Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT: MATH

CLASS-7

PLANNER

FEBRUARY

TOPIC: PROPERTIES OF TRIANGLES

SUBTOPIC:

- TYPES OF TRIANGLE
- PROPERTIES OF TRIANGLE.
- PYTHAGORAS THEOREM

NO. OF BLOCKS: 6

GUIDELINES:

- REFER TO THE CONTENT GIVEN BELOW AND VIEW THE LINKS
- THE NOTES GIVEN BELOW WILL HELP YOU TO UNDERSTAND THE CONCEPT AND COMPLETE THE ASSIGNMENT THAT FOLLOWS
- THE ASSIGNMENT IS TO BE DONE IN MATH NOTE BOOK

INSTRUCTIONAL AIDS/RESOURCE

CHAPTER WILL BE EXPLAINED THROUGH POWER POINT PRESENTATION AND VIDEOS THROUGH ZOOM CLASSES,

CLICK ON THE LINKS BELOW TO UNDERSTAND THE CONCEPTS MORE

https://youtu.be/Q5BHGLXKIyM

https://youtu.be/rBN_RTGu1Jg

https://youtu.be/JgKH1B6aKzI

LEARNING OBJECTIVES:

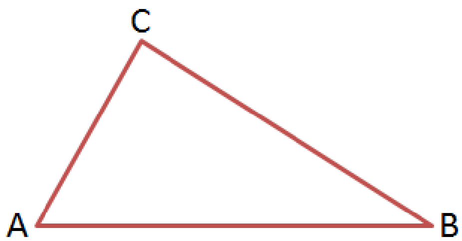
AT THE END OF THE LESSON EACH CHILD WILL BE ABLE TO

- DEFINE TRIANGLE
- RECOGNIZE VARIOUS TYPES OF TRIANGLE

DEVELOPMENT OF THE CHAPTER:

Triangle

- A triangle is a closed curve made of three line segments.



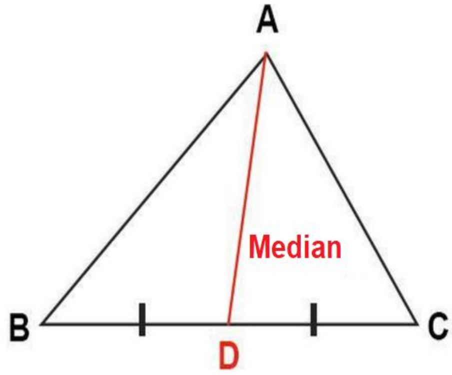
- It has three:Sides:
  (i) Sides: $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$
  (ii) Angles: ∠BAC, ∠ACB and ∠CBA
  (iii) Vertices: A, B and C

Important Lines in a Triangle

Median

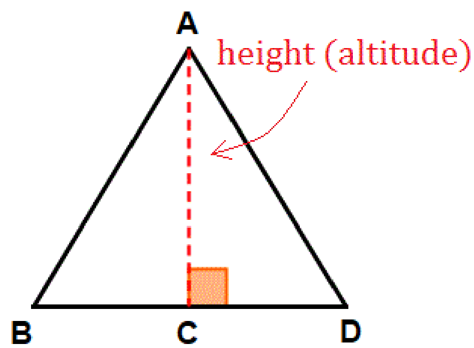
- Median is the line that connects a vertex of a triangle to the mid-point of the opposite side.

- In the given figure, $\overline{AD}$ AD is the median, joining the vertex A to the midpoint of $\overline{BC}$ BC.



Altitude

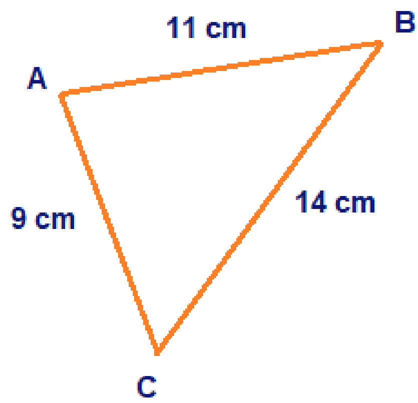
- An altitude is a line segment through a vertex of the triangle and perpendicular to a line containing the opposite side.
-



Sides Also Have Constraints

Sum of the lengths of two sides of a triangle

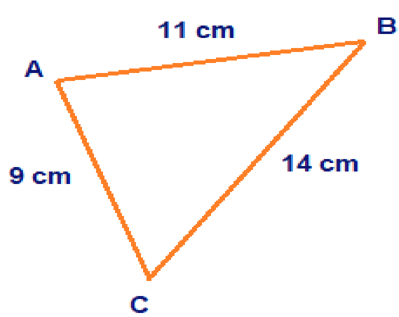
- The sum of the lengths of any two sides of a triangle is greater than the third side.



In the above triangle,
9+11=20 >14
11+14=25 >9
9+14=23 >11

Difference between lengths of two sides of a triangle

- The difference between lengths of any two sides is smaller than the length of the third side.

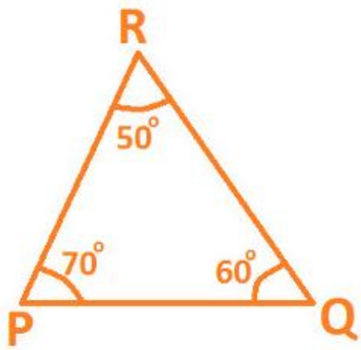


- In the above triangle,
  11 – 9 = 2 < 14
  14 – 11 = 3 < 9
  14 – 9 = 5 < 11
- Using the concept of sum of two sides and difference of two sides, it is possible to determine the range of lengths that the third side can take.

Triangle Properties

Angle sum property of a triangle

- The total measure of the three angles of a triangle is 180^0.

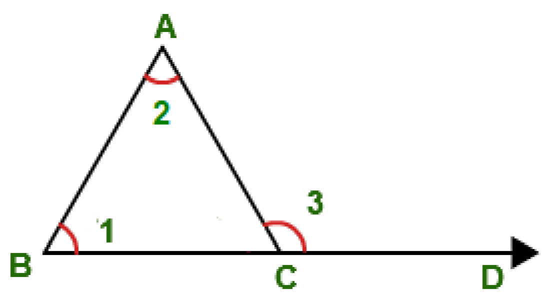


- In △PQR,
  $\angle RPQ + \angle PQR + \angle QRP$
  $= 70^0 + 60^0 + 50^0 = 180^0$

For More Information On Angle Sum Property Of A Triangle, Watch The Below Video.

Exterior angle of a triangle and its property

- An exterior angle of a triangle is equal to the sum of its interior opposite angles.

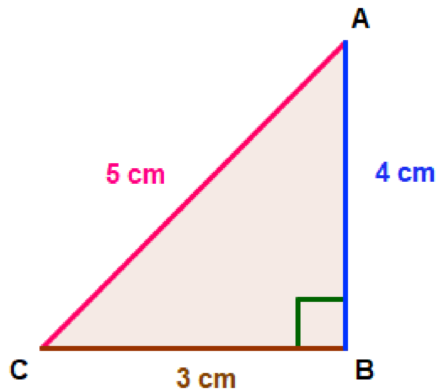


In the given figure, $\angle 1 + \angle 2 = \angle 3$.

