if, EF || DC || AB, find x.



Sol. $\therefore \quad EF \,||\, DC \,||\, AB \;\therefore\; \frac{AE}{ED} = \frac{BF}{FC}$

$\Rightarrow \quad \frac{x}{x+2} = \frac{x-1}{x}$

$\Rightarrow \quad x^2 = (x + 2)(x - 1)$

$\Rightarrow \quad x^2 = x^2 + x - 2 \Rightarrow x = 2$ units

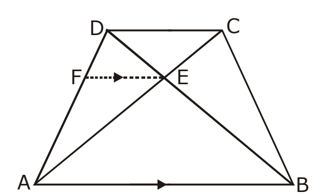
Ex.3 If the diagonals of a quadrilateral divide each other proportionally, prove that it is a trapezium.

Sol. A quadrilateral ABCD whose diagonals AC and BD intersect at E such that $\frac{DE}{EB} = \frac{CE}{EA}$.

To prove : ABCD is a trapezium.

Construction : Draw FE || AB, metting AD in F.

Proof : In ΔABD, we have FE || AB.



$\therefore \quad \frac{DF}{FA} = \frac{DE}{EB}$ ... (i)

But $\frac{DE}{EB} = \frac{CE}{EA}$ ... (ii)

From (i) and (ii), we get

$\frac{DF}{FA} = \frac{CE}{EA}$

which means in ΔACD, E and F are points on AC and AD respectively such that

$\frac{DF}{FA} = \frac{CE}{EA}$

$\Rightarrow$ FE || DC ... (iii) [by converse of B.P.T.]

But, FE || AB ... (iv) [by construction]

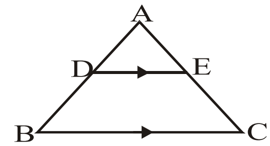
From (iii) and (iv), we get : AB || DC.

Hence, **ABCD is a trapezium**.

Ex.4 In the adjoining figure, DE||BC.

(i) If AD = 3.4 cm, AB = 8.5 cm and AC = 13.5 cm, find AE.

(ii) If $\frac{AD}{DB} = \frac{3}{5}$ and AC = 9.6 cm, find AE.



Sol. (i) Since DE||BC, we have $\frac{AD}{AB} = \frac{AE}{AC}$

$\therefore \quad \frac{3.4}{8.5} = \frac{AE}{13.5} \Rightarrow \frac{3.4 \times 13.5}{8.5}$ = 5.4

Hence, AE = 5.4 cm.

(ii) Since DE||BC, we have $\frac{AD}{DB} = \frac{AE}{EC}$

$\therefore \quad \frac{AE}{EC} = \frac{3}{5} \left[\because \frac{AD}{DB} = \frac{3}{5}\ (\text{Given})\right]$

Let AE = x cm. Then, EC = (AC – AE) = (9.6 – x) cm.

$\therefore \quad \frac{x}{9.6 - x} = \frac{3}{5} \Rightarrow 5x = 3(9.6 - x)$

$\Rightarrow$ 5x = 28.8 – 3x $\Rightarrow$ 8x = 28.8 $\Rightarrow$ x = 3.6.

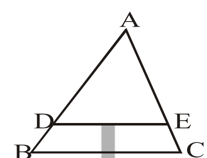
$\therefore$ AE = 3.6 cm.

Ex.5 In the adjoining figure, AD = 5.6 cm, AB = 8.4 cm, AE = 3.8 cm and AC = 5.7 cm. Show that DE||BC.

Sol. We have, AD = 5.6 cm, DB = (AB – AD) = (8.4 – 5.6) cm = 2.8 cm.

AE = 3.8 cm, EC = (AC – AE) = (5.7 – 3.8) cm = 1.9 cm.

$\therefore \quad \frac{AD}{DB} = \frac{5.6}{2.8} = \frac{2}{1}$ and $\frac{AE}{EC} = \frac{3.8}{1.9} = \frac{2}{1}$



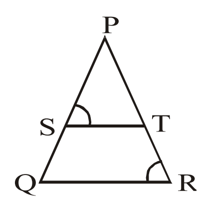
Thus, $\frac{AD}{DB} = \frac{AE}{EC}$

$\therefore$ DE divides AB and AC proportionally.

Hence, DE||BC

Ex.6 In fig, $\frac{PS}{SQ} = \frac{PT}{TR}$ and $\angle$PST = $\angle$PRQ. Prove that PQR is an isosceles triangle.

Sol. It is given that $\frac{PS}{SQ} = \frac{PT}{TR}$



So, ST||QR [Theorem]

Therefore, $\angle$PST = $\angle$PQR [Corresponding angles] - (1)

Also, it is given that

$\angle$PST = $\angle$PRQ (2)

So, $\angle$PRQ = $\angle$PQR [From 1 and 2]

Therefore PQ = PR

[Sides opposite the equal angles]

i.e., PQR is an isosceles triangle.

Ex.7 Prove that any line parallel to parallel sides of a trapezium divides the non-parallel sides proportionally (i.e., in the same ratio).

OR

ABCD is a trapezium with DC||AB. E and F are points on AD and BC respectively such that EF||AB. Show that $\frac{AE}{ED} = \frac{BF}{FC}$

Sol. We are given trapezium ABCD.

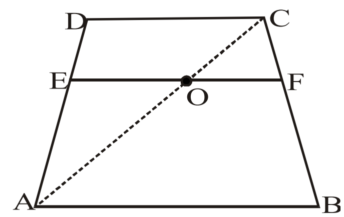
CD||BA

EF||AB and CD both

We join AC.

It mets EF at O.

In ΔACD, OE||CD



$\Rightarrow \quad \frac{AO}{OC} = \frac{AE}{ED}$ ...(i)

(Basic Proportionality Theorem)

In ΔCAB, OF||AB

$\Rightarrow \quad \frac{CO}{OA} = \frac{CF}{FB}$ [B.P.T]

$\Rightarrow \quad \frac{AO}{OC} = \frac{BF}{FC}$ ...(ii)

From (i) and (ii)

$\frac{AE}{ED} = \frac{BF}{FC}$

Hence, proved.

Ex.8 Any point X inside ΔDEF is joined to its vertices. From a point P in DX, PQ is drawn parallel to DE meeting XE at Q and QR is drawn parallel to EF meeting XF in R. Prove that PR || DF.

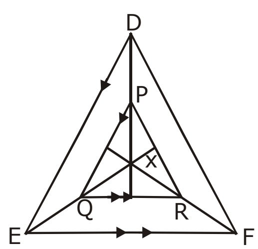
Sol. **Given :** In figure PQ || DE and QR || EF.

To Prove : PR || DF.

Proof : In ΔXED; PQ || DE.

$\therefore \quad \frac{XP}{PD} = \frac{XQ}{QE}$ ... (i) [by B.P.T.]

Also, in ΔXEF, QR || EF $\quad\therefore$ We have



$\frac{XQ}{QE} = \frac{XR}{RF}$ ... (ii) [by B.P.T.]

From (i) and (ii), we have

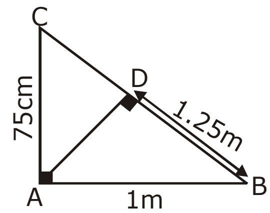
$\frac{XP}{PD} = \frac{XR}{RF}$

Thus, in ΔXFD, R and P are points dividing sides XF and XD in the same ratio.

Therefore, by converse of B.P.T.,we have **PR||DF**.

Ex.9 In the given figure, $\angle CAB = 90^\circ$ and $AD \perp BC$. If AC = 75 cm. AB = 1m and BD = 1.25 m, find AD.

Sol. $\because$ In a ΔABC, $\angle A = 90^\circ$ and $AD \perp BC$, where D is on BC.



$\therefore \quad \Delta BAC \sim \Delta BDA$

$\Rightarrow \quad \frac{BA}{BD} = \frac{AC}{DA} = \frac{BC}{BA}$

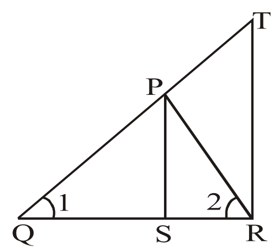
$\Rightarrow \quad \frac{100}{125} = \frac{75}{DA} = \frac{BC}{BA}$ [$\because$ AB = 1m 100cm and BD = 125 cm

$\Rightarrow \quad \frac{100}{125} = \frac{75}{DA} \Rightarrow DA = \left(\frac{125 \times 75}{100}\right)$cm

AD = 93.75 cm

Ex.10 In fig, $\frac{QT}{PR} = \frac{QR}{QS}$ and $\angle 1 = \angle 2$. Prove that $\Delta PQS \sim \Delta TQR$.

Sol. $\angle 1 = \angle 2$ (Given)



$\Rightarrow$ PR = PQ ...(i)

(Sides opposite to equal angles in ΔQRP)

Also $\frac{QT}{PR} = \frac{QR}{QS}$ (Given) ...(ii)

Form (i) and (ii), we have

$\frac{QT}{PR} = \frac{QR}{QS} \Rightarrow \frac{QP}{QT} = \frac{QS}{QR}$ ...(iii)

Now, in triangles PQR and TQR, we have

$\angle PQS = \angle TQR$ (each = $\angle 1$)

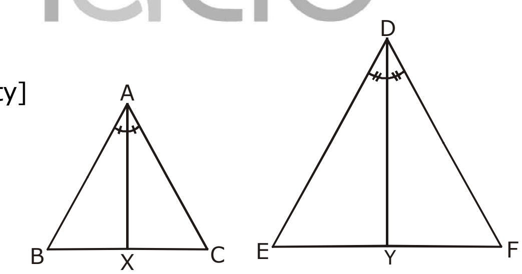
and $\frac{PQ}{TQ} = \frac{QS}{QR}$ (from (3))

$\Rightarrow \quad \Delta PQS \sim \Delta TQR$ (SAS Similarity)

Ex.11 If two triangles are equiangular, prove that the ratio of corresponding sides is the same as the ratio of the corresponding angle bisector segments.

Sol. **Given :** Two Δs ABC and DEF in which $\angle A = \angle D$, $\angle B = \angle E$, $\angle C = \angle F$; and AX, DY are the bisectors of A and D respectively.

To porve : $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{AX}{DY}$



Proof : Since, equiangular traingels are similar [by AA-similarity]

We have : $\Delta ABC \sim \Delta DEF$

$\therefore \quad \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ ..... (i)

Now, $\angle A = \angle D \Rightarrow \frac{1}{2}\angle A = \frac{1}{2}\angle D$

$\Rightarrow \quad \angle BAX = \angle EDY$

Thus, in Δs ABX and DEY, we have : $\angle BAX = \angle EDY$ [proved]

and $\angle B = \angle E$ [given]

$\therefore \quad \Delta ABX \sim \Delta DEY$ [by A.A. similarity]

$\therefore \quad \frac{AB}{DE} = \frac{AX}{DY}$ .... (ii)

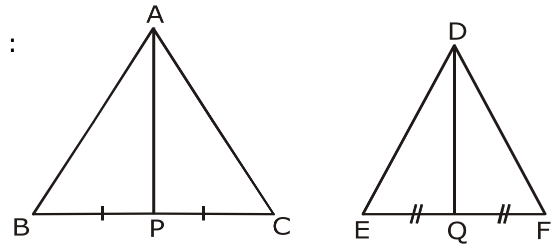
From (i) and (ii), we get :

$$\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{AX}{DY}$$

Ex.12 If two triangles are equiangular, prove that the ratio of the corresponding sides is the same as the ratio of the corresponding medians.

Sol. **Given :** Two Δs ABC and DEF in which $\angle A = \angle D$, $\angle B = \angle E$, $\angle C = \angle F$; AP and DQ are the medians.

To prove : $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{AP}{DQ}$



Proof : Since, equiangular traingles are similar we have :

$\Delta ABC \sim \Delta DEF$ [by A.A. similarity]

$\therefore \quad \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

But, $\frac{AB}{DE} = \frac{BC}{EF} = \frac{2BP}{2EQ} = \frac{BP}{EQ}$ [$\because$ BC = 2BP, EF = 2EQ]

Now, in Ds ABP and DEQ, we have

$\frac{AB}{DE} = \frac{BP}{EQ}$ and B = E [given]

$\therefore \quad \Delta ABP \sim \Delta DEQ$ [byS.A.S. similarity]

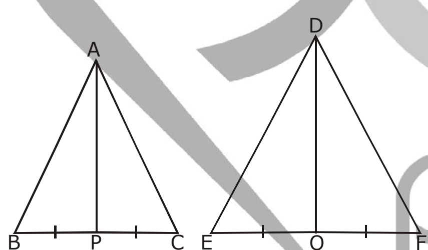
$\therefore \quad \frac{AB}{DE} = \frac{AP}{DQ}$

From (i) and (ii), we get :

$\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{AP}{PQ}$

Ex.13 If two sides and a median bisecting one of these sides of a triangle are respectively proportioanl to the two sides and the corresponding median of another triangle then the triangles are similar.

Sol. **Given :** ΔABC and ΔDEF in which AP and DQ are the medians are such that



$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AP}{DQ}$

To prove : $\Delta ABC \sim \Delta DEF$

Proof : $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AP}{DQ}$ [given] .... (i)

$\Rightarrow \quad \frac{AB}{DE} = \frac{\frac{1}{2}BC}{\frac{1}{2}EF} = \frac{AP}{DQ}$ [note this step]

$\Rightarrow \quad \frac{AB}{DE} = \frac{BP}{EQ} = \frac{AP}{DQ}$ $\left(\because \frac{1}{2}BC = BP, \frac{1}{2}EF = EQ\right)$

$\Rightarrow \quad \Delta ABP \sim \Delta DEQ$ [by S.S.S. similarity]

$\Rightarrow \quad \angle B = \angle E$ ... (ii)

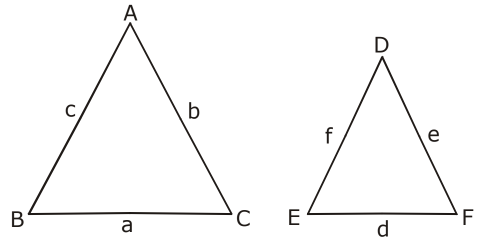
Now, in Δs ABC and DEF, we have

$\frac{AB}{DE} = \frac{BC}{EF}$ and $\angle B = \angle E$ [from (i) and (ii)]

$\therefore \quad \Delta ABC \sim \Delta DEF$ [by S.A.S. similarity]

Ex.14 Prove that the ratio of the perimeters of two similar triangles is the same as the ratio of their correspoding sides.

