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## MATHS

# NCERT - NCERT MATHEMATICS (Bengali) 

## SIMILAR TRIANGLES

## Example

1. In $\triangle \mathrm{ABC}, \mathrm{DE} \| \mathrm{BC}$ and $\frac{A D}{D B}=\frac{3}{5}$.
$A C=5.6$ Find $A E$.

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2. In the given figure $L M \| A B M$
$A L=x-3, A C=2 x, B M=x-2$
and $B C=2 x+3$ find the value of $x$


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3. The diagonals of a quadrilateral $A B C D$ intersect each other at point 'O' such that $\frac{A O}{B O}=\frac{C O}{D O}$. Prove that ABCD is a trapezium

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4. In trapezium $A B C D, A B| | D C$. $E$ and $F$ are points on non-parallel sides $A D$ and $B C$ respectively such that $E F \| A B$. Show that $\frac{A E}{E D}=\frac{B F}{F C}$

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5. A person 1.65 m tall casts 1.8 m shadow. At the same instance, a lamp post casts a shadow of 5.4 m . Find the height of the lamppost.


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6. A man sees the top of a tower in a mirror which is at a distance of 87.6 m from the tower. The mirror is on the ground facing upwards. The man is 0.4 m away from the mirror and his height is 1.5m. How tall is the tower?

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7. Gopal is worrying that his neighbour can peep into his living room from the top floor of his house. He has decided raise the height of the fence that is high enough to block the view from his neighbour's top floor window. What should be the height of the fence? The measurements are given in the figure.

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8. Prove that if the areas of two similar triangles are equal, then they are congruent

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9. $\triangle A B C \sim \triangle D E F$ and their areas are respectively $64 \mathrm{~cm}^{2}$ and $121 \mathrm{~cm}^{2}$. If $\mathrm{EF}=15.4 \mathrm{~cm}$., then find BC .

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10. Diagonals of a trapezium $A B C D$ with $A B \| D C$, intersect each other at the point ' $O$ '. If $A B=2 C D$, find the ratio of areas of triangles AOB and COD.

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11. A ladder 25 m long reaches a window of building 20 m above the ground. Determine the distance from the foot of the ladder to the building.

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12. $B L$ and $C M$ are medians of a triangle $A B C$ right angled at $A$. Prove that $4\left(B L^{2}+C M\right)^{2}=5 B C^{2}$.

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13. ' $O$ ' is any point inside a rectangle $A B C D$. Prove that $O B^{2}+O D^{2}=O A^{2}+O C^{2}$

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14. The hypotenuse of a right triangle is 6 m more than twice of the shortest side. If the third side is 2 m ., less than the hypotenuse, find the sides of the triangle

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15. $A B C$ is a right triangle right angled at $C$. Let $B C=a, C A=b, A B=$ $c$ and let $p$ be the length of perpendicular from $C$ on $A B$. Prove that (i) $\mathrm{pc}=\mathrm{ab}$ (ii) $\frac{1}{p^{2}}=\frac{1}{a^{2}}+\frac{1}{b^{2}}$.

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## Do This Fill In The Blanks

1. All squares are
2. All equilateral triangles are

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3. All isosceles triangles are

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4. Two polygons with same number of sides are if their corresponding angles are equal and corresponding sides are equal.

## 5. Reduced and Enlarged photographs of an object are

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6. Rhombus and squares are ..................... to each other.

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Do This True False

1. Any two similar figures are congruent.

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2. Any two congruent figures are similar.
3. Two polygons are similar if their corresponding angles are equal.

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4. Give two different examples of pair of

Similar figures

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5. Give two different examples of pair of

Non Similar figures

1. What value(s) of $x$ will make $D E \| A B$, in the given figure ?
$A D=8 x+9, C D=x+3$,
$B E=3 x+4, C E=x$.


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2. In $\triangle A B C, D E \| B C . A D=x, D B=x-2$,
$A E=x+2$ and $E C=-1$.

Find the value of $x$.


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3. In $\triangle A C B, \angle C=90^{\circ}$ and $\mathrm{CD} \perp \mathrm{AB}$

Prove that $\frac{B C^{2}}{A C^{2}}=\frac{B D}{A D}$.