For More Information On Exterior Angle Theorem, Watch The Below Video.

Pythagoras Theorem

- The side opposite to the right angle in a right-angled triangle is called the hypotenuse.
- The other two sides are known as legs of the right-angled triangle.
- In a right-angled triangle, square of hypotenuse is equal to the sum of squares of legs.



$AC^2=AB^2+BC^2$
$\Rightarrow 5^2=4^2+3^2$

- If a triangle holds Pythagoras property, then it is a right-angled triangle.

Properties of isosceles and equilateral triangles

Properties of Isosceles Triangle

- Two sides are equal in length.
- Base angles opposite to the equal sides are equal.

To know more about Properties of Isosceles Triangle, visit here.
Properties of Equilateral Triangle

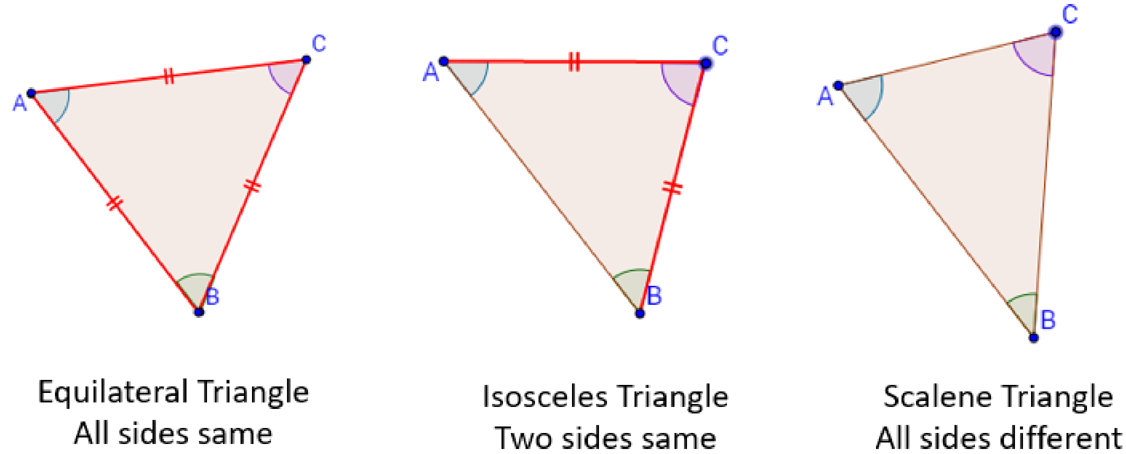
- All three sides are equal in length.
- Each angle equals to 60^0.

To know more about Properties of Equilateral Triangle, visit here.

Classification of Triangles

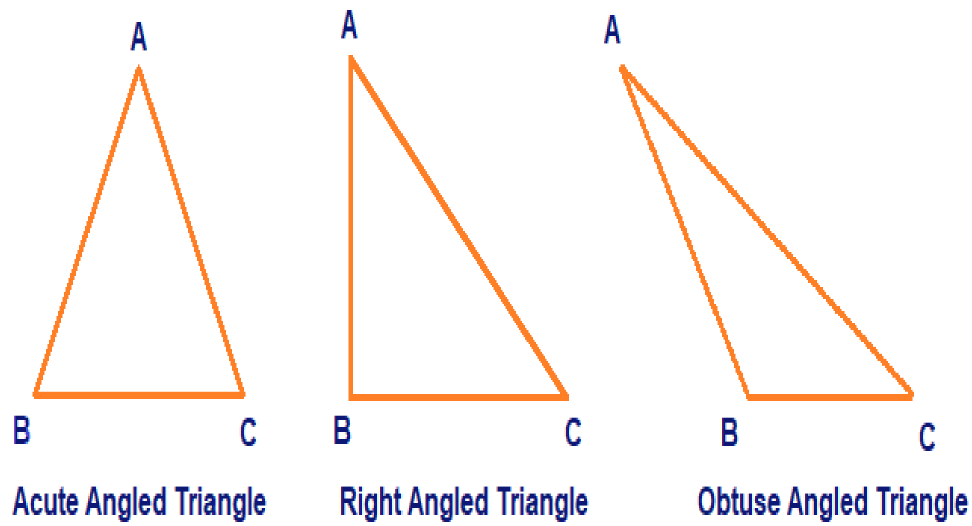
Classification of triangles based on sides

- Equilateral triangle: A triangle in which all the three sides are of equal lengths.
- Isosceles triangle: A triangle in which two sides are of equal lengths.
- Scalene Triangle: A triangle in which all three sides are of different length.



Classification of triangles based on angles

- Acute-angled: A triangle with three acute angles.
- Right-angled: A triangle with one right angle.
- Obtuse-angled: A triangle with one obtuse angle.



SUMMERY:

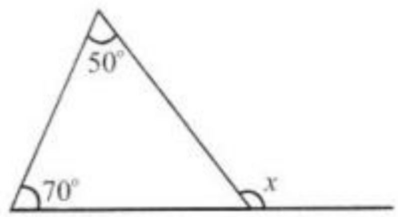
- Three non-collinear points in a plane form a triangle.
- A triangle has six elements, three sides and three angles.
- The sum of the angles of the triangle is 180°.
- The exterior angle formed in the triangle is equal to the sum of two interior angles.
- The sum of the two interior angles of the triangle is greater than third side.
- In a right angle triangle the sum of the square of the two sides is equal to the square of the hypotenuse.

ASSIGNMENT

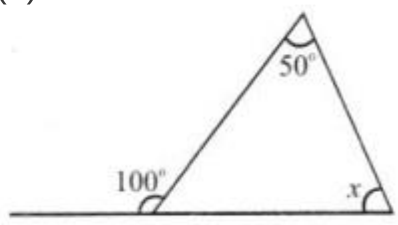
The Triangle and Its Properties Multiple Choice Questions (MCQs)

1. **How many medians a triangle can have?**
(a) 2
(b) 1
(c) 3
(d) 0
2. **A/an …………….. connect a vertex of a triangle to the mid point of the opposite side.**
(a) altitude
(b) median
(c) vertex
(d) none of these
3. **How many altitude can a triangle have?**
(a) 1
(b) 2
(c) 3
(d) 4

4. **Find the value of x in the adjoining figure.**
(a) 50°
(b) 70°
(c) 120°
(d) 180°

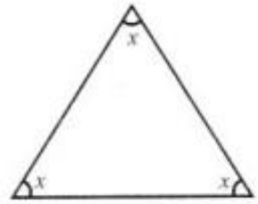


5. Find the value of x
(a) 60°
(b) 110°
(c) 50°
(d) 180°

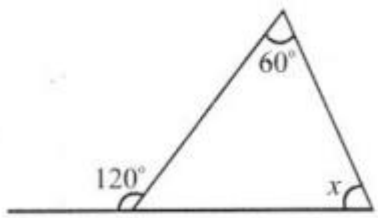


6. **A triangle in which two sides are of equal lengths is called …………………… .**
(a) Equilateral
(b) Isosceles
(c) Scalene
(d) Acute angled triangle
7. **In the Pythagoras property, the triangle must be …………….. .**
(a) acute angled
(b) right angled
(c) obtuse angled
(d) none of these
8. **Find the value of x in this figure.**
(a) 40°
(b) 60°
(c) 35°