Sol. $\Delta ABC \sim \Delta DEF$



To Prove :

$$\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta DEF} = \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

Proof: Let BC = a, AC = b, AB = c,
EF = d, DF = e, DE = f

$\because$ $\Delta ABC \sim \Delta DEF$

$\therefore$ $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = k$ (say) .... (i)

or $\frac{c}{f} = \frac{a}{d} = \frac{b}{e} = k$ .... (ii)

$\therefore$ c = fk, a = dk, b = ek

$$\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta DEF} = \frac{AB + BC + AC}{DE + EF + DF}$$

[perimeter of a trianlge= sum of its sides]

$$\frac{c+a+b}{f+d+e} = \frac{fk+dk+ek}{f+d+e} \quad \text{[using (ii)]}$$

$$= \frac{k(f+d+e)}{(f+d+e)} = k$$

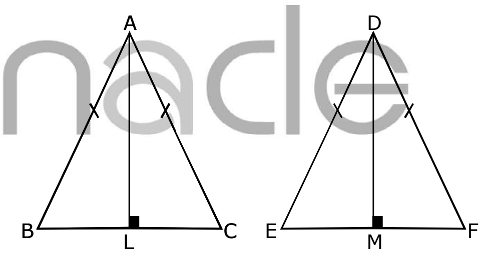
From (i) and (iii), we get

$$\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta DEF} = \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

Ex.15 Two isosceles triangles have equal vertical angles and their areas are in the same ratio 16 : 25. Find the ratio of their corresponding heights.

Sol. **Given :** Δs ABC and DEF such that AB = AC, DE = DF, $\angle A = \angle D$.

and $\frac{\text{area}(\Delta ABC)}{\text{area}(\Delta DEF)} = \frac{16}{25}$



To Determine : $\frac{AL}{DM} = ?$

Proof : AB = AC, DE = DF

$\Rightarrow$ $\frac{AB}{AC} = 1$ and $\frac{DE}{DF} = 1$

$\Rightarrow$ $\frac{AB}{AC} = \frac{DE}{DF} \Rightarrow \frac{AB}{DE} = \frac{AC}{DF}$

Thus, in Δs ABC and DEF, we have

$\frac{AB}{DE} = \frac{AC}{DF}$ and $\angle A = \angle D$ [given]

$\therefore$ $\Delta ABC \sim \Delta DEF$ [by S.A.S. similarity]

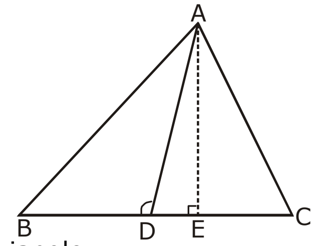
$\Rightarrow$ $\frac{\text{area}(\Delta ABC)}{\text{area}(\Delta DEF)} = \frac{AL^2}{DM^2}$

$\Rightarrow$ $\frac{16}{25} = \frac{AL^2}{DM^2}$ $\left(\because \frac{\text{area }(\Delta ABC)}{\text{area }(\Delta DEF)} = \frac{16}{25}\right)$

$\Rightarrow$ $\frac{AL}{DM} = \frac{4}{5}$

Ex.16 Prove that in any triangle, the sum of the squares of any two sides is equal to twice the square of half of the third side together with twice the square of the median which bisects the third side.

Sol. Given : A ΔABC iin which AD is a median.



To prove : $AB^2 + AC^2 = 2AD^2 + 2\left(\frac{1}{2}BC\right)^2$

or $AB^2 + AC^2 = 2(AD^2 + BD^2)$

Const. : Draw $AE \perp BC$.

Proof : Since, $\angle AED = 90º$. Therefore, in ΔADE, we have

$\angle ADE < 90º \Rightarrow \angle ADB > 90º$

Thus, ΔADB is an obtuse-angled triangle and ΔADC is an acute angled triangle.

Now, ΔABD is obtuse-angled at D and

$AE \perp BD$ produced.

we have $AB^2 = AD^2 + BD^2 + 2BD.DE$ ... (i)

Again, ΔACD is acute-angled at D and

$AE \perp CD$. we have

$AC^2 = AD^2 + DC^2 - 2DC.DE$

$\Rightarrow$ $AC^2 = AD^2 + BD^2 - 2BD.DE$ .... (ii) $[\because CD = BD]$

Adding (i) and (ii), we get

$AB^2 + AC^2 = 2(AD^2 + BD^2)$

$\Rightarrow$ $AB^2 + AC^2$

$= 2\left[AD^2 + \left(\frac{BC}{2}\right)^2\right]\left[\because BD = \frac{BC}{2}\right]$

$\Rightarrow$ $AB^2 + AC^2 = 2AD^2 + 2\left(\frac{1}{2}BC\right)^2$

or $AB^2 + AC^2 = 2(AD^2 + BD^2)$

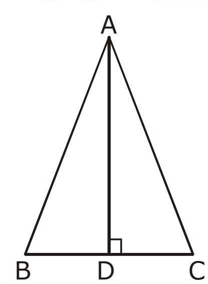
Ex.17 Prove that three times the square on any side of an equilateral triangle is equal to four times the square on the altitude.

Sol. **Given :** An equilateral ΔABC and $AD \perp BC$

To prove : $3AB^2 = 4AD^2$

Proof : We know that in an equilateral triangle perpendicular from a vertex bisect the base.

$\therefore$ $BD = DC = \frac{1}{2}BC$



Since, ΔADB is a right-triangle, right-angled at D.

$\therefore$ $AB^2 = AD^2 + BD^2$ [By Pythagoras Theorem]

$\Rightarrow$ $AB^2 = AD^2 + \left(\frac{1}{2}BC\right)^2$

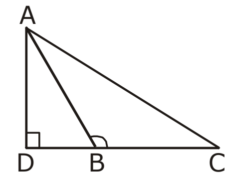
$\Rightarrow$ $AB^2 = AD^2 + \frac{BC^2}{4}$

$\Rightarrow$ $AB^2 = AD^2 + \frac{AB^2}{4}$ $[\because BC = AB]$

$\Rightarrow$ $\frac{3}{4}AB^2 = AD^2 \Rightarrow 3AB^2 = 4AD^2$

Ex.18 In a ΔABC, $\angle ABC > 90^\circ$ and $AD \perp$ (CB produced). Prove that $AC^2 = AB^2 + BC^2 + 2BC \cdot BD$.

Sol. **Given:** A ΔABC in which $\angle ABC > 90^\circ$ and $AD \perp$ (CB produced).



To Prove: $AC^2 = AB^2 + BC^2 + 2BC \cdot BD$.

Proof: In ΔABD, $\angle ADB = 90^\circ$

$\therefore$ $AB^2 = AD^2 + BD^2$ ......(i)

[by Pythagoras' theorem]

In ΔADC, $\angle ADC = 90^\circ$

$\therefore$ $AC^2 = AD^2 + CD^2$

[by Pythagora's theorem]

$= AD^2 + (BC + BD)^2$

[$\because$ CD = (BC + BD)]

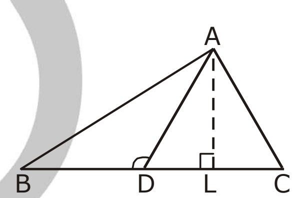
$= AD^2 + (BC^2 + BD^2 + 2BC \cdot BD)$

$= (AD^2 + BD^2) + BC^2 + 2BC \cdot BD$

$= (AB^2 + BC^2 + 2BC \cdot BD)$ [using (i)].

Ex.19 In ΔABC, if AD is the median, the prove that $(AB^2 + AC^2) = 2(AD^2 + BD^2)$.

Sol. **Given:** A ΔABC in which AD is the median.



To Prove: $(AB^2 + AC^2) = 2(AD^2 + BD^2)$.

Construction: Draw $AL \perp BC$.

Proof: In ΔALD, $\angle ALD = 90^\circ$

$\therefore$ $\angle ADL < 90^\circ$ and therefore,

$\angle ADB > 90^\circ$.

Thus, in ΔADB, $\angle ADB > 90^\circ$ and $AL \perp$ (BD produced).

$\therefore$ $AB^2 = AD^2 + BD^2 + 2BD \cdot DL$ ...(i)

In ΔADC, $\angle ADC < 90^\circ$ and $AL \perp DC$.

$\therefore$ $AC^2 = AD^2 + CD^2 - 2CD \cdot DL$

$\Rightarrow$ $AC^2 = AD^2 + BD^2 - 2BD \cdot DL$ ...(ii)

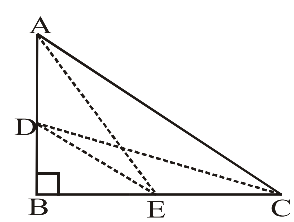
[$\because$ CD = BD]

Adding (i) and (ii), we get :

$(AB^2 + AC^2) = 2(AD^2 + BD^2)$

Ex.20 In the given figure, $\angle B = 90^\circ$. D and E are any points on AB and BC respectively.

Prove that : $AE^2 + CD^2 = AC^2 + DE^2$.



Sol. In ΔABE, $\angle B = 90^\circ$

$\therefore$ $AE^2 = AB^2 + BE^2$ ...(i)

In ΔDBC, $\angle B = 90^\circ$.

$\therefore$ $CD^2 = BD^2 + BC^2$ ...(ii)

Adding (i) and (ii), we get :

$AE^2 + CD^2 = (AB^2 + BC^2) + (BE^2 + BD^2)$

$= AC^2 + DE^2$ [By Pythagoras Theorem]

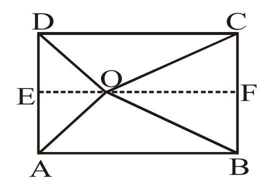
Hence, $AE^2 + CD^2 = AC^2 + DE^2$.

Ex.21 A point O in the interior of a rectangle ABCD is joined with each of the vertices A, B, C and D.

Prove that: $OA^2 + OC^2 = OB^2 + OD^2$.

Sol. Through O, draw EF||AB. Then, ABFE is a rectangle.

In right triangles OEA and OFC, we have:



$OA^2 = OE^2 + AE^2$

$OC^2 = OF^2 + CF^2$

$\therefore$ $OA^2 + OC^2 = OE^2 + OF^2 + AE^2 + CF^2$ ... (i)

Again, in right triangles OFB and OED, we have :

$OB^2 = OF^2 + BF^2$

$OD^2 = OE^2 + DE^2$

$\therefore$ $OB^2 + OD^2 = OF^2 + OE^2 + BF^2 + DE^2$

$= OE^2 + OF^2 + AE^2 + CF^2$ ...(ii) [$\because$ BF = AE & DE = CF]

From (i) and (ii), we get

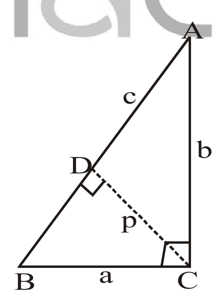
$OA^2 + OC^2 = OB^2 + OD^2$.

Ex22 In the given figure, $\triangle ABC$ is right-angled at C.

Let BC = a, CA = b, AB = c and CD = p, where CD $\perp$ AB.

Prove that: (i) cp = ab (ii) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$

Sol. (i) Area of $\triangle ABC = \frac{1}{2}$ AB × CD = $\frac{1}{2}$ cp.



Also, area of $\triangle ABC = \frac{1}{2}$ BC × AC = $\frac{1}{2}$ ab.

$\therefore \frac{1}{2}$ cp = $\frac{1}{2}$ ab. $\Rightarrow$ cp = ab

(ii) cp = ab $\Rightarrow$ p = $\frac{ab}{c}$

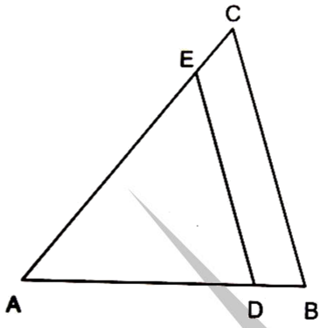
$\Rightarrow$ $p^2 = \frac{a^2b^2}{c^2}$

$\Rightarrow$ $\frac{1}{p^2} = \frac{c^2}{a^2b^2} = \frac{a^2+b^2}{a^2b^2}$ [$\because c^2 = a^2 + b^2$]

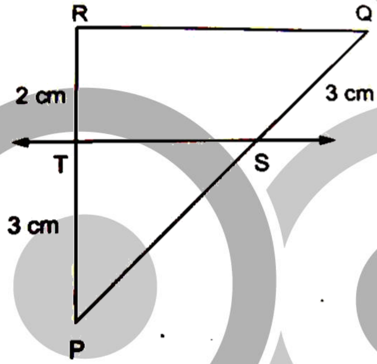
$\Rightarrow$ $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$.

EXERCISE – 1

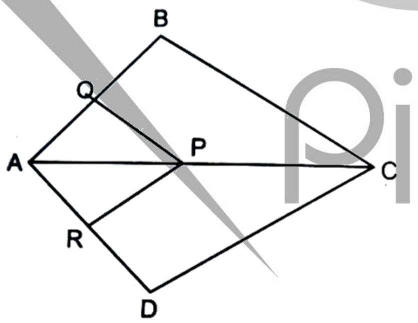
1. In fig. DE ||BC. If AD = x, DB = x – 2, AE = x + 2 and EC = x – 1, find the value of x.



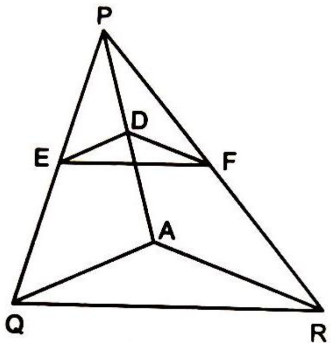
2. In fig., if ST||QR. Find PS.



