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## TRIANGLES

## KEY POINTS

1. Similar Triangles:- Two triangles are said to be similar, if (a) their corresponding angles are equal and (b) their corresponding sides are in proportion (or are in the same ration).
2. Basic proportionality Theorem [ or Thales theorem ].
3. Converse of Basic proportionality Theorem.
4. Criteria for similarity of Triangles.
(a) AA or AAA similarity criterion.
(b) SAS similarity criterion.
(c) SSS similarity criterion.
5. Areas of similar triangles.
6. Pythagoras theorem.
7. Converse of Pythagoras theorem.
(Level-1)
8. If in two triangles, corresponding angles are equal, then the two triangles are

Ans. Equiangular then similar
2. $\triangle A B C$ is a right angled at $B . B D$ is perpendicular upon $A C$. If $A D=a, C D=b$, then $A B^{2}=$

Ans. $a(a+b)$
3. The area of two similar triangles are $32 \mathrm{~cm}^{2}$ and $48 \mathrm{~cm}^{2}$. If the square of a side of the first $\Delta$ is $24 \mathrm{~cm}^{2}$, then the square of the corresponding side of $2^{\text {nd }}$ triangle will be

Ans. $36 \mathrm{~cm}^{2}$
4. $A B C$ is a triangle with $D E \| B C$. If $A D=2 c m, B D=4 c m$ then find the value $D E: B C$

Ans. 1:3
5. In $\triangle A B C, D E \| B C$, if $A D=4 x-3, D B=3 x-1, A E=8 x-7$ and $B C=5 x-3$, then find the values of $x$ are:

$$
\text { Ans. } 1,-\frac{1}{2}
$$

6. The perimeters of two similar triangles are 40 cm and 50 cm respectively, find the ratio of the area of the first triangle to the area of the $2^{\text {nd }}$ triangle:

Ans. 16:25
7. A man goes 150 m due east and then 200 m due north. How far is he from the starting point?

Ans. 250 m
8. A ladder reaches a window which is 12 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 9 m high. If the length of the ladder is 15 m , find the width of the street.

Ans. 21m
9. BO and CO are respectively the bisector of $\angle \mathrm{B}$ and $\angle \mathrm{C}$ of $\triangle \mathrm{ABC}$. AO produced meets BC at P , then find $A B / A C$

$$
\text { Ans. } \frac{B P}{P C}
$$

10.In $\triangle A B C$, the bisectors of $\angle B$ intersects the side $A C$ at D.A line parallel to side $A C$ intersects line segments $A B, D B$ and $C B$ at points $P, R, Q$ respectively.Then, Find $A B X C Q$

Ans. BC X AP
11.If $\triangle A B C$ is an equilateral triangle such that $A D \perp B C$, then $A D^{2}=$.

Ans. $3 C^{2}$
12.If $\triangle A B C$ and $\triangle D E F$ are similar triangles such that $\angle A=47^{\circ}$, and $\angle E=83^{\circ}$, then find $\angle C$

$$
\text { Ans. } 50^{\circ}
$$

13.Two isosceles triangles have equal angles and their areas are in the ratio $16: 25$,then find the ratio of their corresponding heights

Ans. 4:5
14.Two poles of heights 6 m and 11 m stand vertically upright on a plane ground.If the distance between their feet is 12 m , then find the distance between their tops.

Ans.13m
15.The lengths of the diagonals of a rhombus are 16 cm and 12 cm . Then, find the length of the side of the rhombus.

Ans. 10 cm

## (Level - 2)

1.In given fig. $B D \perp A C$ and $C E \perp A B$ then prove that
(a) $\triangle A E C \sim \triangle A D B$
(b) $C A / A B=C E / D B$

2. In the given figure fig $\cdot \frac{P S}{S Q}=\frac{P T}{T R}$, and $\angle \mathrm{PST}=\angle \mathrm{PQR}$. Prove that $\triangle \mathrm{PQR}$ is an isosceles triangle.


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3.In given fig $A D \perp B C$ and $\angle B<90^{\circ}$, prove that $A C^{2}=A B^{2}+B C^{2}-2 B C \times B D$

4.In given fig. $\triangle A B C$ is right angled at $C$ and $D E \perp A B$. Prove that $\triangle A B C \sim \triangle A D E$ and hence find length of $A E$ and DE.


Ans. $\frac{15}{17}, \frac{36}{17}$
5. In a $\triangle \mathrm{ABC}$, if $\mathrm{DE} \| \mathrm{AC}$ and $\mathrm{DF} \| \mathrm{AE}$, prove that $\frac{E F}{B F}=\frac{E C}{B E}$
6. In given fig. $A D \perp B C$, if $\frac{B D}{A D}=\frac{D A}{D C^{\prime}}$, prove that $A B C$ is a right angled triangle.

7.Two $\triangle s A B C$ and $D E F$ are similar. If $\operatorname{ar}(\triangle D E F)=243 \mathrm{~cm}^{2}, \operatorname{ar}(\triangle A B C)=108 \mathrm{~cm}^{2}$ and $B C=6 \mathrm{~cm}$, find $E F$.

Ans. 9 cm
8. What is the value of $K$ in given figure if $D E \| B C$.

Ans. $K=4,-1$

9. A pole of length 10 m casts a shadow 2 m long on the ground. At the same time a tower casts a shadow of length 60 m on the ground then find the height of the tower.