(d) 180°



9. **Find the value’of x in given figure.**
(a) 180°
(b) 55°
(c) 90°
(d) 60°



10. **A triangle in which all three sides are of equal lengths is called ....**
(a) Equilateral
(b) Isosceles
(c) Scalene
(d) Acute angled triangle
11. **Δ ABC is right-angled at C. If AC = 5 cm and BC = 12 cm find the length of AB.**
(a) 7 cm
(b) 17cm
(c) 13 cm
(d) none of these
12. **PQR is a triangle right angled at P. If PQ = 3 cm and PR = 4 cm, find QR.**
(a) 7 cm
(b) 17 cm
(c) 13 cm
(d) none of these.
13. **Which is the longest side in the triangle PQR right angled at P?**
(a) PQ
(b) QR
(c) PR
(d) none of these.
14. **Which is the longest side in the triangle ABC right angled at B?**
(a) AB
(b) BC

(c) AC
(d) none of these.
15. **Which is the longest side of a right triangle?**
(a) perpendicular
(b) base
(c) hypotenuse
(d) none of these.
16. **In a ∆ ABC, ∠A = 35° and ∠B = 65°, then the measure of ∠C is:**
(a) 50°
(b) 80°
(c) 30°
(d) 60°
17. **The hypotenuse of a right triangle is 17 cm long. If one of the remaining two sides is 8 cm in length, then the length of the other side is:**
(a) 15 cm
(b) 12 cm
(c) 13 cm
(d) none of these.
18. **How many acute angles can a right triangle have?**
(a) 1
(b) 2
(c) 3
(d) 0
19. **The acute angles of right triangle are in the ratio 2 : 1. Find the measure of each of these angles.**
(a) 55° and 35°
(b) 60° and 30°
(c) 50° and 40°
(d) 45° and 45°
20. **One of the angles of a triangle is 100* and the other two angles are equal. Find the measure of each of these equal angles.**
(a) 45°
(b) 40°
(c) 41°
(d) 42°

Grade 7 Maths Lines and Angles Fill In The Blanks

1. Every triangle has at least ……………. acute angles.
2. The longest side of a right angled triangle is called its …………….. .
3. Median is also called …………….. in an equilateral triangle.
4. The line segment joining a vertex of a triangle to the mid-point of its opposite side is called its ……….. .
5. Measures of each of the angles of an equilateral triangle is ……………… .

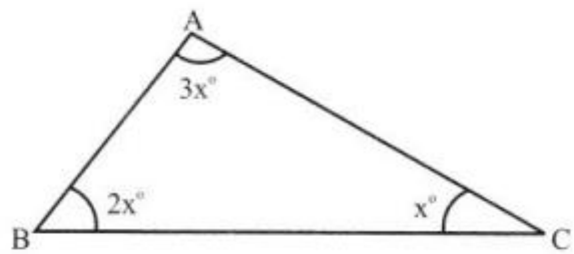
True(T) And False(F)

1. Sum of two sides of a triangle is greater than or equal to the third side.
2. The difference between the lengths of any two sides of a triangle is smaller than the length of third side.
3. Sum of any two angles of a triangle is always greater than the third angle.
4. It is possible to have a right angled equilateral triangle.
5. It is possible to have a triangle in which two of the angles are right angles.

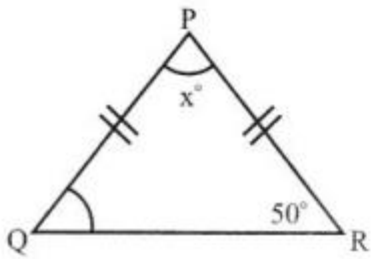
Very Short Answer Type Questions

Find the value of x:

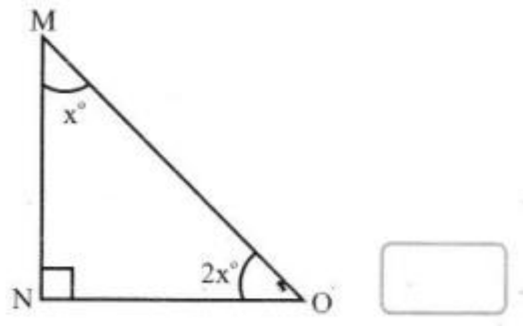
1.



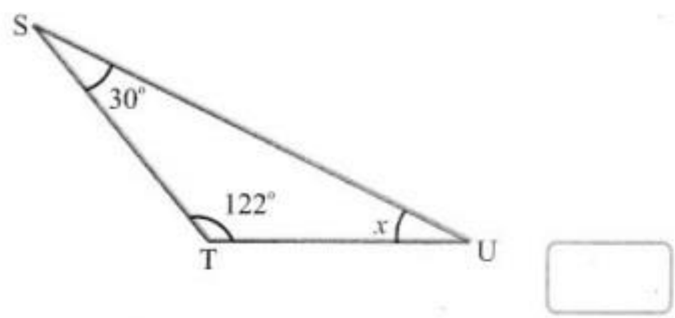
2.



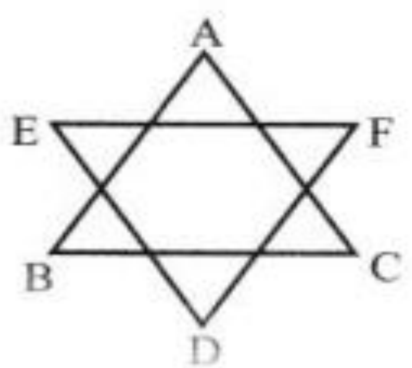
3.



4.



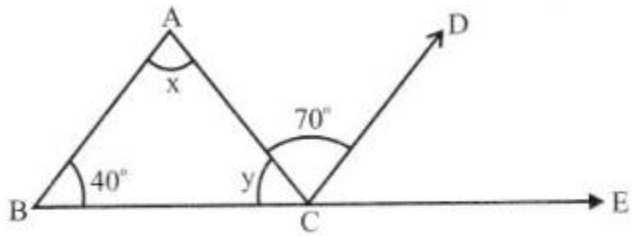
5. If one angle of a triangle is 60° and the other two angles are in the ratio 1 : 2, then find the angles.
6. In figure find the value of ∠A + ∠B + ∠C + ∠D + ∠E + ∠F



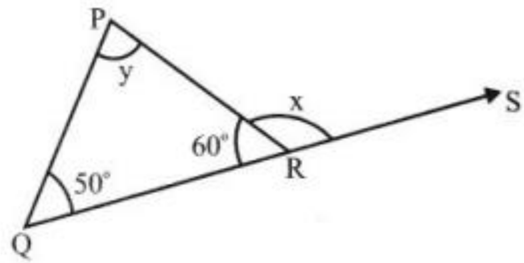
Short Answer Type Questions

Find the value of x an y:

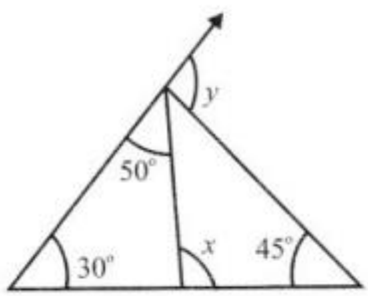
1. Here CD || AB



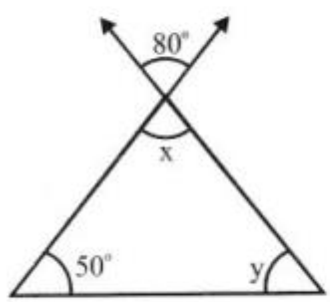
2.