3. In fig., if PQ||BC an PR||CD. Prove that (i) $\frac{AR}{AD}=\frac{AQ}{AB}$ (ii) $\frac{QB}{AQ}=\frac{DR}{AR}$



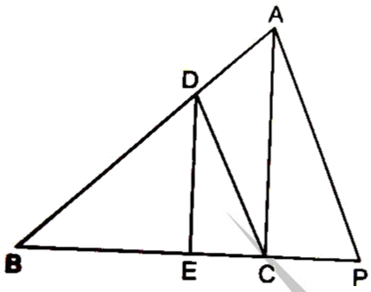
4. In fig., if DE ||AQ and DF||AR. Prove that EF||QR.



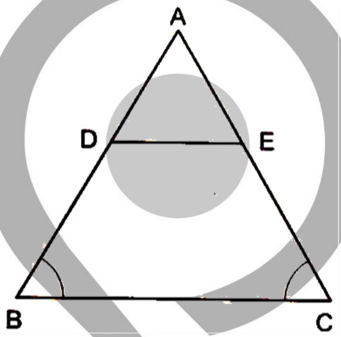
5. ABCD is a parallelogram, P is a point on side BC and DP when produced meets AB produced at L. Prove that

(i) $\frac{DP}{PL} = \frac{DC}{BL}$ (ii) $\frac{DP}{DP} = \frac{AL}{DC}$

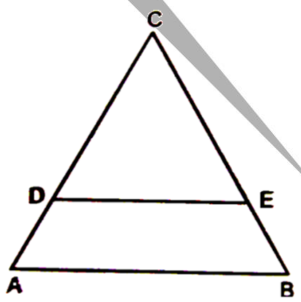
6. In fig, DE||BC and CD||EF. Prove that $AD^2 = AB \times AF$.



7. Two triangles ABC and DBC lie on the same side of the base BC. From a point P on BC, PQ||AB and PR||BD are drawn. They meet AC in Q and DC in R respectively. Prove that QR||AD
8. Let ABC be a triangle and D and E be two points on side AB such that AD = BE. If DP ||BC and EQ||AC, then prove that PQ ||AB.
9. In fig., ABC is a triangle in which AB = AC. Points D and E are points on the sides AB and AC respectively such that AD = AE. Show that the points B, C, E and D are concyclic.

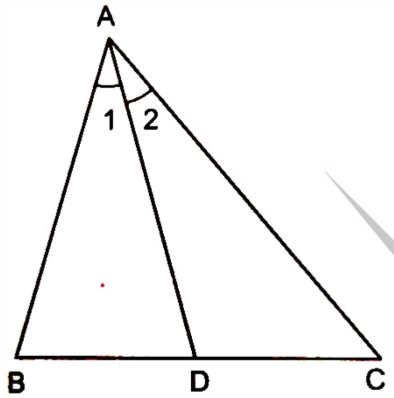


10. In fig., if $\frac{AD}{DC} = \frac{BE}{EC}$ *and* $\angle CDE = \angle CED$, prove that Δ CAB is isosceles.

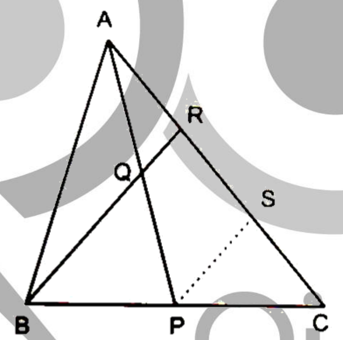


11. In three line segments OA, OB and OC, points L, M, N respectively are so chosen that LM||AB and MN||BC but neither of L, M, N nor of A, B, C are collinear. Show that LN||AC.
12. If D and E are points on sides AB and AC respectively of a ΔABC such that DE ||BC and BD = CE. Prove that ΔABC is isosceles.
13. If the bisector of an angle of a triangle bisects the opposite side, prove that the triangle is isosceles.
14. The bisector of interior $\angle$A of ΔABC meets BC in D, and the bisector of exterior $\angle$A meets BC produced in E. prove that $\frac{BD}{BE} = \frac{CD}{CE}$.
15. AD is a median of ΔABC. The bisector of $\angle$ADB and $\angle$ADC meet AB and AC in E and F respectively. Prove that EF ||BC.

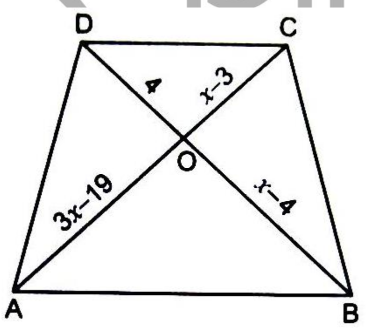
16. In a quadrilateral ABCD, if bisectors of the $\angle$ ABC and $\angle$ ADC meet on the diagonal AC, prove that the bisectors of $\angle$ BAD and $\angle$ BCD will meet on the diagonal BD.
17. In ΔABC (fig), if $\angle 1 = \angle 2$, prove that $\frac{AB}{AC} = \frac{BD}{DC}$.



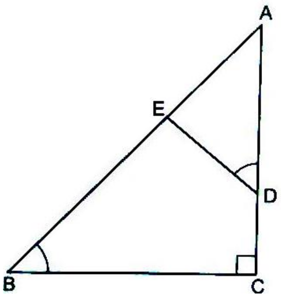
18. D, E and F are the points on sides BC, CA and AB respectively of ΔABC such that AD bisects $\angle$ A, BE bisects $\angle$ B and CF bisects $\angle$ C. if AB = 5 cm, BC = 8 cm and CA = 4 cm, determine AF, CE and BD.
19. In fig., P is the mid-point of BC and Q is the mid-point of AP. If BQ when produced meets AC at R, prove that RA $= \frac{1}{3}CA$.



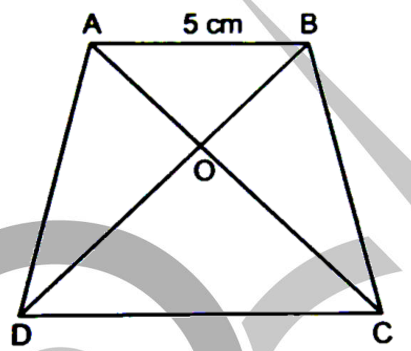
20. In fig., AB ||CD. If OA = 3x – 19, OB = x – 4, OC = x – 3 and OD = 4, find x.



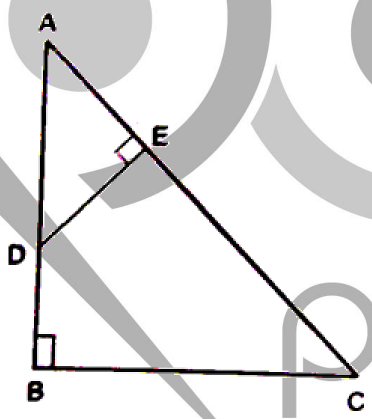
21. In fig., if $\angle$ ADE = $\angle$ B show that ΔADE ~ ΔABC. If AD = 3.8 cm, AE = 3.6 cm, BE = 2.1 cm and BC = 4.2 cm, find DE.



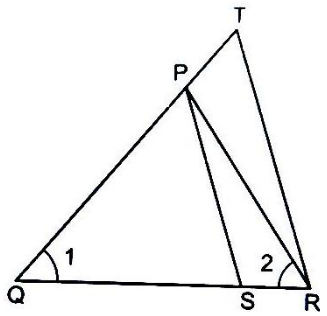
22. In fig., $\frac{AO}{OC}=\frac{BO}{OD}=\frac{1}{2}$ and AB = 5 cm. find the value of DC.



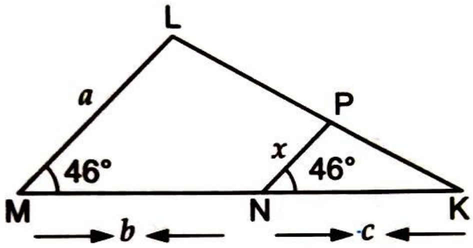
23. In fig., if AB $\perp$ BC and DE $\perp$ AC. Prove that ΔABC ~ ΔAED.



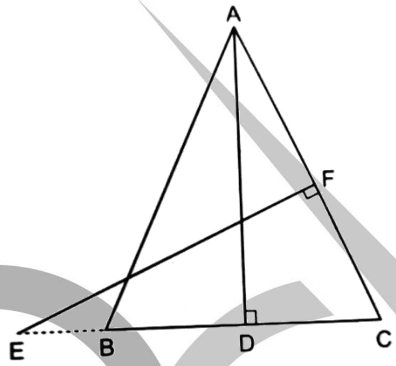
24. In fig., if $\frac{QT}{PR}=\frac{QR}{QS}$ and $\angle 1 = \angle 2$. Prove that ΔPQS ~ ΔTQR.



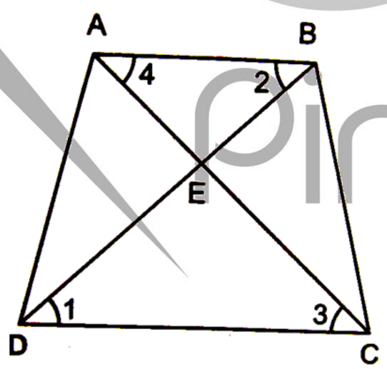
25. D is a point on the side BC of ΔABC such that $\angle$ADC = $\angle$BAC. Prove that $\frac{CA}{CD}=\frac{CB}{CA}$ or, $CA^2 = CB \times CD$.
26. P and Q are points on sides AB and AC respectively of ΔABC. If AP = 3cm. PB = 6 cm, AQ = 5 cm and QC = 10 cm, show that BC = 3 PQ.
27. In fig., express x terms of a, b and c.



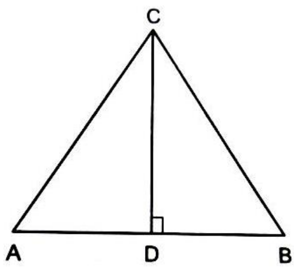
28. In fig., E is a point on side CB produced of an isosceles triangle ABC with AB = AC. If AD $\perp$ BC and EF $\perp$ AC. Prove that (i) ΔABD ~ ΔECF (ii) AB × EF = AD × EC.



29. Prove that the line segments joining the mid-points of the sides of a triangle form four triangles, each of which is similar to the original triangle.
30. In ΔABC, DE is parallel to base BC, with D on AB and E on AC. If $\frac{AD}{DB}=\frac{2}{3}$, find $\frac{BC}{DE}$.
31. A vertical stick 12 m long casts a shadow 8 m long on the ground. At the same time a tower casts the shadow 40 m long on the ground. Determine the height of the tower.
32. In fig., ABCD is a trapezium with AB||DC. If ΔAED is similar to ΔBEC. Prove that AD = BC.



33. Through the mid-point M of the side CD of a parallelogram ABCD, the line BM is drawn intersecting AC in L and AD produced in E. Prove that EL = 2 BL
34. In fig., $\angle$ ACB = 90^0 and CD $\perp$ AB. Prove that $\frac{CB^2}{CA^2}=\frac{BD}{AD}$.



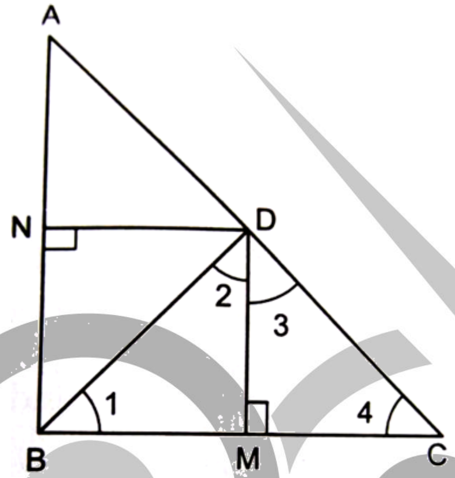
35. ABC is a triangle in which AB = AC and D is a point on AC such that $BC^2 = AC \times CD$.. prove that BD = BC.

36. In trapezium ABCD, AB ||DC and DC = 2 AB. EF drawn parallel to AB cuts AD in F and BC in E such that $\frac{BE}{EC} = \frac{3}{4}$.

Diagonal DB intersects EF at G. Prove that 7 FE = 10 AB.

37. In fig., ABC is a right triangle right angled at B and D is the foot of the perpendicular drawn from B on AC. If DM $\perp$ BC and DN $\perp$ AB, prove that

(i) $DM^2 = DN \times MC$ (ii) $DN^2 = DM \times AN$

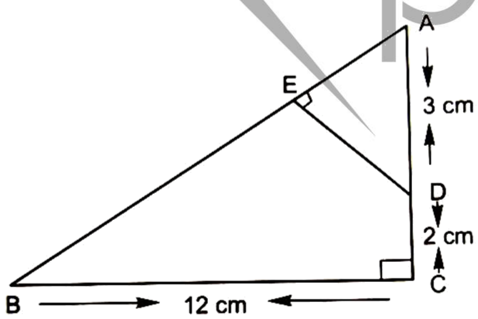


38. In a right angled triangle with sides a and b and hypotenuse c, the altitude drawn on the hypotenuse is x. Prove that ab = cx.

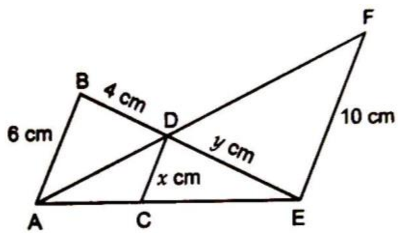
39. Diagonals AC and BD of a trapezium ABCD with AB ||DC intersect each other at the point O. using similarity criterion for two triangles, show that $\frac{OA}{OC} = \frac{OB}{OD}$.

40. A girl of height 90 cm is walking away from the base of a lamp-post at a speed of 1.2 m/sec. If the lamp is 3.6 m above the ground, find the length of her shadow after 4 seconds.

41. In fig., ΔABC is right angled at C and DE $\perp$ AB. Prove that ΔABC ~ ΔADE and hence find the lengths of AE and DE.

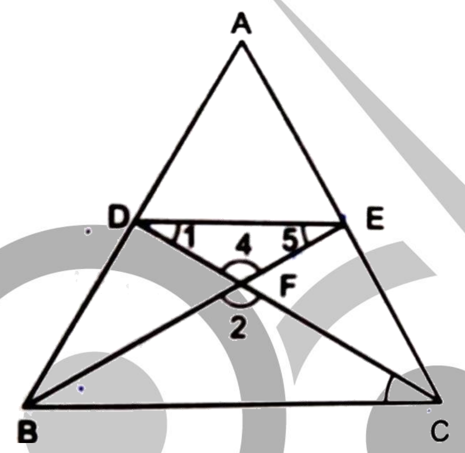


42. In fig., we have AB||CD||EF. If AB = 6 cm, CD = x cm, EF = 10 cm, BD = 4 cm and DE = y cm, calculate the values of x and y.