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4. A ladder 15 m long reaches a window which is 9 m above the ground on one side of a street. Keeping its foot at the same point, the ladder is turned to other side of the street to reach a window 12 m high. Find the width of the street.

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5. In the given fig. if $A D \perp B C$

Prove that $A B^{2}+C D^{2}=B D^{2}+A C^{2}$.

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## Exercise 81

1. In $\triangle P Q R$, $S T$ is a line such that $\frac{P S}{S Q}=\frac{P T}{T R}$ and also $\angle P S T=\angle P R Q$.

Prove that $\triangle P Q R$ is an isosceles triangle .


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2. In the given figure, $L M \| C B$ and $L N \| C D$ Prove that
$\frac{A M}{A B}=\frac{A N}{A D}$


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3. In the given figure, DE \|AC and DF \|AE Prove that $\frac{B F}{F E}=\frac{B E}{E C}$

4. Prove that a line drawn through the mid-point of one side of a triangle parallel to another side bisects the third side (Using basic proportionality theorem).

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5. Prove that a line joining the midpoints of any two sides of a triangle is parallel to the third side. (Using converse of basic proportionality theorem)
6. In the given figure, DE || OQ and DF || OR. Show that EF || QR. n)


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7. In the adjacent figure, $\mathrm{A}, \mathrm{B}$ and C are points on $\mathrm{OP}, \mathrm{OQ}$ and OR respectively such that $A B \| P Q$ and $A C|\mid P R$. Show that $B C| \mid Q R$.


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8. $A B C D$ is a trapezium in which $A B \| D C$ and its diagonals intersect each other at point 'O'. Show that $\frac{A O}{B O}=\frac{C O}{D O}$.

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9. Draw a line segment of length 7.2 cm and divide it in the ratio 5
: 3. Measure the two parts.

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## Exercise 82

1. In the given figure, $\angle A D E=\angle B$
(i) Show that $\triangle \mathrm{ABC} \sim \triangle \mathrm{ADE}$
(ii) If $\mathrm{AD}=3.8 \mathrm{~cm}, \mathrm{AE}=3.6 \mathrm{~cm}, \mathrm{BE}=2.1 \mathrm{~cm}$ and $\mathrm{BC}=4.2 \mathrm{~cm}$, find DE .


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2. The perimeters of two similar triangles are 30 cm and 20 cm respectively. If one side of the first triangle is 12 cm , determine the corresponding side of the second triangle.

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3. In the given figure, $A B\|C D\| E F$. given that $A B=7.5 \mathrm{~cm}, D C=y \mathrm{~cm}$ $E F=4.5 \mathrm{~cm}$ and $B C=x \mathrm{~cm}$, find the values of $x$ and $y$.


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

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5. Given that $\triangle A B C \sim \Delta P Q R, \mathrm{CM}$ and RN are respectively the medians of $\triangle A B C$ and $\triangle P Q R$. Prove that
(i) $\triangle A M C \sim \Delta P N R$
(ii) $\frac{C M}{R N}=\frac{A B}{P Q}$
(iii) $\Delta C M B \sim \Delta R N Q$


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6. Diagonals $A C$ and $B D$ of a trapezium $A B C D$ with $A B \| D C$ intersect each other at the point ' $O$ '. Using the criterion of
similarity for two triangles, show that $\frac{O A}{O C}=\frac{O B}{O D}$.

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7. $A B, C D, P Q$ are perpendicular to $B D$. If $A B=x, C D=y$ and $P Q=z$
prove that $\frac{1}{x}+\frac{1}{y}=\frac{1}{z}$


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8. A flag pole 4 m tall casts a 6 m shadow. At the same time, a nearby building casts a shadow of 24 m . How tall is the building ?
9. $C D$ and $G H$ are respectively the bisectors of $\angle A C B$ and $\angle E G F$ such that D and H lie on sides AB and FE of $\triangle A B C$ and $\triangle F E G$ respectively. If $\triangle A B C \sim \triangle F E G$, then show that
(i) $\frac{C D}{G H}=\frac{A C}{F G}$ (ii) $\Delta D C B \sim \Delta H G E$ (iii) $\Delta D C A \sim \Delta H G F$

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10. $A X$ and $D Y$ are altitudes of two similar triangles $\triangle A B C$ and $\triangle D E F$. Prove that $\mathrm{AX}: \mathrm{DY}=\mathrm{AB}: \mathrm{DE}$.