3.



4.



Long Answer Type Questions

1. Two poles of 8m and 14m stand upright on a plane ground. If the distance between two tops is 10m. Find the distance between their feet.
2. Mohini walks 1200m due East and then 500m due North. How far is she from her starting point?

Mount Abu Public School

H-Block, Sector-18, Rohini, New Delhi-110085 India

SUBJECT: MATH

CLASS-7

PLANNER

WEEK: 15 FEBRUARY TO 21 FEBRUARY

TOPIC: CONGRUENCY OF TRIANGLES

SUBTOPIC:

- CONGRUENCE OF TRIANGLE
- PROPERTIES OF CENTROIDS & ORTHOCENTRE.
- PREPENDICULAR BISECTOR OF THE SIDES OF TRIANGLE.

GUIDELINES:

- REFER TO THE CONTENT GIVEN BELOW AND VIEW THE LINKS
- THE NOTES GIVEN BELOW WILL HELP YOU TO UNDERSTAND THE CONCEPT AND COMPLETE THE ASSIGNMENT THAT FOLLOWS
- THE ASSIGNMENT IS TO BE DONE IN MATH NOTE BOOK

INSTRUCTIONAL AIDS/RESOURCE

CHAPTER WILL BE EXPLAINED THROUGH POWER POINT PRESENTATION AND VIDEOS THROUGH ZOOM CLASSES,

CLICK ON THE LINKS BELOW TO UNDERSTAND THE CONCEPTS MORE

https://youtu.be/U7SDnAnnFU8

https://youtu.be/PL5mGOSGrao

https://youtu.be/GiGLhXFBtRg

LEARNING OBJECTIVES:

AT THE END OF THE LESSON EACH CHILD WILL BE ABLE TO

- UNDERSTAND THE CONGRUENCY OF TRIANGLE
- PROPERTIES OF VARIOUS PARTS OF TRIANGLE.

DEVELOPMENT OF THE CHAPTER

Congruence of Triangles

Congruence

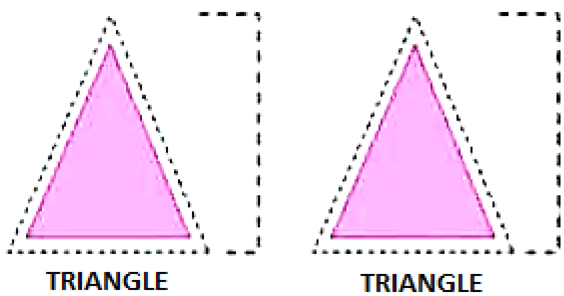
If we superpose one figure over other and they fit into each other then they must be congruent shapes. They must have the same shape and size.

Symbol of Congruence

$$\cong$$

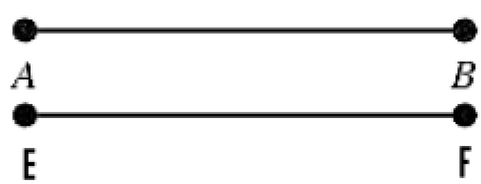
Congruence of 2-dimensional Shapes

In the case of 2D shapes, the two shapes will be congruent if they have the same shape and size. You cannot bend, stretch or twist the image.



Congruence among Line Segments

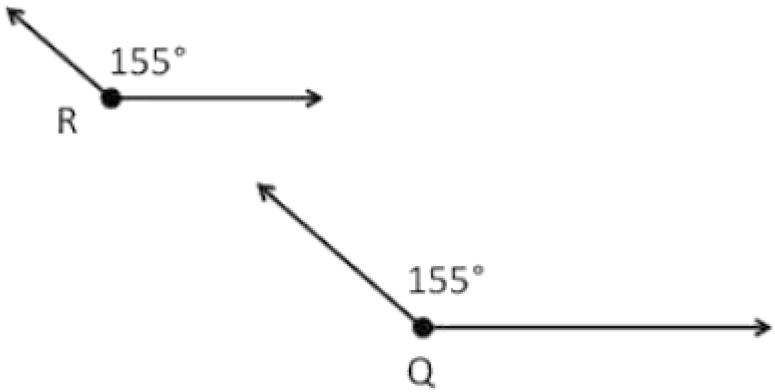
To check whether the line segments are congruent or not, we can superpose one line segment over another and if they completely cover each other then they must be congruent.



Two line segments are congruent if they have equal length and if two line segments have equal length then they must be congruent.

Congruence of Angles

Two angles of the same measurement are congruent and if two angles are congruent then their measurement must be the same.



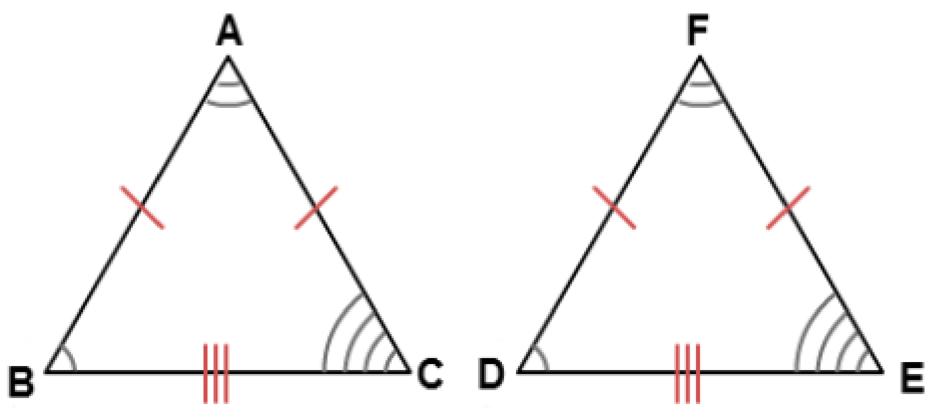
Here, ∠R ≅ ∠Q

Congruence of Triangle

If we superpose one triangle over other triangle and they cover each other properly, then they must be congruent triangles.

In case of congruent triangles-

- All the sides of one triangle must be equal to the corresponding sides of another triangle.
- All the angles of one triangle must be equal to the corresponding angles of another triangle.
- All the vertices of one triangle must be corresponding to the vertices of another triangle.