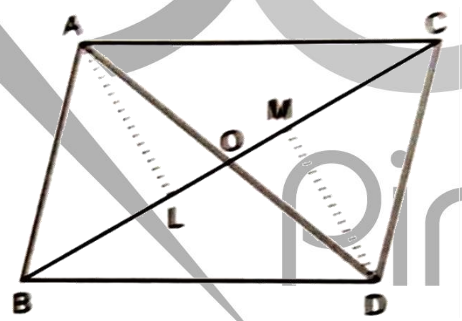


43. If ΔABC is similar to ΔDEF such that BC = 3 cm. EF = 4 cm and area of ΔABC = 54 cm. determine the area of ΔDEF.

44. Prove that the area of the equilateral triangle described on the side of a square is half the area of the equilateral triangle described on its diagonal.
45. Equilateral triangles are drawn on the sides of a right triangle. Show that the area of the triangle on the hypotenuse is equal to the sum of the area of triangles on the other two sides.
46. D and E are points on the sides AB and AC respectively of a ΔABC such that DE ||BC and divides ΔABC into two parts, equal in area, find $\frac{BD}{AB}$.
47. I fig., DE||BC and AD : DB = 5 : 4. Find $\frac{Area\ (\triangle DEF)}{Area\ (\triangle CFB)}$.



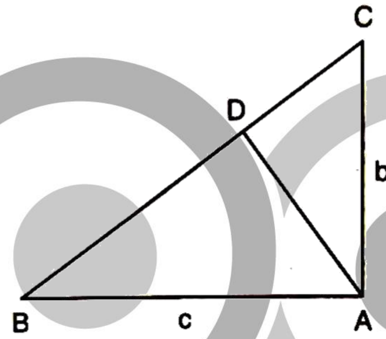
48. In fig., ΔABC and ΔDBC are on the same base BC. If AD and BC intersect at O, prove that $\frac{Area\ (\triangle ABC)}{Area\ (\triangle DBC)} = \frac{AO}{DO}$



49. AD is an altitude of an equilateral triangle ABC. On AD as base, another equilateral triangle ADE is constructed. Prove that Area (ΔADE): Area (ΔABC) = 3 : 4.
50. ABC is a right triangle right-angled at B. Let D and E be any points on AB and BC respectively. Prove that $AE^2 + CD^2 = AC^2 + DE^2$
51. Prove that three times the square of any sides of an equilateral-triangle is equal to four times the square of the altitude.
52. In an equilateral triangle with side a prove that

    (i) Altitude = $\frac{a\sqrt{3}}{2}$ (ii) Area = $\frac{\sqrt{3}}{4}a^2$
53. In an isosceles triangle ABC with AB = AC, BD is perpendicular from B to the side AC. Prove that $BD^2 - CD^2 = 2$ CD. AD
54. A point O in the interior of a rectangle ABCD is joined with each of the vertices A, B, C and D. Prove that $OB^2 + OD^2 = OC^2 + OA^2$
55. ABCD is a rhombus. Prove that $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$

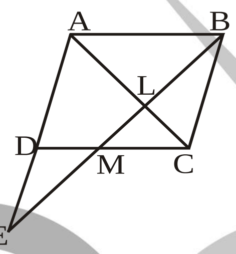
56. In an equilateral triangle ABC the side BC is trisected at D. Prove that 9 AD^2 = 7 AB^2
57. ABC is an isosceles triangle right-angled at B. similar triangles ACD and ABE are constructed or sides AC and AB. Find the ratio between the areas of ΔABE and ΔACD.
58. ABC is a right-angled triangle right angled at A. A circle is inscribed in it the lengths of the two sides containing the right angle are 6 cm and 8 cm. Find the radius of the circle.
59. In a ΔABC, the angles at B and C are acute. If BE and CF be drawn perpendiculars on AC and AB respectively. Prove that BC^2 = AB × BF + AC × CE.
60. If A be the area of a right triangle and B one of the sides containing the right angle. Prove that the length of the altitude on the hypotenuse is $\frac{2Ab}{\sqrt{b^4+4A^2}}$.
61. The foot of a ladder is 6 m away from a wall and its top reaches a window 8 m above the ground. If the ladder is shifted in such a way that its foot is 8 m away from the wall, to what height does its tip reach?
62. Using Pythagoras theorem determine the length of AD in terms of b and c shown in fig.,



63. The lengths of the diagonals of a rhombus are 24 cm and 10 cm. Find each side of the rhombus.
64. In an acute-angled triangle, express a median in terms of its sides.
65. In ΔABC, $\angle$A is obtuse, PB $\perp$ AC and QC $\perp$ AB. Prove that:
    (i) AB × AQ = AC × AP (ii) BC^2 = (AC × CP + AB × BQ)
66. In a right ΔABC right-angled at C, if D is the mid-point of BC, prove that BC^2 = 4 (AD^2 – AC^2).

EXERCISE – 2

1. P and Q are points on the sides CA and CB respectively of a DABC right-angled at C. Prove that $AQ^2 + BP^2 = AB^2 + PQ^2$.
2. ABC is a right triangle, right angled at B. AD and CE are the two medians drawn from A and C respectively. If AC = 5 cm and AD = $\frac{3\sqrt{5}}{2}$ cm, find the length of CE.
3. In ΔABC, if AD is the median, show that $AB^2 + AC^2 = 2\,[AD^2 + BD^2]$.
4. In the given figure, M is the mid-point of the side CD of parallelogram ABCD. BM, when joined meets AC in L and AD produced in E. Prove that EL = 2BL.



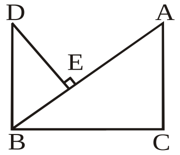
5. ABC is a right triangle, right-angled at C. If p is the length of the perpendicular from C to AB and a, b, c have the usual meaning, then prove that (i) pc = ab (ii) $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$
6. In an equilateral triangle PQR, the side QR is trisected at S. Prove that $9PS^2 = 7PQ^2$.
7. If the diagonals of a quadrilateral divide each other proportionally, prove that it is trapezium.
8. In an isosceles triangle ABC with AB = AC, BD is a perpendicular from B to the side AC. Prove that $BD^2 - CD^2 = 2CD.\ AD$.
9. ABC and DBC are two triangles on the same base BC. If AD intersect BC at O. Prove that $\frac{ar.\Delta ABC}{ar.\Delta DBC} = \frac{AO}{DO}$
10. In ΔABC, $\angle$A is acute. BD and CE are perpendiculars on AC and AB respectively. Prove that AB × AE = AC × AD.
11. Points P and Q are on sides AB and AC of a triangle ABC in such a way that PQ is parallel to side BC. Prove that the median AD drawn from vertex A to side BC bisects the segment PQ.
12. If the diagonals of a quadrilateral divide each other proportionally, prove that it is a trapezium.

    OR

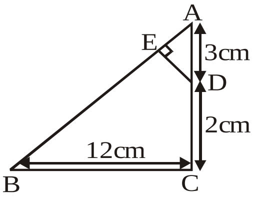
    Two Δs' ABC and DBC are on the same base BC and on the same side of BC in which $\angle A = \angle D = 90°$. If CA and BD meet each other at E, show that AE.EC = BE.ED.
13. D and E are points on the sides CA and CB respectively of ΔABC right-angled at C. Prove that $AE^2 + BD^2 = AB^2 + DE^2$.

    OR

    In fig. DB $\perp$ BC, DE $\perp$ AB and AC $\perp$ BC. Prove that $\frac{BE}{DE} = \frac{AC}{BC}$.

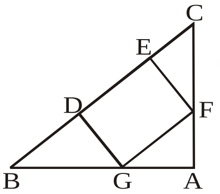


14. E is a point on the side AD produced of a $||^{gm}$ ABCD and BE intersects CD at F. Show that ΔABE ~ ΔCFB.
15. In fig, ΔABC is right angled at C and DE ^ AB. Prove that ΔABC ~ ΔADE and hence find the lengths of AE and DE.

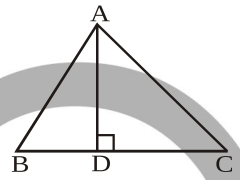


OR

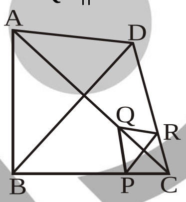
In fig, DEFG is a square and $\angle BAC = 90°$. Show that $DE^2 = BD \times EC$



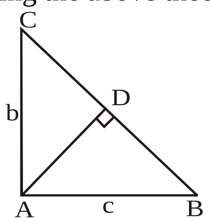
16. In fig, $AD \perp BC$ and $BD = \frac{1}{3}CD$. Prove that $2CA^2 = 2AB^2 + BC^2$.



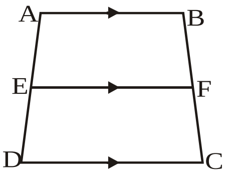
17. In fig, two triangles ABC and DBC lie on the same side of base BC. P is a point on BC such that PQ||BA and PR||BD. Prove that QR||AD.



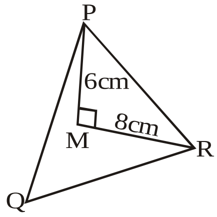
18. In a right triangle ABC, right-angled at C, P and Q are points on the sides CA and CB respectively which divide these sides in the ratio 1 : 2. Prove that
    (i) $9AQ^2 = 9AC^2 + 4BC^2$
    (ii) $9BP^2 = 9BC^2 + 4AC^2$
    (iii) $9(AQ^2 + BP^2) = 13AB^2$.
19. The ratio of the areas of similar triangles is equal to the ratio of the squares on the corresponding sides, prove. Using the above theorem, prove that the area of the equilateral triangle described on the side of a square is half the area of the equilateral triangle described on its diagonal.
20. Perpendiculars OD, OE and OF are drawn to sides BC, CA and AB respectively from a point O in the interior of a ΔABC. Prove that :
    (i) $AF^2 + BD^2 + CE^2 = OA^2 + OB^2 + OC^2 - OD^2 - OE^2 - OF^2$.
    (ii) $AF^2 + BD^2 + CE^2 = AE^2 + CD^2 + BF^2$.
21. In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares on the other two sides, prove. Using the above theorem, determine the length of AD in terms of b and C.



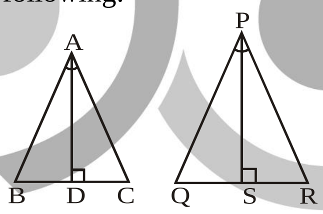
22. If a line is drawn parallel to one side of a triangle, the other two sides are divided in the same ratio, prove. Use this result to prove the following: In the given figure, if ABCD is a trapezium in which AB || DC || EF, then $\frac{AE}{ED} = \frac{BF}{FC}$.



23. State and prove pythagoras theorem. Use the theorem and calculate area (ΔPMR) from the given figure.

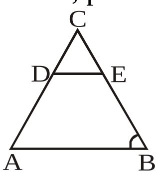


24. In a right-angled triangle, the square of hypotenuse is equal to the sum of the squares of the two sides. Given that $\angle$B of ΔABC is an acute angle and AD $\perp$ BC. Prove that $AC^2 = AB^2 + BC^2 - 2BC \cdot BD$.
25. In a right triangle, prove that the square on the hypotenuse is equal to the sum of the squares on the other two sides. Using above, solve the following : In quadrilateral ABCD, find the length of CA, if CD $\perp$ DB, AB $\perp$ DB, CD = 6 m, DB = 12 m and AB = 11 m.
26. Prove that the ratio of the areas of two similar triangles is equal to the squares of their corresponding sides. Using the above, do the following:



In fig. ΔABC and ΔPQR are isosceles triangles in which $\angle A = \angle P$. If $\frac{area\ (\Delta ABC)}{area\ (\Delta PQR)} = \frac{9}{16}$, find $\frac{AD}{PS}$.

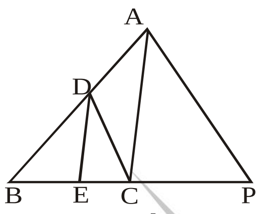
27. In a right-angled triangle, prove that the square on the hypotenuse is equal to the sum of the squares on the other two sides. Using the above result, find the length of the second diagonal of a rhombus whose side is 5 cm and one of the diagonals is 6 cm.
28. In a triangle, if the square on one side is equal to the sum of the squares on the other two sides prove that the angle opposite the first side is a right angle.
Use the above theorem and prove that following: In triangle ABC, AD $\perp$ BC and BD = 3CD. Prove that $2AB^2 = 2AC^2 + BC^2$.
29. In a right triangle, prove that the square on hypotenuse is equal to sum of the squares on the other two sides.
Using the above result, prove the following: PQR is a right triangle, right angled at Q. If S bisects QR, show that $PR^2 = 4\,PS^2 - 3\,PQ^2$.
30. If a line is drawn parallel to one side of a trial prove that the other two sides are divided in the same ratio. Using the above result, prove from fig. that AD = BE if $\angle A = \angle B$ and DE || AB.



31. Prove that the ratio of areas of two similar triangles is equal to the ratio of squares of their corresponding sides. Apply the above theorem on the following: ABC is a triangle and PQ is a straight line meeting AB in P

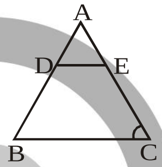
and AC in Q. If AP = 1 cm, PB = 3 cm, AQ = 1.5 cm, QC = 4.5 cm, prove that area of ΔAPQ is one-sixteenth of the area of ΔABC.

32. If a line is drawn parallel to one side of a triangle, prove that the other two sides are divided in the same ratio. Use the above to prove the following : In the given figure DE || AC and DC || AP. Prove that $\frac{BE}{EC} = \frac{BC}{CP}$.



33. In a triangle if the square on one side is equal to the sum of squares on the other two sides, prove that the angle opposite to the first side is a right angle. Use the above theorem to prove the following :
In a quadrilateral ABCD, $\angle B = 90°$. If $AD^2 = AB^2 + BC^2 + CD^2$, prove that $\angle ACD = 90°$.