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11. Construct a triangle similar to the given $\triangle A B C$, with its sides equal to $\frac{5}{3}$ of the corresponding sides of the triangle $A B C$.
12. Construct a triangle of sides $4 \mathrm{~cm}, 5 \mathrm{~cm}$ and 6 cm . Then, construct a triangle similar to it , whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

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13. Construct an isosceles triangle whose base is 8 cm and altitude is 4 cm . Then, draw another triangle whose sides are $1 \frac{1}{2}$ times the corresponding sides of the isosceles triangle.

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## Exercise 83

1. $\mathrm{D}, \mathrm{E}, \mathrm{F}$ are mid points of sides $\mathrm{BC}, \mathrm{CA}, \mathrm{AB}$ of $\triangle A B C$. Find the ratio of areas of $\triangle D E F$ and $\triangle A B C$.

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2. In $\triangle A B C, \mathrm{XY} \| \mathrm{AC}$ and XY divides the triangle into two parts of equal area. Find the ratio of $\frac{A X}{X B}$.

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3. Prove that the ratio of areas of two similar triangles is equal to the square of the ratio of their corresponding medians.

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4. $\triangle A B C \sim \triangle D E F$. $\mathrm{BC}=3 \mathrm{~cm}, \mathrm{EF}=4 \mathrm{~cm}$ and area of $\triangle A B C=54 \mathrm{~cm}^{2}$. Determine the area of $\triangle D E F$.

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5. $A B C$ is a triangle and $P Q$ is a straight line meeting $A B$ in $P$ and
$A C$ in $Q$. If $A P=1 \mathrm{~cm}, B P=3 \mathrm{~cm}, A Q=1.5 \mathrm{~cm}$ and $C Q=4.5 \mathrm{~cm}$, prove that area of $\triangle A P Q=\frac{1}{16}($ area of $\triangle A B C)$.

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6. The areas of two similar triangles are $81 \mathrm{~cm}^{2}$ and $49 \mathrm{~cm}^{2}$ respectively. If the altitude of the bigger triangle is 4.5 cm . Find the corresponding altitude of the smaller triangle.
7. Prove that the sum of the squares of the sides of a rhombus is equal to the sum of the squares of its diagonals

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2. $A B C$ is a right triangle right angled at $B$. Let $D$ and $E$ be any points on $A B$ and $B C$ respectively. Prove that $A E^{2}+C D^{2}=A C^{2}+D E^{2}$.


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

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4. $P Q R$ is a triangle right angled at $P$ and $M$ is a point on $Q R$ such that $\mathrm{PM} \perp \mathrm{QR}$. Show that $P M^{2}=\mathrm{QM} . \mathrm{MR}$.

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5. ABD is a triangle right angled at $A$ and $A C \perp B D$ Show that
(i) $A B^{2}=\mathrm{BC} . \mathrm{BD}$.
(ii) $A C^{2}=\mathrm{BC} . \mathrm{DC}$
(iii) $A D^{2}=\mathrm{BD} . \mathrm{CD}$.


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6. $A B C$ is an isosceles triangle right angled at $C$. Prove that $A B^{2}=2 A C^{2}$.

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7. ' $O$ ' is any point in the interior of a triangle $A B C$. If $O D \perp B C, O E \perp \mathrm{AC}$ and $\mathrm{OF} \perp \mathrm{AB}$, show that
(i)

$$
O A^{2}+O B^{2}+O C^{2}-O D^{2}-O E^{2}-O F^{2}=A F^{2}+B D^{2}+C E^{2}
$$

(ii) $A F^{2}+B D^{2}+C E^{2}=A E^{2}+C D^{2}+B E^{2}$.


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8. A wire attached to a vertical pole of height 18 m is 24 m long and has a stake attached to the other end. How far from the base of
the pole should the stake be driven so that the wire will be taut?

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

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10. In an equilateral triangle $A B C, D$ is a point on side $B C$ such that
$\mathrm{BD}=\frac{1}{3} \mathrm{BC}$. Prove that $9 A D^{2}=7 A B^{2}$.