In the above triangles,

If, ΔABC ≅ ΔFDE then

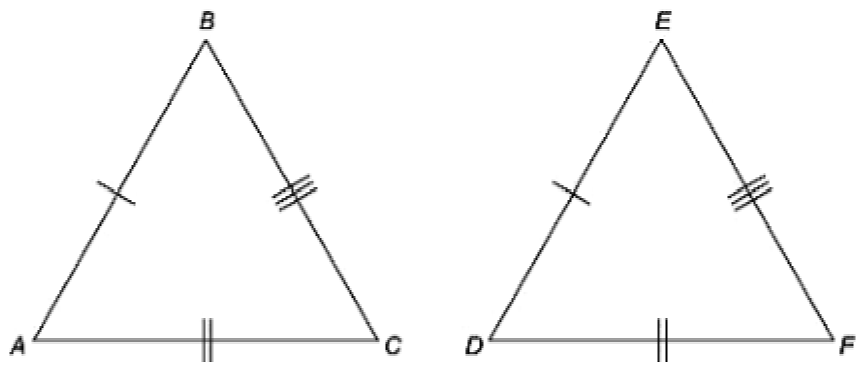
- Corresponding vertices are – ∠A ↔ ∠F, ∠B ↔ ∠D and ∠C ↔ ∠E
- Corresponding angles are - ∠A ↔ ∠F, ∠B ↔ ∠D and ∠C ↔ ∠E
- Corresponding sides are – AB ↔ FD, BC ↔ DE and AC ↔ FE

Remark: It is the order of the letters in the names of congruent triangles which tells the corresponding relationships between two triangles. If we change it from ∆ABC ≅ ∆FDE to ∆BCA ≅ ∆FDE, then it is not necessary that the two triangles are congruent as it is important that all the corresponding sides, angles and vertices are same.

The Criterion for Congruence of Triangles

1. SSS Criterion(Side-Side-Side)

This criterion says that the two triangles will be congruent if their corresponding sides are equal.

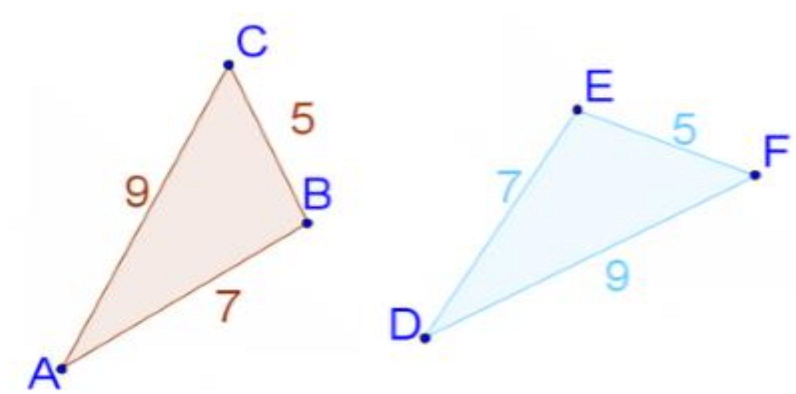


If **S**ide AB = DE
Side BC = EF
Side AC = DF

Then, ∆ABC ≅ ∆DEF

Example

In the two given triangles, ∆ABC and ∆DEF AB = 7 cm, BC = 5 cm, AC = 9 cm, DE = 7 cm, DF = 9 cm and EF = 5 cm. Check whether the two triangles are congruent or not.



Solution

In ∆ABC and ∆DEF,

AB = DE = 7 cm,

BC = EF = 5 cm,

AC = DF = 9 cm

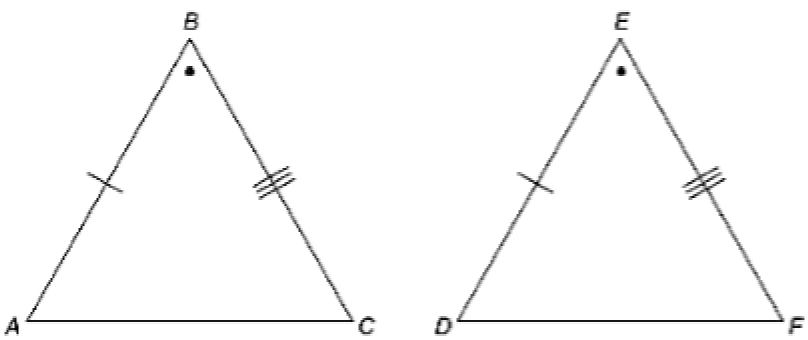
This show that all the three sides of ∆ABC are equal to the sides of ∆DEF.

Hence with the SSS criterion of congruence, the two triangles are congruent.

∆ABC ≅ ∆DEF

2. SAS Criterion(Side-Angle-Side)

This criterion says that the two triangles will be congruent if their corresponding two sides and one included angle are equal.



If **S**ide AB = DE
Angle ∠B = ∠E
Side BC = EF

Then, ∆ABC ≅ ∆DEF

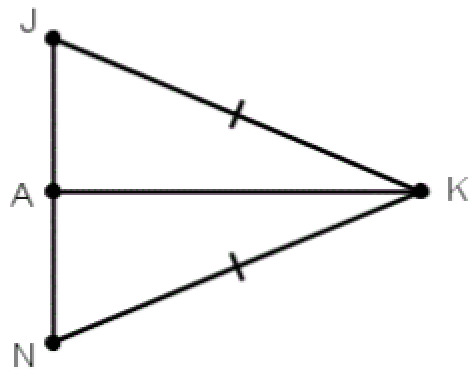
Example

In ∆JKN, JK = KN and AK is the bisector of ∠JKN, then

1. Find the three pairs of equal parts in triangles JKA and AKN.

2. Is ∆JKA ≅ ∆NKA? Give reasons.

Is ∠J = ∠N? Give reasons.



Solution

1. The three pairs of equal parts are:

JK = KN (Given)

∠JKA = ∠NKA (KA bisects ∠JKN)

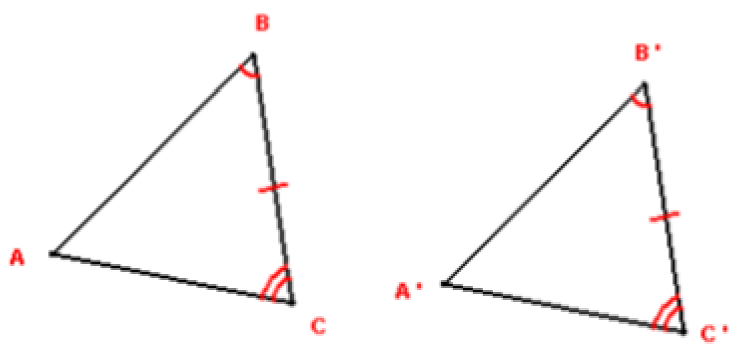
AK = AK (common)

2. Yes, ΔJKA ≅ ΔNKA (By SAS congruence rule)

3. ∠J = ∠N(Corresponding parts of congruent triangles)

3. ASA criterion(Angle-Side-Angle)

This criterion says that the two triangles are congruent if the two adjacent angles and one included side of one triangle are equal to the corresponding angles and one included side of another triangle.

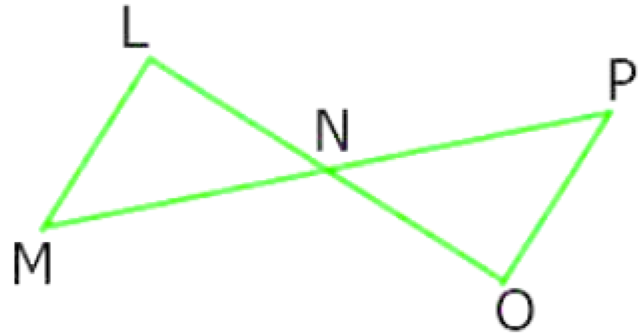


If **A**ngle ∠B = ∠B'
Side BC = EF
Angle ∠C = ∠C'

Then, ∆ABC ≅ ∆A'B'C'

Example

In ∆LMN and ∆OPN, if LMN = ∆NPO = 60°, LNM = 35° and LM = PO = 4 cm.Then check whether the triangle LMN is congruent to triangle PON or not.