34. If a line is drawn parallel to one side of a triangle, to intersect the other two sides in distinct points, prove that the other two sides are divided in the same ratio. Using the above, prove the following : In figure, DE || BC and BD = CE. Prove that ABC is an isosceles triangle.

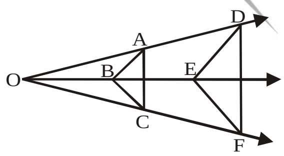


35. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides. Use the above for the following : If the areas of two similar triangles are equal, prove that they are congruent.

36. Prove that the ratio of the areas of two similar triangles is equal to the ratio of squares of their corresponding sides. Using the above result, prove the following :
In a ΔABC, XY is parallel to BC and it divides ΔABC into two parts of equal area. Prove that $\frac{BX}{AB} = \frac{\sqrt{2}-1}{\sqrt{2}}$

37. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares on their corresponding sides. Using the above, do the following:
The diagonals of a trapezium ABCD, with AB||DC, intersect each other at the point O. If AB = 2 CD, find the ratio of the area of ΔAOB to the area of ΔCOD.

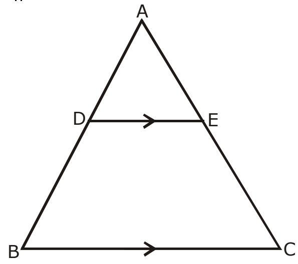
38. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, prove that the other two sides are divided in the same ratio. Using the above, prove the following :
In the fig, AB||DE and BC||EF. Prove that AC||DF.



39. Prove that the ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides. Using the above, do the following: In a trapezium ABCD, AC and BD are intersecting at O, AB||DC and AB = 2 CD. If area of $\Delta AOB = 84 \text{ cm}^2$, find the area of ΔCOD.

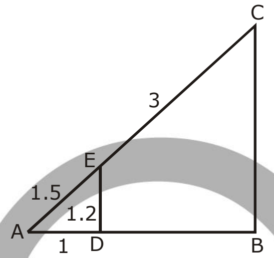
EXERCISE – 3

1. In ΔABC, $DE \parallel BC$, $AD = 2.4$cm, $AE = 3.2$ cm, and $EC = 4.8$ cm. The length of AB is:



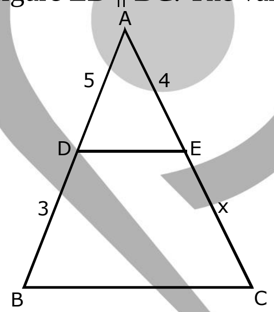
(a) 3.6 cm (b) 6cm (c) 6.4cm (d) 1.6cm

2. If $\Delta ADE \sim \Delta ABC$, then BC = ?



(a) 4.5 (b) 3 (c) 3.6 (d) 2.4

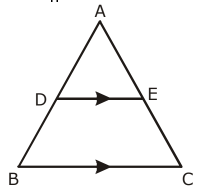
3. In the given figure $ED \parallel BC$. The value of x is:



(a) 2.8 (b) 2.5 (c) 2.4 (d) 4

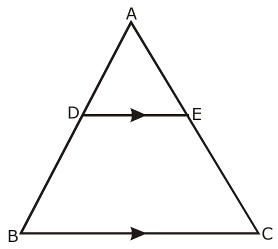
4. The line segments joining the midpoints of the sides of a triangle form four triangles, each of which is
   (a) congruent to the original triangle
   (b) similar to the original triangle
   (c) an isosceles triangle
   (d) an equilateral triangle

5. In the ΔABC $DE \parallel BC$, $AD = 1.7$ cm, $AB = 6.8$ cm and $AC = 9$ cm. The length of AE is



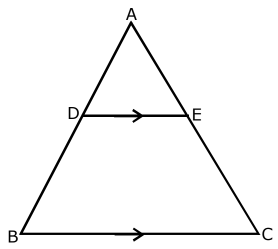
(a) 2.5 cm (b) 4.5 cm (c) 2.2 cm (d) 7.3 cm

6. In the ΔABC, $DE \parallel BC$, $AD = (7x - 4)$ cm, $AE = (5x - 2)$ cm, $DB = (3x + 4)$ cm, and $EC = 3x$ cm. The value of x is:?



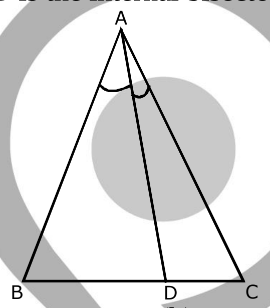
(a) 3 (b) 5 (c) 4 (d) 2.5

7. In the ΔABC, DE || BC and $\frac{AD}{DB} = \frac{3}{5}$. If AC = 5.6 cm, then the length of AE is :



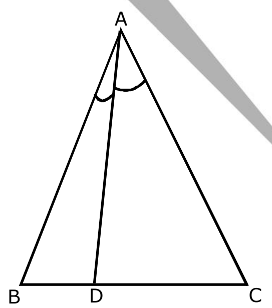
(a) 4.2 cm (b) 3.1cm (c) 2.1 cm (d) 2.8 cm

8. In ΔABC, AD is the internal bisector of $\angle A$. If BD = 5 cm, BC= 7.5 cm, then AB : AC is equal to :



(a) 2 : 1 (b) 1 : 2 (c) 4 : 5 (d) 3 : 5

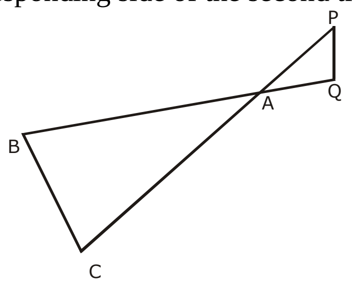
9. In the ΔABC, AD is the internal bisector of $\angle A$. If BD = 4 cm, DC= 5 cm and AB = 6 cm, then the length of AC = ?



(a) 3 cm (b) 8 cm (c) 4.5 cm (d)7.5 cm

10. In a right triangle PQR, $PR^2 + PQ^2 = QR^2$. Which angle is equal to 90°?
(a) $\angle P$ (b) $\angle Q$ (c) $\angle R$ (d) none of these

11. The perimeter of two similar triangles are 25 cm and 15 cm respectively. If one side of the first triangle is 9cm, then the corresponding side of the second triangle is:

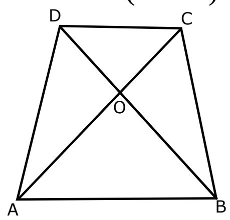


(a) 4.5 cm (b) 5cm (c) 3.5cm (d) 5.4 cm

12. In the given figure, $\Delta ACB \sim \Delta APQ$. If BC = 8 cm, PQ = 4 cm, BA = 6.5 cm and AP = 2.8 cm, then the length of AQ is:
(a) 3.25 cm (b) 4cm (c) 4.25cm (d) 3 cm

13. The areas of two similar triangles are 169 cm^2 and 121 cm^2 respectively. If the longest side of the larger triangle is 26 cm, the longest side of the smaller triangle is
(a) 21 cm (b) 22cm (c) 24 cm (d) 20 cm

14. In the given figure, AB || DC and diagonals AC and BD intersect at O. If AO = (3x –1) cm, BO = (2x +1) cm, OC = (5x –3) cm and OD = (6x – 5) cm, then the value of x is :



(a) 2 (b) 3 (c) 2.5 (d) 4

15. $\Delta ABC \sim \Delta DEF$ and the perimeters of ΔABC and ΔDEF are 30 cm and 18 cm respectively. If BC = 9 cm, then EF is equal to:
(a) 6.3 (b) 5.4 (c) 7.2 (d) 4.5

16. $\Delta ABC \sim \Delta DEF$ such that AB = 9.1 cm and DE = 6.5 cm. If the perimeter of ΔDEF is 25 cm, then the perimeter of ΔABC is :
(a) 35 cm (b) 28 cm (c) 42 cm (d) 40 cm

17. If D is a point on the side AB of ΔABC such that AD : DB = 3 : 2 and E is a point on BC such that DE || AC. The ratio of areas of ΔABC and ΔBDE is
(a) 4 : 25 (b) 25 : 4 (c) 5 : 4 (d) 4 : 5

18. In an equilateral triangle ABC, if AD $\perp$ BC, then:
(a) $2AB^2 = 3AD^2$ (b) $4AB^2 = 3AD^2$ (c) $3AB^2 = 4AD^2$ (d) $3AB^2 = 2AD^2$

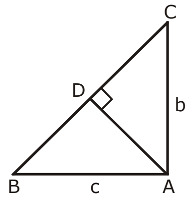
19. The line segments joining the mid points of the adjacent sides of a quadrilateral form a:
(a) Paralle logram (b) square (c) rhombus (d) rectangle

20. If the diagonals of a quadrilateral divide each other proportionally, then it is a:
(a) Paralle logram (b) trapezium (c) rectangle (d) square

21. A right triangle has hypotenuse of length p cm and one side of length q cm. If p – q = 1, then the length of the third side of the triangle is :
(a) $\sqrt{2q+1}$ (b) $\sqrt{2p+1}$ (c) 2p (d) 1 + q

22. ABC is an isosceles triangle with AC = BC. If $AB^2 = 2AC^2$, then ΔABC is right angled at:
(a) $\angle A$ (b) $\angle B$ (c) $\angle C$ (d) none of these

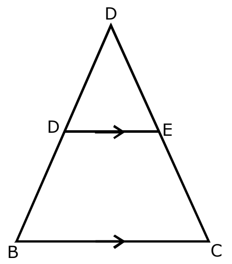
23. In the figure, DABC is a right triangle, right angled at A and AD $\perp$ BC. If AB = c and AC = b, then AD is equal to:



(a) $\frac{bc}{\sqrt{b^2+c^2}}$ (b) $\frac{bc}{b^2+c^2}$ (c) $\frac{b^2c}{\sqrt{b^2+c^2}}$ (d) none of these

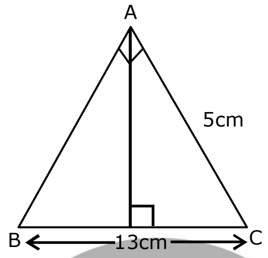
24. A triangle has sides 5cm, 12 cm and 13 cm. The length of the perpendicular from the opposite vertex to the side whose length is 13 cm is:
(a) 4.9 (b) 3.6 cm (c) 5.5 cm (d) 4.6 cm

25. In the given figure, DE || BC. If DE= 3 cm, BC = 6 cm and ar (ΔADE) = 15 cm^2. Area of ΔABC is:



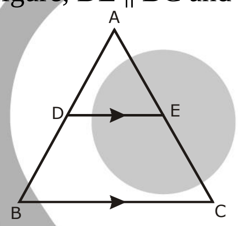
(a) 30 cm^2 (b) 60 cm^2 (c) 40 cm^2 (d) 50 cm^2

26. ΔABC is right angled at A and AD $\perp$ BC. If BC = 13 cm and AC = 5 cm, the ratio of the areas of ΔABC and ΔADC is :



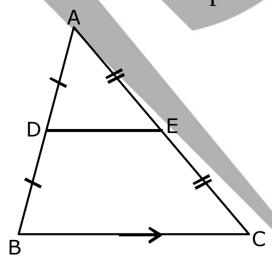
(a) 25 : 169 (b) 169 : 25 (c) 5 : 13 (d) 13 : 5

27. In the given figure, DE || BC and DE : BC = 3 : 5. The ratio of the areas of ΔADE and the trapezium BCED is :



(a) 9 : 16 (b) 16 : 9 (c) 3 : 5 (d) 5 : 3

28. In ΔABC, D and E are the mid points of AB and AC respectively. The ratio of the areas of ΔADE and ΔABC is:

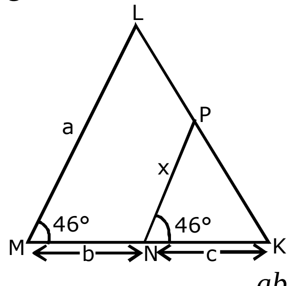


(a) 1 : 2 (b) 2 : 1 (c) 1 : 4 (d) 4 : 1

29. In a trapezium ABCD, O is the point of intersection of AC and BD, AB || CD and AB = 2 × CD. If the area of ΔAOB = 84 cm^2, then the area of ΔCOD is :

(a) 25 cm^2 (b) 21 cm^2 (c) 24 cm^2 (d) 32 cm^2

30. In the given figure, x in terms of a,b and c is :



(a) $x = \dfrac{ac}{b+c}$ (b) $x = \dfrac{ab}{b+c}$ (c) $x = \dfrac{ac}{a+b}$ (d) $x = \dfrac{bc}{a+c}$

31. Two poles of heights 6 m and 11 m stand on a plane ground. If the distance between their feet is 12 m, the distance between their tops is

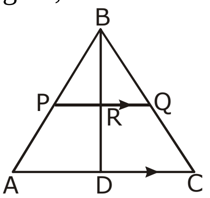
(a) 12 m (b) 13 m (c) 15 m (d) 11 m

32. Two isosceles triangles have their corresponding angles equal and their areas are in the ratio 25 : 36. The ratio of their corresponding height is
(a) 25 : 36 (b) 36 : 25 (c) 5 : 6 (d) 6 : 5

33. A vertical stick 20 m long casts a shadow 10 m long on the ground. At the same time , a tower casts a shadow 50 m long on the ground. The height of the tower is:
(a) 100 m (b) 120 m (c) 25 m (d) 200 m

34. The length of altitude AD of an isosceles ΔABC, in which AB = AC = 2a units and BC = a units, is :
(a) $\frac{a\sqrt{15}}{4}$ (b) $\frac{a\sqrt{15}}{2}$ (c) $\frac{\sqrt{15a}}{4}$ (d) none of these

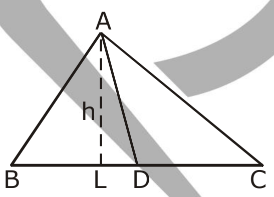
35. In the given figure, if BD is the bisector of $\angle B$, PQ $\parallel$ AC, then :



(a) PR × QR = BQ × BP
(b) PR × BQ = QR × BP
(c) both (a) and (b)
(d) None of these