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11. In the given figure, $A B C$ is a triangle right angled at $B$. $D$ and $E$ are ponts on $B C$ trisect it.

Prove that $8 A E^{2}=3 A C^{2}+5 A D^{2}$.


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12. $A B C$ is an isosceles triangle right angled at $B$. Similar triangles
$A C D$ and $A B E$ are constructed on sides $A C$ and $A B$. Find the ratio
between the areas of $\triangle A B E$ and $\triangle A C D$


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13. Equilateral triangles are drawn on the three sides of a right angled triangle. Show that the area of the triangle on the hypotenuse is equal to the sum of the areas of triangles on the other two sides.

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14. Prove that the area of the equilateral triangle described on the side of a square is half the area of the equilateral triangles described on its diagonal.

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## Optional Exercise

1. In the given figure,
$\frac{Q T}{P R}=\frac{Q R}{Q S}$ and $\angle 1=\angle 2$

Prove that $\triangle P Q S \sim \Delta T Q R$.


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2. Ravi is 1.82 m tall. He wants to find the height of a tree in his backyard. From the tree's base he walked 12.20 m . along the tree's shadow to a position where the end of his shadow exactly overlaps the end of the tree's shadow. He is now 6.10 m from the end of the shadow. How tall is the tree ?


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3. The diagonal $A C$ of a parallelogram $A B C D$ intersects $D P$ at the point $Q$, where ' $P$ ' is any point on side $A B$. Prove that $C Q \times P Q=Q A \times Q D$.
4. $\triangle A B C$ and $\triangle A M P$ are two right triangles right angled at $B$ and $M$ respectively.

Prove that (i) $\triangle A B C \sim \Delta A M P$ and
(ii) $\frac{C A}{P A}=\frac{B C}{M P}$.


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5. An aeroplane leaves an airport and flies due north at a speed of 1000 kmph . At the same time, another aeroplane leaves the same
airport and flies due west at a speed of 1200 kmph . How far apart will the two planes be after $1 \frac{1}{2}$ hour ?

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6. In a right triangle $A B C$ right angled at $C, P$ and $Q$ are points on sides $A C$ and $C B$ respectively which divide these sides in the ratio of $2: 1$.

Prove that (i) $9 A Q^{2}=9 A C^{2}+4 B C^{2}$
(ii) $9 B P^{2}=9 B C^{2}+4 A C^{2}$
(iii) $9\left(A Q^{2}+B P^{2}\right)=13 A B^{2}$

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## Try This

1. In triangle $\triangle P Q R, \mathrm{E}$ and F are points on the sides PQ and PR respectively. State whether EF \|QR or not?
(i) $\mathrm{PE}=3.9 \mathrm{~cm} \mathrm{EQ}=3 \mathrm{~cm}$ PF $=3.6 \mathrm{~cm}$ and $\mathrm{FR}=2.4 \mathrm{~cm}$

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2. In triangle $\triangle P Q R, \mathrm{E}$ and F are points on the sides PQ and PR respectively. State whether EF \|QR or not?
(ii) $\mathrm{PE}=4 \mathrm{~cm}, \mathrm{QE}=4.5 \mathrm{~cm}, \mathrm{PF}=8 \mathrm{~cm}$ and $\mathrm{RF}=9 \mathrm{~cm}$.

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3. In triangle $\triangle P Q R, \mathrm{E}$ and F are points on the sides PQ and PR respectively. State whether EF \|QR or not?
(iii) $\mathrm{PQ}=1.28 \mathrm{~cm}$ PR $=2.56 \mathrm{~cm} \mathrm{PE}=1.8 \mathrm{~cm}$ and $\mathrm{PF}=3.6 \mathrm{~cm}$
4. In the following figures $D E \| B C$.
(i) Find EC (ii) Find AD


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5. Are triangles formed in each figure similar? If so, name the criterion of similarity. Write the similarity relation in symbolic
form.
the similarity relation in symbolic form.
(1)

(ii)

(iil)

(iv)

(v)

(.1)

(vii)


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6. If pairs of the triangles are similar and then find the value of $x$.
(i)

(ii)

(iv)

(iii)

(11)


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