Ans. 300m

## Level - 3

1.In given figure, $A B\left|\left\lvert\, D C a n d \frac{A O}{O C}=\frac{B O}{O D}\right.\right.$ then find the value of x , if.
$O A=2 x+7, O B=4 x, O D=4 x-4$ and $O C=2 x+4$

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2. PQR is a right angled triangle with $\angle \mathrm{P}=90^{\circ}$. If $\mathrm{PM} \perp \mathrm{QR}$, then show that $P M^{2}=Q M X M R$
3. In given fig. $\frac{Q R}{Q S}=\frac{Q T}{P R}$ and $\angle 1=\angle 2$. Show that $\triangle P Q S^{\sim} \triangle T Q R$.

4. Find the length of altitude of an equilateral triangle of side 2 cm .

Ans. $\sqrt{3} \mathrm{~cm}$
5. In a trapezium $A B C D, O$ is the point of intersection of $A C$ and $B D, A B \| C D$ and $A B=2 C D$.If the area of $\triangle A O B=84 \mathrm{~cm}^{2}$ then find area of $\triangle C O D$.
6.In given fig. $\frac{P S}{S Q}=\frac{P T}{T R}=3$.If area of $\triangle \mathrm{PQR}$ is $32 \mathrm{~cm}^{2}$, then find the area of the quad.STQR

7. $M$ is the mid-point of the side $C D$ of a \|gm $A B C D$. The line $B M$ is drawn intersecting $A C$ at $L$ and $A D$ produced at E . Prove that $\mathrm{EL}=2 \mathrm{BL}$.
8.Prove that the ratio of the area of two similar $\Delta \mathrm{s}$ is equal to the square of the ratio of their corresponding medians.
9. $D$ and $E$ are points on the sides $C A$ and $C B$ respectively of $\triangle A B C$, right angled at $C$.Prove that $A E^{2}+B D^{2}=A B^{2}+D E^{2}$.
$10 . A B C$ and $D B C$ are two $\triangle s$ on the same base $B C$ and on the same side of $B C$ with $\angle A=\angle D=90^{\circ}$.If $C A$ and $B D$ meet each other at $E$, show that $A E \times E C=B E \times E D$.

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1.Prove that in a right angled triangle the square of hypotenuse is equal to the sum of the squares of the other two sides.
2.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 into the same ratio.
3. $\triangle A B C$ is right angled at $B$ and $D$ is midpoint of side $B C$. Prove that $A C^{2}=4 A D^{2}-3 A B^{2}$
4. Prove that the ratio of the areas of two similar triangles is equal to the ratio of square of their corresponding sides.
5. In a $\Delta$, if the square of one side is equal to sum of the squares of the other two sides, prove that the angle opposite to the first side is a right angle.
6. In an equilateral $\triangle A B C, D$ is a point on the side $B C$, such that $B D=\frac{1}{3} B C$. Prove that9 $A D^{2}=7 A B^{2}$
7. $P$ and $Q$ are the mid points of side $C A$ and $C B$ respectively of $\triangle A B C$ right angled at $C$. Prove that $4\left(A Q^{2}+B P^{2}\right)=5 A B^{2}$.
8. $C M$ and $R N$ are respectively the medians of $\triangle A B C$ and $\triangle P Q R$. If $\triangle A B C^{\sim} \triangle P Q R$, prove that
(i) $\triangle \mathrm{AMC}^{\sim} \sim \mathrm{PNR}$
(ii) $C M / R N=A B / P Q$
(iii) $\triangle C M B^{\sim} \sim R^{2} Q$

## SELF EVALUATION

1.The diagonal $B D$ of a \|gm $A B C D$ intersects the line segment $A E$ at the point $F$, where $E$ is any point on the side $B C$. Prove that $D F \times E F=F B \times F A$.
2. In fig. $D B \perp B C, D E \perp A B$ and $A C \perp B C$. Prove that $B E / D E=A C / B C$.

3. In given fig. $\mathrm{PA}, \mathrm{QB}, \mathrm{RC}$ are each perpendicular to AC . Prove that $\frac{1}{x}+\frac{1}{z}=\frac{1}{y}$

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4. Prove that three times the sum of the squares of the sides of a triangle is equal to four times the sum of the squares of the medians of the triangle.
5. $A B C$ is a right triangle with $\angle A=90^{\circ}, A$ 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 incircle.

Ans. 4cm
6. $A B C$ is a right triangle, right angled at $C$. If $p$ is the length of the perpendicular from $C$ to $A B$ and $a, b, c$ have the usual meaning, then prove that
(i) $\mathrm{cp}=\mathrm{ab}$ ( ii ) $\frac{1}{p^{2}}=\frac{1}{a^{2}}+\frac{1}{b^{2}}$
7. In a trapezium $A B C D, A B| | D C$ and $D C=2 A B . E F| | A B$, where $E$ and $F$ lie on the side $B C$ and $A D$ respectively such that $B E / E C=4 / 3$. Diagonal $D B$ intersects $E F$ at $G$. Prove that $E F=11 A B$.
8. Sides $A B, A C$ and median $A D$ of a triangle $A B C$ are respectively proportional to sides $P Q, P R$ and median $P M$ of another triangle PQR. Show that $\triangle A B C \sim \triangle P Q R$.