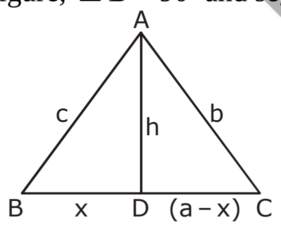
36. $\Delta ABC \sim \Delta DEF$ such that ar(ΔABC) = 36 cm^2 and ar(ΔDEF) = 49 cm^2. Then, the ratio of their corresponding sides is
(a) 36 : 49 (b) 6 : 7 (c) 7 : 6 (d) $\sqrt{6} : \sqrt{7}$

37. In ΔABC, if AD is the bisector of ÐA, then $\frac{ar\,(\Delta ABD)}{ar\,(\Delta ADC)}$ is equal to



(a) $\frac{BD}{DC}$ (b) $\frac{AB}{AC}$ (c) both A and B (d) none of these

38. In the given figure, $\angle B < 90^o$ and segment AD $\perp$ BC, then :



(a) $b^2 = h^2 + a^2 + x^2 - 2ax$
(b) $b^2 = h^2 - a^2 - x^2 + 2ax$
(c) $b^2 = h^2 + a^2$
(d) none of these

39. If ABC is an isosceles triangle and D is a point on BC such that AD $\perp$ BC, then :
(a) $AB^2 - AD^2 = BD \cdot DC$
(b) $AB^2 - AD^2 = BD^2 - DC^2$
(c) $AB^2 + AD^2 = BD \cdot DC$
(d) $AB^2 + AD^2 = BD^2 \cdot DC^2$

40. ΔABC is a right angle right-angled at A and AD $\perp$ BC. Then is equal to :

(a) $\left(\frac{AB}{DC}\right)^2$ (b) $\frac{AB}{AC}$ (c) $\left(\frac{AB}{AD}\right)^2$ (d) $\frac{AB}{AD}$

41. If each side of a rhombus is 10 cm and one of its diagonals is 16 cm, then the length of the other diagonal is :
(a) 16 cm (b) 14 cm (c) 12 cm (d) 10 cm

42. D, E and F are the mid-points of side AB, BC and CA respectively of ΔABC. The ratio of the areas of ΔDEF and ΔABC is :
(a) 1 : 2 (b) 4 : 1 (c) 3 : 4 (d) 1 : 4

43. An aeroplane leaves an airport and flies due north at a speed of 1000 km/h. At the same time, another aeroplane leaves the same airport and flies due west at a speed of 1200 km/h. After $1\frac{1}{2}$ hours, the distance between the two planes is :
(a) $300\sqrt{61}$ km (b) $61\sqrt{300}$ km (c) $\sqrt{36100}$ km (d) $30\sqrt{61}$ km

44. ABC is a right triangle, right angled at C. If p is the length of the perpendicular from C to AB, AB = c, BC = a and AC = b, then :
(a) $\frac{1}{a^2}=\frac{1}{b^2}-\frac{1}{p^2}$ (b) $\frac{1}{p^2}=\frac{1}{a^2}-\frac{1}{b^2}$ (c) $\frac{1}{b^2}=\frac{1}{p^2}+\frac{1}{a^2}$ (d) $\frac{1}{p^2}=\frac{1}{a^2}+\frac{1}{b^2}$

45. A vertical pole 5m long casts a shadow 2m long on the ground. At the same time, a tower casts a shadow 25m long on the ground. The height of the tower is
(a) 12.5 m (b) 50 m (c) 100 m (d) 75 m

46. A vertical stick 1.2m long casts a shadow 40cm long on the ground. At the same time a pole 6m high casts a shadow x on the ground. the value of x is
(a) 3m (b) 12m (c) 2m (d) 18m

47. Two poles 6m and 11m high stand vertically on the ground. If the distance between their feet is 12m, then the distance between their tops is
(a) 11m (b) 14m (c) 12m (d) 13m

48. ΔABC and ΔDEF, are two similar triangles such that $\angle A = 36^\circ$ and $\angle E = 74^\circ$, then $\angle C$ is
(a) 70º (b) 50º (c) 60º (d) 80º

49. Corresponding sides of two similar triangles are in the ratio of 5 : 7. Areas of these triangles are in the ratio of
(a) $\sqrt{5}:\sqrt{7}$ (b) 7 : 5 (c) 25 : 49 (d) 49 : 25

50. The area of two similar triangles are 25 sq cm and 121 sq cm. The ratio of their corresponding sides is
(a) 5 : 11 (b) 11 : 5 (c) $\sqrt{5}:\sqrt{11}$ (d) $\sqrt{11}:\sqrt{5}$

51. In ΔABC, AB = 2cm, BC = 3cm and AC = 2.5cm If $\Delta DEF \sim \Delta ABC$ and EF = 6cm, then perimeter of ΔDEF is
(a) 7.5 cm (b) 15cm (c) 22.5cm (d) 30cm

52. In ΔABC, and ΔDEF, $\frac{AB}{DE}=\frac{AC}{DF}=\frac{BC}{EF}=\frac{3}{4}$, then area ($\Delta ABC$) : Area ($\Delta DEF$) is equal to
(a) 3 : 4 (b) 16 : 9 (c) 9 : 16 (d) 27 : 64

53. DE is drawn parallel to base BC of ΔABC meeting AB at D and AC at E. If $\frac{AB}{BD}=4$ and CE = 2cm, then AE is equal to
(a) 2cm (b) 4cm (c) 6cm (d) 8cm

54. In ΔPQR, G and H are points on PQ and PR respectively such that GH || QR and PG : GQ = 3 : 1. If PH = 3.3 cm then PR is equal to
(a) 1.1 cm (b) 4cm (c) 5.5 cm (d) 4.4 cm

55. ΔABC and ΔBDE are two equilateral triangles such that D is mid-point of BC. The ratio of areas of triangles ABC and BDE is
(a) 4 : 1 (b) 2 : 1 (c) 1 : 2 (d) 1 : 4

56. In a ΔABC, D and E are points on sides AB and AC respectively such that BCED is a trapezium. If $\frac{DE}{BC}=\frac{3}{5}$, then $\frac{\text{Area }(\Delta ADE)}{\text{Area (Trap.BCED)}}$ is equal to

(a) $\frac{3}{4}$ (b) $\frac{9}{16}$ (c) $\frac{3}{5}$ (d) $\frac{9}{25}$

57. Two isosceles triangles have equal angles and their areas are as 16 : 25. The ratio of their corresponding heights is
(a) 3 : 2 (b) 5 : 4 (c) 5 : 7 (d) 4 : 5

58. ABCD is a trapezium in which BC || AD. If AB = 4cm and the diagonals AC and BD intersect at O such that $\frac{AO}{OC}=\frac{DO}{OB}=\frac{1}{2}$, then BC is equal to
(a) 7 cm (b) 8 cm (c) 6 cm (d) 9 cm

59. In a ΔABC, $\angle A = 90^o$, AB = 5cm and AC = 12cm. If AD $\perp$ BC, then AD is equal to
(a) $\frac{13}{2}cm$ (b) $\frac{13}{60}cm$ (c) $\frac{60}{13}cm$ (d) $\frac{2\sqrt{15}}{13}cm$

60. A man goes 24 m due west and then 10 m due north. How far is the from the starting point?
(a) 34 m (b) 17 m (c) 26 m (d) 28 m

61. A man goes 12 m due south and then 35 m due west. How far is he from the starting point?
(a) 47 m (b) 23.5 m (c) 23 m (d) 37 m

62. Two poles of height 13 m and 7 m respectively stand vertically on a plane ground at a distance of 8 m from each other. The distance between their tops is
(a) 9 m (b) 10 m (c) 11 m (d) 12 m

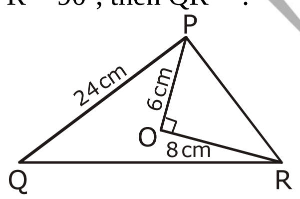
63. A vertical stick 1.8 m long casts a shadow 45 cm long on the ground. At the same time, what is the length of the shadow of a pole 6 m high?
(a) 2.4 m (b) 1.35 m (c) 1.5 m (d)13.5 m

64. A vertical pole 6 m long casts a shadow of length 3.6 m on the ground. What is the height of a tower which casts a shadow of length 18m at the same time?
(a) 10.8 m (b) 28.8 m (c) 32.4 m (d) 30 m

65. A ladder 25 m long just reaches the top of building 24 m high from the ground. What is the distance of the foot of the ladder from the building?
(a) 7 m (b) 14 m (c) 21 m (d)24.5 m

66. A ladder 15 m long reaches a window which 9 m above the ground on one side of the street. Keeping its foot at the same point, the ladder is turned to the other side of the street to reach a window 12 m high. The width of the street is
(a) 27 m (b) 21 m (c) 24 m (d) 18 m

67. In the given figure, O is a point inside a ΔPQR such that $\angle PQR = 90^o$. OP = 6 cm and OR = 8 cm. If PQ = 24 cm and $\angle QPR = 90^o$, then QR = ?



(a) 28 cm (b) 25 cm (c) 26 cm (d) 32 cm

68. The hypotenuse of a right triangle is 25 cm. The other two sides are such that one is 5 cm longer than the other. The length of these sides are
(a) 10 cm, 15 cm (b) 15 cm, 20 cm (c) 12 cm, 17 cm (d) 13 cm, 18 cm

69. The height of an equilateral triangle having each side 12 cm, is
(a) $6\sqrt{2}$ cm (b) $6\sqrt{3}$ cm (c) $3\sqrt{6}$ cm (d) $6\sqrt{6}$ cm

70. ΔABC is an isosceles triangle with AB = AC = 13 cm and the length of altitude from A on BC is 5 cm. Then, BC = ?
(a) 12 cm (b) 16 cm (c) 18 cm (d) 24 cm

71. The measures of three angles of a triangle are in the ratio 1 : 2 : 3. Then, the triangle is
(a) right-angled (b) equilateral (c) isosceles (d) obtuse-angled

72. For a ΔABC, which is true?

(a) AB – AC = BC (b) (AB – AC) > BC (c) (AB – AC) < BC (d) None of these

73. In a triangle, the perpendicular from the vertex to the base bisect the base. The triangle is
(a) right-angled (b) isosceles (c) scalene (d) obtuse-angled

74. In a rhombus of side 10 cm, one of the diagonals is 12 cm long. The length of the second diagonal is
(a) 20 cm (b) 18 cm (c) 16 cm (d) 22 cm

75. The length of the diagonals of a rhombus are 24 cm and 10 cm. The length of each side of the rhombus is
(a) 12 cm (b) 13 cm (c) 14 cm (d) 17 cm

76. If the diagonals of a quadrilateral divide each other proportionally, then it is a
(a) parallelogram (b) trapezium (c) rectangle (d) square

77. The line segment joining the midpoints of the adjacent sides of a quadrilateral form
(a) a parallelogram (b) a rectangle (c) a square (d) rhombus

78. If the bisector of an angle of a triangle bisects the opposite side, then the triangle is
(a) scalene (b) equilateral (c) isosceles (d) right-angled

79. In ΔABC, it is given that AB = 9 cm, BC = 6 cm and CA = 7.5 cm. Also, ΔDEF is given such that EF = 8 cm and $\Delta DEF \sim \Delta ABC$. Then, perimeter of ΔDEF is
(a) 22.5 cm (b) 25 cm (c) 27 cm (d) 30 cm

80. It is given that $\Delta ABC \sim \Delta DEF$. If $\angle A = 30^o$. $\angle C = 50^o$, AB = 5 cm, AC = 8 cm and DF = 7.5 cm, then which of the following is ture?
(a) DE = 12 cm, $\angle F = 50^o$
(b) DE = 12 cm, $\angle F = 100^o$
(c) EF = 12 cm, $\angle D = 100^o$
(d) EF = 12 cm, $\angle D = 30^o$

81. In ΔABC and ΔDEF, it is given that $\frac{AB}{DE} = \frac{BC}{FD}$, then
(a) $\angle B = \angle E$ (b) $\angle A = \angle D$ (c) $\angle B = \angle D$ (d) $\angle A = \angle F$

82. In $\angle DEF$ and ΔPQR, it is given that $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true?
(a) $\frac{EF}{PR} = \frac{DF}{PQ}$ (b) $\frac{DE}{PQ} = \frac{EF}{RP}$ (c) $\frac{DE}{QR} = \frac{DF}{PQ}$ (d) $\frac{EF}{RP} = \frac{DE}{QE}$

83. In ΔABC and ΔDEF, it is given that $\angle B = \angle E$, $\angle F = \angle C$ and AB = 3DE, then the two triangles are
(a) congruent but not similar
(b) similar but not congrunet
(c) neither congruent nor similar
(d) similar as well as congruent

84. If in ΔABC and ΔPQR, we have: $\frac{AB}{QR} = \frac{BC}{PR} = \frac{CA}{PQ}$, then
(a) $\Delta PQR \sim \Delta CAB$ (b) $\Delta PQR \sim \Delta ABC$ (c) $\Delta CBA \sim \Delta PQR$ (d) $\Delta BCA \sim \Delta PQR$

85. It is given that $\Delta ABC \sim \Delta DEF$ and the corresponding sides of these triangles are in the ratio 3 : 5. Then ar(ΔABC) : ar(ΔDEF) =
(a) 3 : 5 (b) 5 : 3 (c) 9 : 25 (d) 25 : 9

86. It is given that $\Delta ABC \sim \Delta PQR$ and $\frac{BC}{QR} = \frac{2}{3}$, then $\frac{ar(\Delta PQR)}{ar(\Delta ABC)}$ = ?
(a) $\frac{2}{3}$ (b) $\frac{3}{2}$ (c) $\frac{4}{9}$ (d) $\frac{9}{4}$

87. In ΔABC and ΔDEF, we have $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = \frac{5}{7}$, then ($\Delta ABC$) : ar($\Delta DEF$) = ?
(a) 5 : 7 (b) 25 : 49 (c) 49 : 25 (d) 125 : 343

88. In right ΔABC, BC = 7 cm, AC – AB = 1 cm and $\angle B = 90°$. The value of cosA + cosB + cosC is
(a) $\frac{1}{7}$ (b) $\frac{32}{24}$ (c) $\frac{31}{25}$ (d) $\frac{25}{31}$

89. Given that $\Delta ABC \sim \Delta PQR$ and $\frac{\text{area of } \Delta ABC}{\text{area of } \Delta PQR} = \frac{16}{9}$. If PQ = 18 cm and BC = 12 cm. Then, AB and QR are, respectively