Solution

In the two triangles ∆LMN and ∆OPN,

Given,

LMN = NPO = 60°

LNM = ∠PNO = 35° (vertically opposite angles)

So, ∠L of ΔLMN = 180° – (60° + 35°) = 85° (by angle sum property of a triangle) similarly,

∠O of ΔOPN =180° – (60° + 35°) = 85°

Thus, we have ∠L = ∠O, LM = PO and ∠M = ∠P

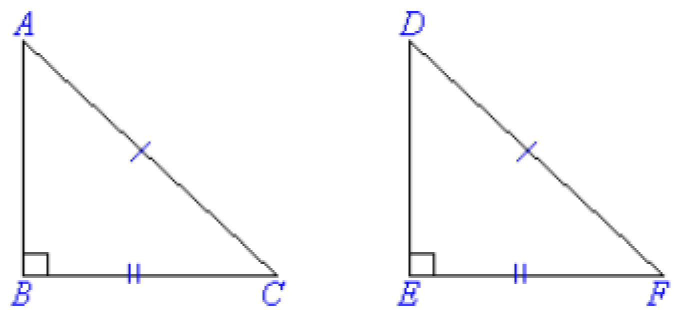
Now, side LM is between ∠L and ∠M and side PO is between ∠P and ∠O.

Hence, by ASA congruence rule,

∆LMN ≅ ∆OPN.

4. RHS Criterion(Right angle-Hypotenuse –Side)

This criterion says that the two right-angled triangles will be congruent if the hypotenuse and one side of one triangle are equal to the corresponding hypotenuse and one side of another triangle.

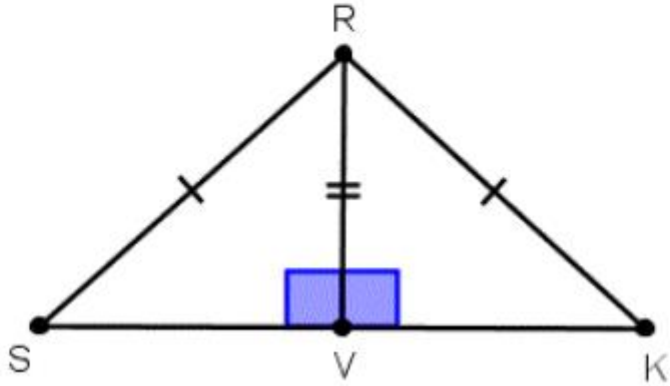


If **R**ight angle ∠B = ∠E
Hypotenuse AC = DF
Side BC = EF

Then, ∆ABC ≅ ∆DEF

Example

Prove that ∆RSV ≅ ∆RKV, if RS = RK = 7 cm and RV = 5 cm and is perpendicular to SK.



Solution

In ∆RSV and ∆RKV,

Given

RS = RK = 7 cm

RV = RV = 5 cm (common side)

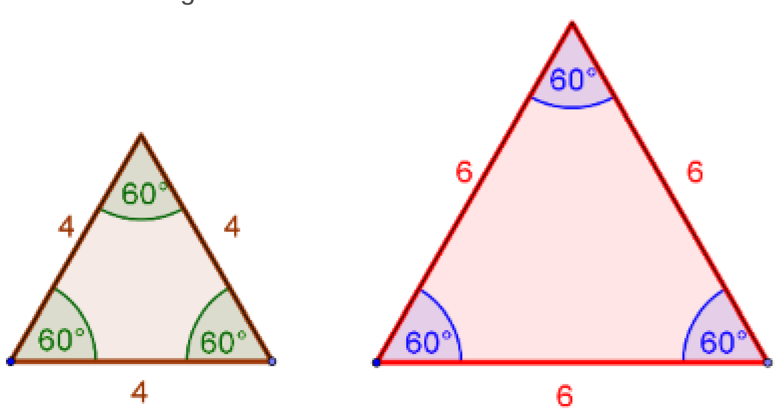
If RV is perpendicular to SK then

∠RVS = ∠RVK = 90°.

Hence, ∆RSV ≅ ∆RKV

As in the two right-angled triangles, the length of the hypotenuse and one side of both the sides are equal.

Remark: AAA is not the criterion for the congruent triangles because if all the angles of two triangles are equal then it is not compulsory that their sides are also equal. One of the triangles could be greater in size than the other triangle.

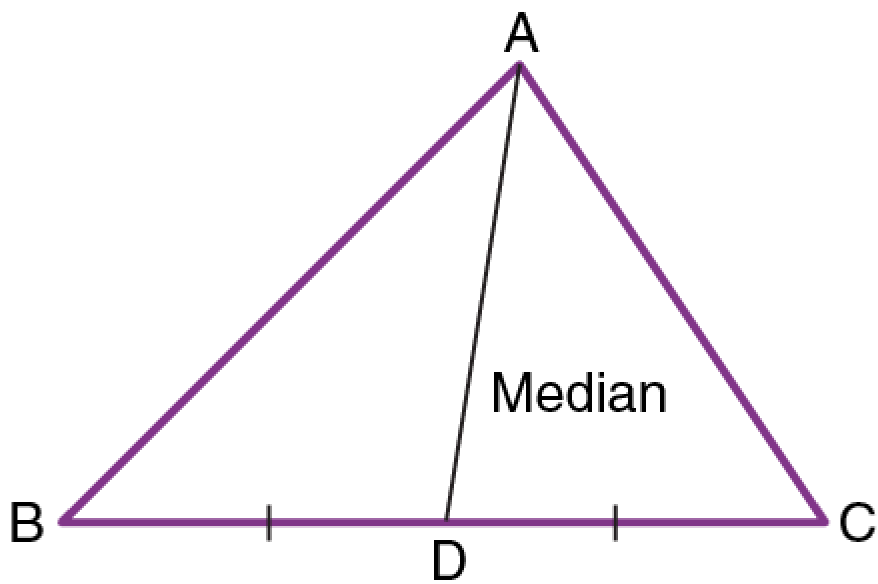


In the above figure, the two triangles have equal angles but their length of sides is not equal so they are not congruent triangles.

Altitude And Median Of A Triangle

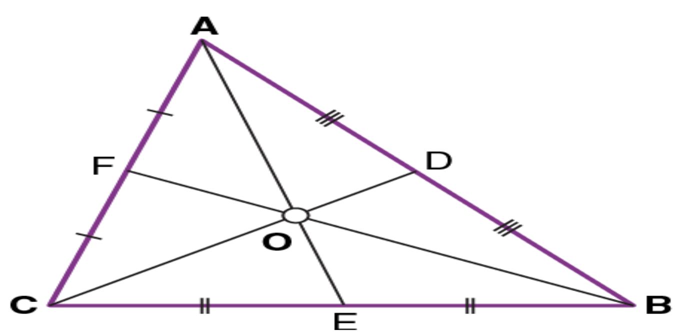
You are already aware of the term ‘triangle’ and its properties. Before exploring more about them, let us go through some of their basic properties. A triangle is a three-sided polygon which has 3 vertices and 3 sides enclosing 3 angles. Based on the length of its sides, a triangle can be classified into scalene, isosceles and equilateral. Based on the measure of its angles, it can be an acute-angled, obtuse-angled or right-angled triangle. The sum of interior angles in a triangle is 180 degrees. In this article, we introduce you to two more terms- altitude and median of the triangle.