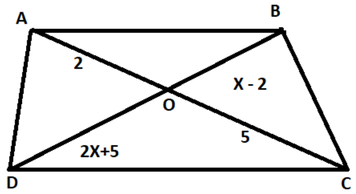
(a) 9 cm, 24 cm
(b) 24 cm, 9 cm
(c) 32 cm, 6.75 cm
(d) 13.5 cm, 16 cm

90. ΔABC is an equilateral triangle of side $2\sqrt{3}$ cm, O is any point in the interior of ΔABC. If x, y, z are the distances of O from the sides of the triangle, then x + y + z is equal to

(a) $2 + \sqrt{3}$ cm (b) 3 cm (c) 4 cm (d) 5 cm

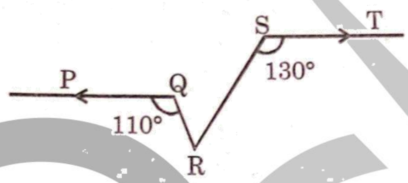
EXERCISE – 4

1. In a given figure in trapezium ABCD if AB || CD then value of x is : (NTSE Stage – 1 = 2013)



(a) $\frac{29}{8}$ (b) $\frac{8}{29}$ (c) 20 (d) $\frac{1}{20}$

2. In a given figure PQ || ST, <PQR = 110°, <RST = 130° then value of <QRS is (NTSE Stage – 1 = 2013)



(a) 20° (b) 50° (c) 60° (d) 70°

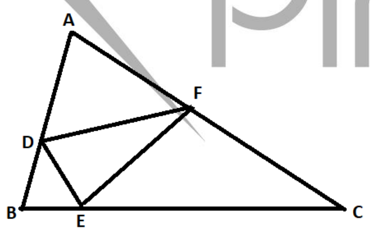
3. $\Delta ABC \sim \Delta PQR$ and $\frac{\text{area } \Delta ABC}{\text{area} \Delta PQR} = \frac{16}{9}$. If PQ = 18 cm and BC = 12cm, then AB and QR are respectively: (NTSE Stage – 1 = 2013)

(a) 9cm, 24 cm (b) 24 cm, 9 cm
(c) 32 m, 675 cm (d) 135 cm, 16 cm

4. E and F are respectively, the mid points of the sides AB and AC of ΔABC and the area of the quadrilateral BEFC is k times the area of ΔABC. The value of k is: (NTSE Stage – 1 = 2013)

(a) $\frac{1}{2}$ (b) 3 (c) $\frac{3}{4}$ (d) 4

5. In the figure AD = DB, BE = $\frac{1}{2}$ EC and CF = $\frac{1}{3}$ AF. If the area of ΔABC = 120 cm², the area (in cm²) of ΔDEF is : (NTSE – 1 = 2013)



(a) 21 (b) 35 (c) 40 (d) 45

6. In ΔABC, <A = 100°, <B = 50°, AHBC , BM is a median and MH is joined. Then <MHC = (NTSE Stage – 1 = 2013)

(a) 15° (b) 30° (c) 45° (d) 60°

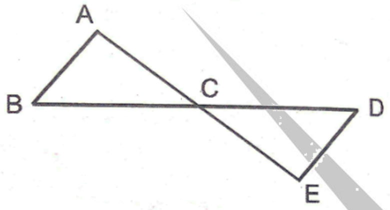
7. In ΔABC and ΔDEF, AC = BC = DF = EF, length AB 2FH, where FHDE. Which of the following statemnets is (are) true?

I. <ACB and <DFE are complementary
II. <ACB and <DFE are supplementary
III. Area of ΔABC = Area of ΔDEF
IV. Area of ΔABC = 1.5x (Area of ΔDEF) (NTSE Stage – 2)

(a) II only (b) III only (c) I and III only (d) II and III only

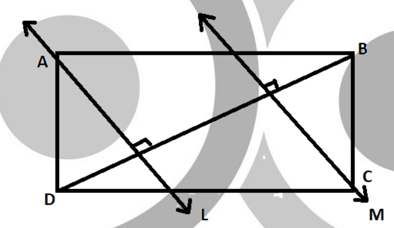
8. The ratio of the areas of two similar triangles is equal to: (NTSE Stage – 1 = 2013)
(a) The ratio of corresponding medians
(b) The ratio of corresponding sides
(c) The ratio of the squares of corresponding sides
(d) None of these

9. In the figure, ΔABC is similar to ΔEDC. If we have AB = 4cm, ED = 3cm, CE = 4.2 cm and CD = 4.8 cm, then the values of CA and CB respectively are: (NTSE Stage – 1 = 2013)



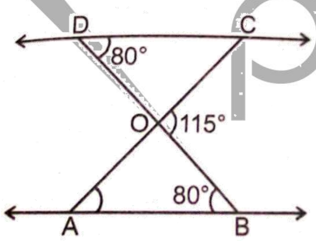
(a) 6 cm, 6.6 cm (b) 4.8 cm, 6.6 cm (c) 5.4 cm, 6.4 cm (d) 5.6 cm. 6.4 cm

10. In the figure, DB is diagonal of rectangle ABCD and line 1 through A and line m each of length 1 cm and are perpendicular each of length 1 cm and are prependcular to DB. Area (in cm²) of rectangle ABCD is : (NTSE Stage – 1 = 2014)



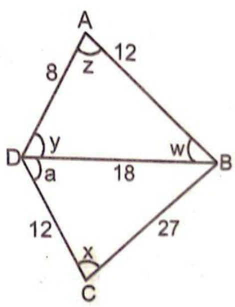
(a) $2\sqrt{2}$ (b) $2\sqrt{3}$ (c) $3\sqrt{2}$ (d) $3\sqrt{3}$

11. In the given figure, ΔODC ~ ΔOBA, <BOC = 115° and <CDO = 80°. Then <OAB is equal to – (NTSE Stage – 1 = 2014)



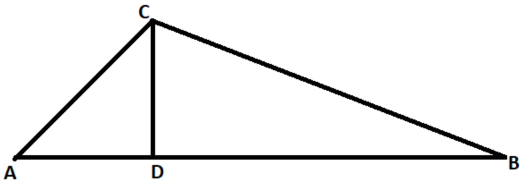
(a) 80° (b) 35° (c) 45° (d) 65°

12. In the quadrilateral ABCD : (NTSE Stage – 1 = 2015)



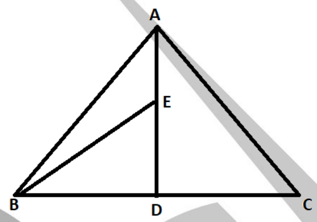
(a) x = y, a = z (b) x = z, a = y (c) x = z, a = y (d) x = y, a = w

13. In the following figure <ACB = 90° and CD ⊥ AB. If AD = 4cm and BD = 9 cm then the ratio BC : AC is : (NTSE Stage – 1 = 2017)



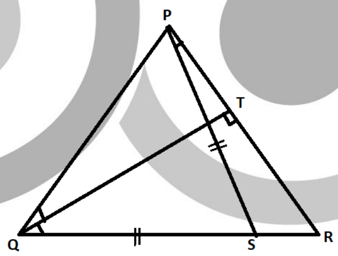
(a) 3 : 2 (b) 2 : 3 (c) 16 : 81 (d) 81 : 16

14. In the following figure of trinalge ABC, E is the midpoint of median AD. The ratio of areas of the triangles ABC and BED is : (NTSE Stage – 1 = 2017)



(a) 1 : 4 (b) 3 : 4 (c) 4 : 1 (d) 4 : 3

15. In the following figure QT ⊥ PR and QS = PS. If <TQR = 40° and <RPS = 20° the value of x is (NTSE Stage – 1 = 2018)

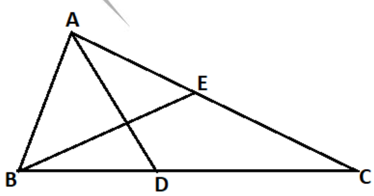


(a) 80° (b) 25° (c) 15° (d) 35°

16. If ratio of heights of two similar triangles is 4 : 9, then ration between their areas is (NTSE Stage – 1 = 2018)

(a) 2 : 3 (b) 3 : 2 (c) 81 : 16 (d) 16 : 81

17. In given ΔABC, AD and BE are medians of triangle which intersect each other at point G. If area of ΔBDG is 1 cm², then what is the area of DCEG? (NTSE Stage – 1 = 2018)



(a) 2 cm^2 (b) 3 cm^2 (c) 4 cm^2 (d) 1 cm^2

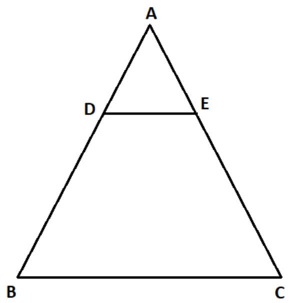
18. If ΔABC, m<B = 90°, AB = BC. Then AB : AC = ________. (NTSE Stage – 1 = 2018)

(a) 1 : 3 (b) 1 : 2 (c) 1 : $\sqrt{2}$ (d) $\sqrt{2}$: 1

19. If the sides of a triangle are parallel respectively to the sides of another triangle, then the triangles are necessarily –

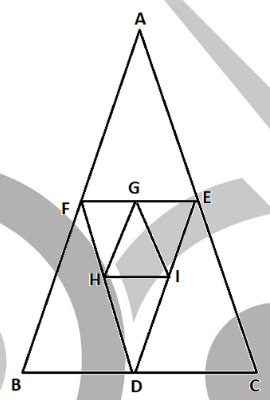
(a) Similar (b) Congruent (c) Equal in area (d) None of these

20. Sides AB and AC of ΔABC are trisected at D and E such that $\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{3}$. ΔADE and trapezium DECB have their areas in the ratio of



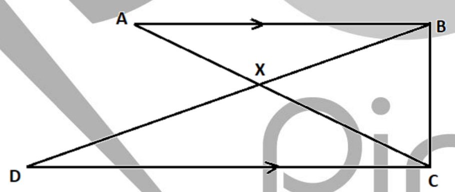
(a) 1 : 4 (b) 1 : 8 (c) 1 : 9 (d) 1 : 2

21. D, E, F are midpoints of BC, CA and AB respectively. G, H, I are midpoints of FE, FD, DE respectively. Area of triangles DHI and AFE are in the ratio



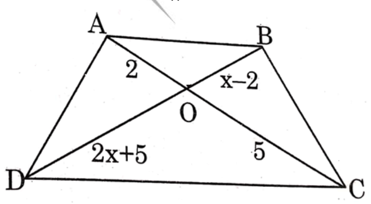
(a) 1 : 3 (b) 1: 4 (c) 1 : 9 (d) 1 : 16

22. In the given diagram, AB is parallel to DC. AC and BD intersect at X. if AX = 4 cm, XC = 6cm and BD = 14 cm. Find BX.



(a) 4.5 cm (b) 5.6 cm (c) 8.5 cm (d) 12 cm

23. In a given figure in trapezium ABCD if AB || CD then value of x is –



(a) $\frac{29}{8}$ (b) $\frac{8}{29}$ (c) 20 (d) $\frac{1}{20}$

24. If ΔABC ~ Δ EDF and ΔABC is not similar to ΔDEF, then which of the following is noe true?

(a) BC. EF = AC. FD (b) AB. EF = AC. DE

(c) BC. DE = AB. EF (d) BC. DE = AB. FD

25. In triangles ABC and DEF, <B = <E, <F = <C and AB = 3 DE. Then, the two triangles are –

(a) Congruent but not similar

(b) Similar but not congruent

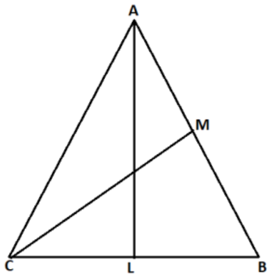
(c) Neither congreunt nor similar

(d) Congreunt as well as similar

26. In a right triangle with sides a and b, and hypothenuse c, the altitude drawn on the hypotenuse is x. Then which one of the following is correct?

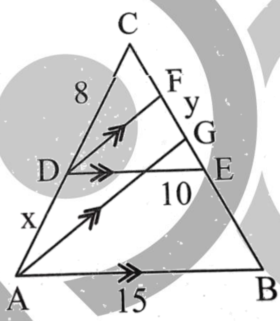
(a) $Ab = x^2$ (b) $\frac{1}{a}+\frac{1}{b}=\frac{1}{x}$ (c) $a^2+b^2=2x^2$ (d) $\frac{1}{x^2}=\frac{1}{a^2}+\frac{1}{b^2}$

27. In the figure below, AL is perpendicular to BC and CM is perpendicular to AB. If CL = AL = 2BL, find MC/BM.



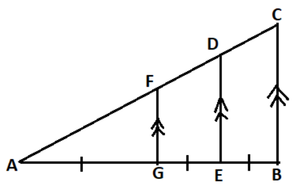
(a) 2 (b) 3 (c) 4 (d) Cannot be determined

28. In the figure DF || AG, DE || AB, AB = 15, CD = 8, AD = x, DE = 10, FG = y and CG = 6. The ratio x : y equal to:



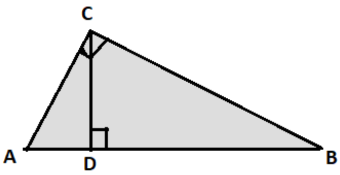
(a) 1 : 2 (b) 1 : 3 (c) 2 : 1 (d) 3 : 2

29. In the given figure, ABC is a right angled triangle. Also GF || ED || BC and AG = GE = EB. If DE = 12 cm, then the measure of BC is :



(a) 12 cm (b) 18 cm (c) 24 cm (d) 30 cm

30. In a right angled ΔABC, <C = 90° and CD is perpendicular on hypotenuse AB. If BC = 15 cm and AC = 20 cm then CD is equal to:



(a) 18 cm (b) 12 cm (c) 17.5 cm (d) Can't be determined

31. What is the ratio of side and height of an equilateral triangle?

(a) 2 : 1 (b) 1 : 1 (c) 2 : $\sqrt{3}$ (d) $\sqrt{3}$: 2

32. The point in the plane of a triangle which is at equal perpendicular distance from the sides of the triangle is:
(a) Centroid (b) Incentre (c) Circumcentre (d) Orthocentre

33. Incentre of a triangle lies in the interior of:
(a) An isosceles triangle only (b) A right angled triangle only
(c) Any equilateral triangle only (d) Any triangle

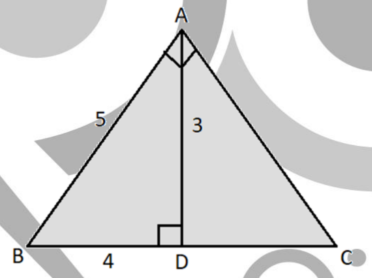
34. In a triangle PQR, PQ = 20 cm and PR = 6cm, the side QR is:
(a) Equal to 14 cm (b) Less than 14 cm
(c) Greater than 14 cm (d) None of these

35. If ABC is a right angled triangle at B and M, N are the mid – points of AB and BC, then $4(AN^2 + CM^2)$ is equal to –
(a) $4AC^2$ (b) $6AC^2$ (c) $5AC^2$ (d) $\frac{5}{4}AC^2$

36. If ΔABC and ΔDEF are so related that $\frac{AB}{FD} = \frac{BC}{DE} = \frac{CA}{EF}$, then which of the following is true?
(a) <A = <F and <B = <D (b) <C = <F and <A =<D
(c) <B=<F and <C = <D (d) <A=<E and <B = <D

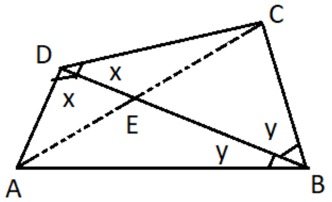
37. ABC is a right angle triangle at A and AD is perpendicular to the hypotenuse. Then $\frac{BD}{CD}$ is equal to:
(a) $\left(\frac{AB}{AC}\right)^2$ (b) $\left(\frac{AB}{AD}\right)^2$ (c) $\frac{AD}{AC}$ (d) $\frac{AB}{AD}$

38. In the adjoinig figure the <BAC and <ADB are right angles. BA = 5cm, AD = 3 cm and BD = 4 cm, what is the length of DC?