Median of a Triangle



A median of a triangle is a line segment that joins a vertex to the mid-point of the side that is opposite to that vertex. In the figure, AD is the median that divides BC into two equal halves, that is, DB = DC.

Properties of Median of a Triangle



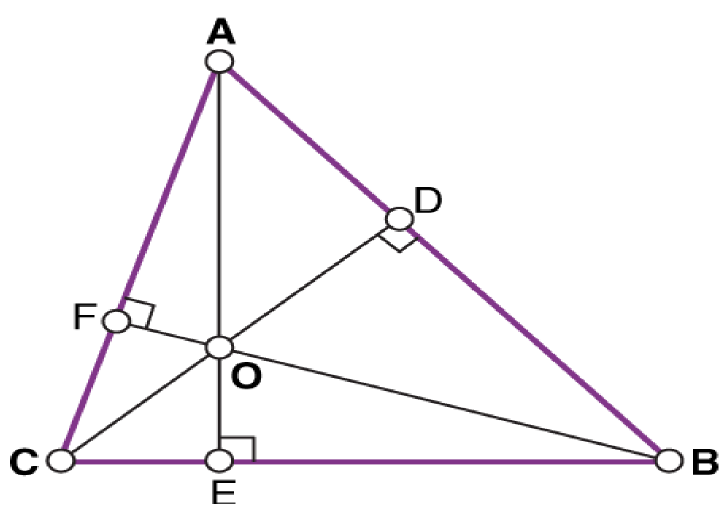
- Every triangle has 3 medians, one from each vertex. AE, BF and CD are the 3 medians of the triangle ABC.
- The 3 medians always meet at a single point, no matter what the shape of the triangle is.
- The point where the 3 medians meet is called the centroid of the triangle. Point O is the centroid of the triangle ABC.
- Each median of a triangle divides the triangle into two smaller triangles which have equal area.
- In fact, the 3 medians divide the triangle into 6 smaller triangles of equal area.

PROPERTIES OF CENTROID:

- The centroid is **the point** where the three medians of the triangle intersect.
- It has the following properties:
- The centroid is always located in the interior of the triangle.
- The centroid is located 2/3 of the distance from the vertex along the segment that connects the vertex to the midpoint of the opposite side.

Altitude of Triangle

An altitude of a triangle is a line segment that starts from the vertex and meets the opposite side at right angles.



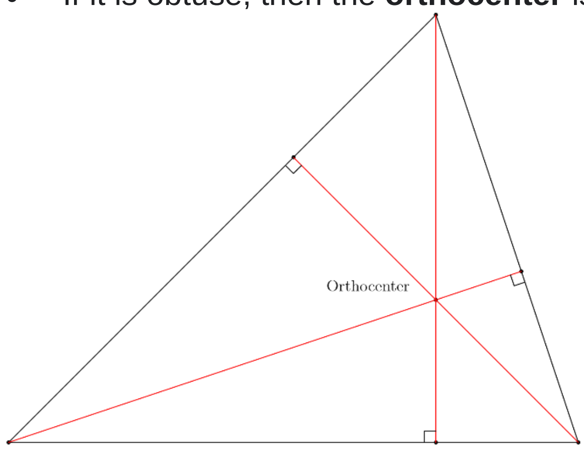
Properties of Altitudes of a Triangle

- Every triangle has 3 altitudes, one from each vertex. AE, BF and CD are the 3 altitudes of the triangle ABC.
- The altitude is the shortest distance from the vertex to its opposite side.
- The 3 altitudes always meet at a single point, no matter what the shape of the triangle is.
- The point where the 3 altitudes meet is called the ortho-centre of the triangle. Point O is the ortho-centre of the triangle ABC.
- The altitude of a triangle may lie inside or outside the triangle.

Properties of ortho-centre of a Triangle

Properties.

- The **orthocenter** and the circumcenter of a triangle are isogonal conjugates.
- If the **orthocenter's** triangle is acute, then the **orthocenter** is in the triangle.
- If the triangle is right, then it is on the vertex opposite the hypotenuse
- If it is obtuse, then the **orthocenter** is outside the triangle.

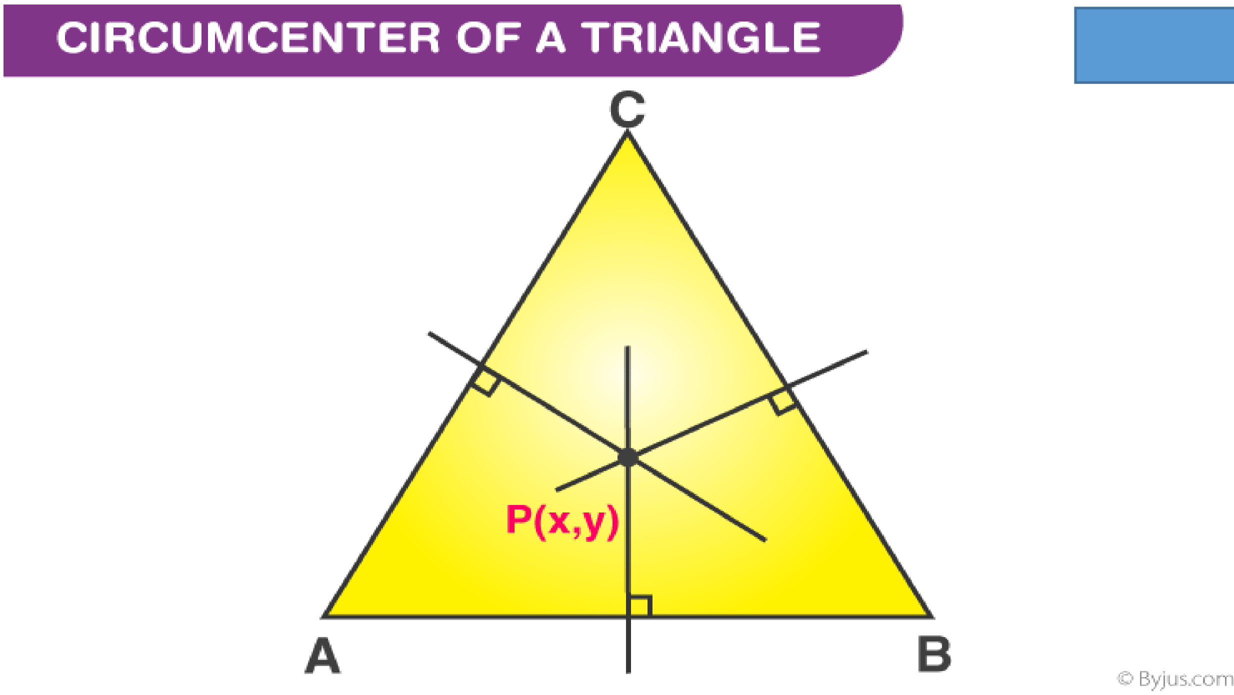


ANGLE BISECTOR - DEFINITION

Angle bisector of a triangle is a line segment which bisects an angle of a triangle.