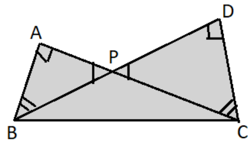
(a) 2. 5 (b) 3 (c) 2.25 (d) 2

39. The diagonal BD of quadrilateral ABCD bisects <B and <D, then:



(a) $\frac{AB}{CD} = \frac{AD}{BC}$ (b) $\frac{AB}{BC} = \frac{AD}{CD}$ (c) AB = AD × BC (d) None of these

40. Two right triangles ABC and DBC are drawn on the same hypotenuse BC on the same side of BC. If AC and DB intersects at P, then



(a) $\frac{AP}{PC} = \frac{BP}{DP}$ (b) AP × DP = PC × BP
(c) AP × PC = BP × DP (d) AP × BP = PC × PD

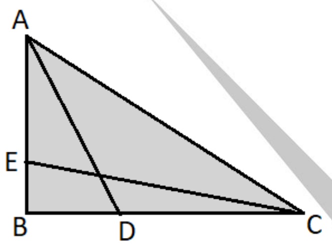
41. A vertical stick 15 m long casts is shadow 10 cm long on the ground. At the same time a flag pole casts a shadow 60 cm long. Find the height of the flag pole.

(a) 40 cm (b) 45 cm (c) 90 cm (d) None

42. Verticla angles of two isoceles triangles are equal. Then corresponding altitudes are in the ratio 4 : 9. Find the ratio of their areas:

(a) 16 : 49 (b) 16 : 81 (c) 16 : 65 (d) None

43. In figure, ABC is a right triangle, righ angled at B. AD and CE are the two medians drawn from A and C respectively. If AC = 5 and AD = $\frac{3\sqrt{5}}{2}$ cm, find the length of CE.

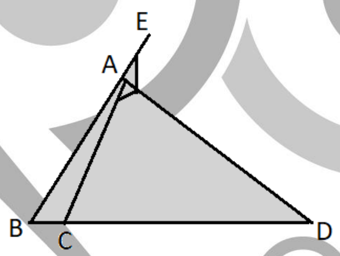


(a) $2\sqrt{5}$ cm (b) 2.5 cm (c) 5 cm (d) $4\sqrt{2}$ cm

44. Area of ΔABC = 30 cm². D and E are the mid – points of BC and AB respectively. Find ar (ΔBDE).

(a) 10 cm (b) 7.5 cm (c) 15 cm (d) None

45. In the figure, AD is the external bosector of <EAC, intersects BC produced to D. If AB = 12 cm, AC = 8 cm and BC = 4 cm, find CD.

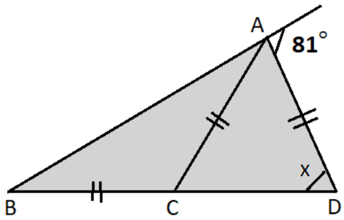


(a) 10 cm (b) 6 cm (c) 8 cm (d) 9 cm

46. In ΔABC, AB² + AC² = 2500 cm² and median AD = 25 cm, find BC.

(a) 25 cm (b) 40 cm (c) 50 cm (d) 48 cm

47. In the givne fig, BC = AC = AD, <EAD = 81°. Find the value of x.

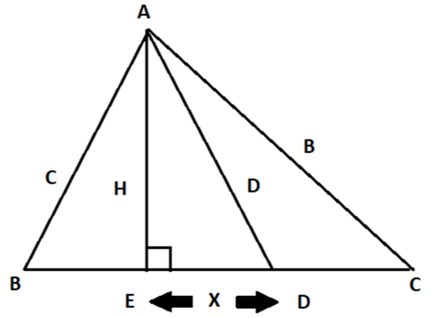


(a) 45° (b) 54° (c) 63° (d) 36°

48. If in triangle ABC, D is the mid – point of side BC, <ADB = 45° and <ACD = 30°, then <BAD and <ABC are respectively equal to – (NTSE Stage – 2 = 2016)

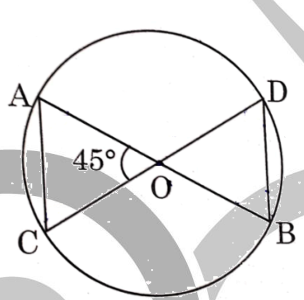
(a) 15°, 105° (b) 30°, 105° (c) 30°, 100° (d) 60°, 100°

49. In the following figure, AE ⊥ BC, D is the mid point of BC, then x is equal to:



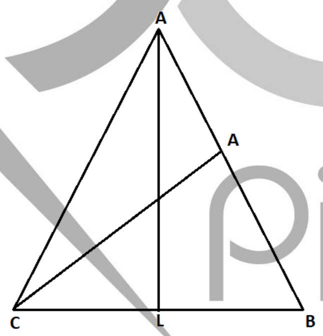
(a) $\frac{1}{a}\left[b^2 - d^2 - \frac{a^2}{4}\right]$ (b) $\frac{h+d}{3}$ (c) $\frac{c+d-h}{2}$ (d) $\frac{a^2+b^2+d^2-c^2}{4}$

50. If in Fig, O is the point of intersection of two chords AB and CD such that OB = OD, the triangles OAC and ODB are



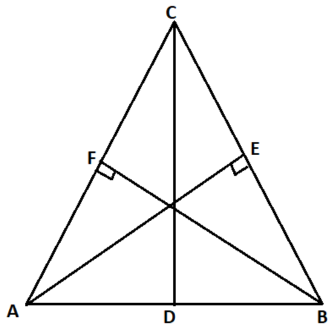
(a) Equilateral but not similar (b) Isosceles but not similar
(c) Equilateral and similar (d) Isosecles and similar

51. In the figure below, AL is perpendicular to BC and CM is perpendicular to AB. If CL = AL = 2BL, find MC/AM.



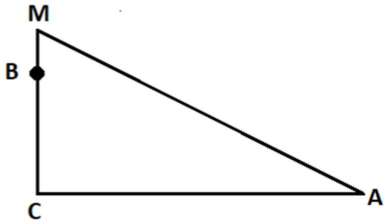
(a) 2 (b) 3 (c) 4 (d) Cannot be determined

52. In the given triangle ABC, CD, BF and AE are the altitudes. If the ratio of CD : AE : BF = 2 : 3 : 4, then the ratio of AB : BC : CA is –



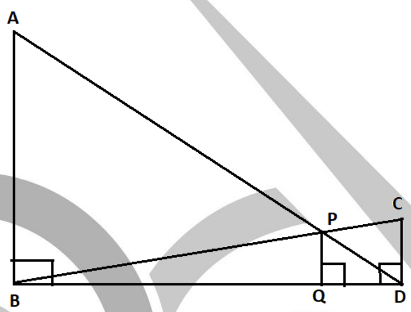
(a) 4 : 3 : 2 (b) 2 : 3 : 4 (c) 4 : 9 : 16 (d) 6 : 4 : 3

53. In the right triangle shown the sum of the distances BM and MA is equal to the distances BC and CA. If MB = x, CB = h and CA = d, then x equals.



(a) $\frac{hd}{ah+d}$ (b) d – h (c) h + d – $\sqrt{2d}$ (d) $\sqrt{h^2 + d^2 - h}$

54. In the diagram given below, <ADB = <CDB = <PQD = 90°. If AB : CD = 3 : 1, the ratio of CD : PQ is :



(a) 1 : 0.69 (b) 1 : 0.75 (c) 1 : 0.72 (d) None of the above

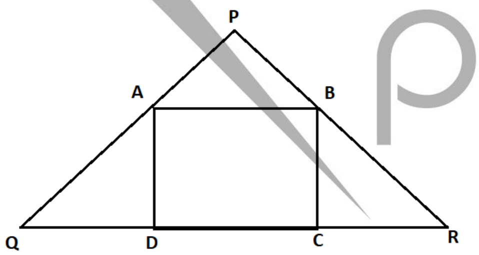
55. A line drawn from vertex A of an equilateral ΔABC meets BC at D and the circumcircle at P. Then :

(a) PA = PB + PD (b) $\frac{1}{PD} = \frac{1}{PB} + \frac{1}{PC}$ (c) $\frac{1}{PA} = \frac{1}{PB} + \frac{1}{PC}$ (d) None of these

56. The area of a right angled triangle is 40 sq. cm and its perimeter is 40 cm, the length of its hypotenuse is :

(a) 16 cm (b) 18 cm (c) 17 cm (d) Data insufficient

57. A square ABCD is constructed inside a triangle PQR having sides 10 cm, 17 cm and 21 cm as shown in figure. Find the perimeter of the square ABCD.



(a) 28 cm (b) 23.2 cm (c) 25. 4 cm (d) 28.8 cm

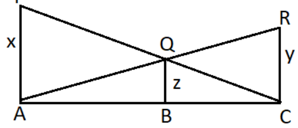
58. If AD, BE, CF are the altitudes of ΔABC whose orthocentre is H, then C is the orthocentre of:

(a) ΔABH (b) ΔBDH (c) ΔABD (d) ΔBEA

59. O is orthocentre of a triangle PQR, which is formed by joining the mid points of the sides of a ΔABC , O is:

(a) Orthocentre (b) Incentre (c) Circumcentre (d) Centroid

60. In the adjoining figure PA, QB and RC are each perpendicular to AC. Which one of the folloiwng is true?



(a) x + y = z (b) xy = 2z (c) $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$ (d) $\frac{1}{x} + \frac{1}{y} = \frac{1}{z}$ = 0

ANSWER KEY

EXERCISE – 1

1. x = 4
2. PS = $\frac{9}{2}$ cm
18. AF = $\frac{5}{3}cm$, CE = $\frac{32}{13}cm, BD = \frac{40}{9}cm$
20. 11 or, 8
21. DE = 2.8
22. DC = 10 cm
40. 1.6 m
41. DE = $\frac{36}{13}cm$ and AE = $\frac{15}{13}cm$
42. x = 3.75 cm; y = 6.67 cm
64. $\frac{2AB^2 + 2AC^2 - BC^2}{4}$

EXERCISE – 2

2. $2\sqrt{5}\,cm$
15. AE = $\frac{15}{13}$, DE = $\frac{36}{13}$
21. $\frac{bc}{\sqrt{b^2 + c^2}}$
23. 24 cm^2
25. 13 cm
26. 3 : 4
27. 8 cm
37. 4 : 1
39. 21 cm^2

EXERCISE – 3

Ques.	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
Ans.	b	c	c	b	c	c	c	a	d	a
Ques.	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
Ans.	d	a	b	a	b	a	b	c	a	b
Ques.	**21.**	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
Ans.	a	c	a	d	b	b	a	c	b	a
Ques.	**31.**	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
Ans.	b	c	a	a	b	b	c	a	a	a
Ques.	**41.**	**42.**	**43.**	**44.**	**45.**	**46.**	**47.**	**48.**	**49.**	**50.**
Ans.	c	d	a	d	b	c	d	a	c	a
Ques.	**51.**	**52.**	**53.**	**54.**	**55.**	**56.**	**57.**	**58.**	**59.**	**60.**
Ans.	b	c	c	d	a	a	d	b	c	c
Ques.	**61.**	**62.**	**63.**	**64.**	**65.**	**66.**	**67.**	**68.**	**69.**	**70.**
Ans.	d	b	c	d	a	b	c	b	b	d
Ques.	**71.**	**72.**	**73.**	**74.**	**75.**	**76.**	**77.**	**78.**	**79.**	**80.**
Ans.	a	c	b	c	b	b	a	c	d	b
Ques.	**81.**	**82.**	**83.**	**84.**	**85.**	**86.**	**87.**	**88.**	**89.**	**90.**
Ans.	c	a	b	a	c	d	b	c	b	b

EXERCISE – 4

Ques.	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
Ans.	c	c	b	c	b	b	d	c	d	c
Ques.	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
Ans.	b	a	a	c	c	d	a	c	a	b
Ques.	**21.**	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
Ans.	b	b	c	d	b	d	a	c	b	b
Ques.	**31.**	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
Ans.	c	b	d	c	c	a	a	c	b	c
Ques.	**41.**	**42.**	**43.**	**44.**	**45.**	**46.**	**47.**	**48.**	**49.**	**50.**
Ans.	c	b	a	b	c	c	b	b	a	d
Ques.	**51.**	**52.**	**53.**	**54.**	**55.**	**56.**	**57.**	**58.**	**59.**	**60.**
Ans.	b	d	a	b	b	b	b	a	c	c