Properties of Circumcenter

- The **circumcenter** is the **centre** of the circumcircle.
- All the vertices of a triangle are equidistant from the **circumcenter**.
- In an acute-angled triangle, **circumcenter** lies inside the triangle.
- In an obtuse-angled triangle, it lies outside of the triangle.

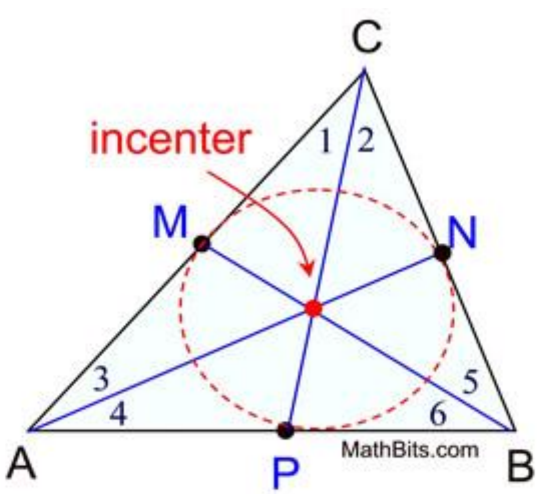


PERPENDICULAR BISECTOR - DEFINITION

Perpendicular bisector of a triangle is a line segment , which is perpendicular to the side and bisect it.

Properties of incentre

- The incentre of a triangle always lies in its interior.
- The incentre of the triangle is always equidistance from the all the sides od the triangle.



ASSIGNMENT

Fill in the blanks:

Question 1.

(a) Two objects with same shape and size are said to be

____

(b) The relation of two objects being congruent is called

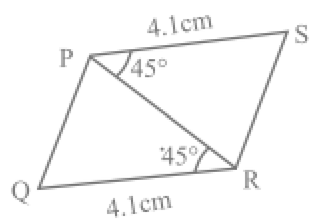
____

(c) Two line segments are said to be congruent if they have same

____

(d) If two angles are congruent, their __________________ are same.

(e) for the below figure



∆PQR≅∆∆PQR≅∆ _____

(f) Two triangles are congruent, if two angles and the side included between them in one of the triangles are equal to the two angles and the side included between them of the other triangle. This is known as the

____

(g) If all three _____________ of a triangle are respectively equal to that of other triangle, the triangle may not be congruent.

(h) In congruence condition RHS, 'H' stands for ______________________

(i)Two rectangles are congruent, if they have same _____ and ______

(j) Two squares are congruent, if they have same ______

True/false

Question 2.

(a) A circle of radius 10cm and a square of side 10cm are congruent.

(b) If the areas of two rectangles are same, they are congruent

(c) Two photos made up from the same negative but of different size are not congruence.

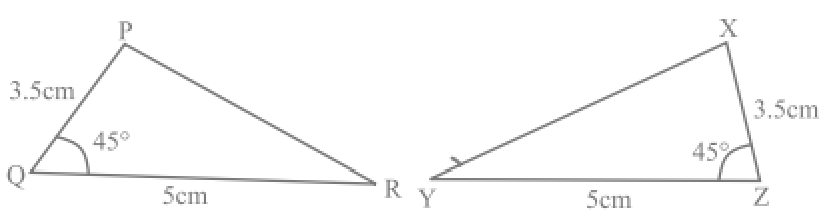
(d) if two sides and any angle of one triangle are equal to the corresponding sides and an angle of another triangle, then the triangles are not congruent.
(e) There is no AAA congruence criterion.
(f) Two circles having same circumference are congruent.
(g) If two triangles are equal in area, they are congruent.
(h) If two triangles are congruent, they have equal areas
. (i) AAS congruence criterion is same as ASA congruence criterion.
(j) $\Delta ABC \cong \Delta DFE$ $\Delta ABC \cong \Delta DFE$ implies $\Delta BAC \cong \Delta DEF$ $\Delta BAC \cong \Delta DEF$

Multiple Choice Questions

Question 3.
By which of the following criterion two triangles cannot be proved congruent?
(a) AAA
(b) SSS
(c) SAS
(d) ASA

Question 4.
$\Delta ABC \cong \Delta PRQ$ $\Delta ABC \cong \Delta PRQ$ and AB=5 cm, BC= 6 cm , AC=7 cm, What is the length of QR?
(a) 5 cm
(b) 6 cm
(c) 7 cm
(d) Cannot be determined

Question 5.
In the below figure , ΔPQR ΔPQR is congruent with the triangle



(a) ΔXYZ
(b) ΔXZY
(c) ΔYZX
(d) ΔZXY

Question 6.
If ΔPQR and ΔXYZ are congruent under the correspondence $QPR \leftrightarrow XYZ$, then which of the following is false
(a) $\angle R=\angle Z$,QR=XZ
(b) PQ=YX and PR=YZ
(c) $\angle P=\angle Y$ and QR= YZ
(d) $\angle Q=\angle X$

Question 7.
If for ΔABC and ΔDEF, the correspondence $CAB \leftrightarrow EDF$ gives a congruence, then which of the following is not true?
(a) AC = DE
(b) AB = EF
(c) $\angle A=\angle D$
(d) $\angle C=\angle E$

Question 8.
In triangles DEF and PQR, $\angle E=800$, $\angle F=300$, EF = 5 cm, $\angle P=800$, PQ = 5 cm, $\angle R=300$. By which congruence rule the triangles are congruent?
(a)SAS
(b)ASA
(c)SSS
(d) None of these

Question 9.
What is the side included between the angles M and N of ΔMNP?
(a)MN
(b)NP
(c) None of these
(d) MP

Numerical Type Questions

Question 10.
ΔABC is isoceles with AB=AC, AD is the altitude from A to side BC, prove that
(i) $\Delta ADB \cong \Delta ADC$
(ii) $\angle BAD = \angle CAD$

Question 11.
Prove that in an isosceles triangle, angles opposite to equal sides are equal.

Question 12.
Without drawing the triangles write all six pairs of equal measures in each of the following pairs of congruent triangles.
(a) $\Delta STU \cong \Delta DEF$
(b) $\Delta ABC \cong \Delta LMN$
(c) $\Delta YZX \cong \Delta PQR$
(d) $\Delta XYZ \cong \Delta MLN$

SUBJECT: MATH

CLASS-7

PLANNER

FEBRUARY

TOPIC: MENSURATION

SUBTOPIC:

- AREA
- VOLUME
- SURFACE AREA

NO. OF BLOCKS: 8

GUIDELINES:

- REFER TO THE CONTENT GIVEN BELOW AND VIEW THE LINKS
- THE NOTES GIVEN BELOW WILL HELP YOU TO UNDERSTAND THE CONCEPT AND COMPLETE THE ASSIGNMENT THAT FOLLOWS
- THE ASSIGNMENT IS TO BE DONE IN MATH NOTE BOOK

INSTRUCTIONAL AIDS/RESOURCE

CHAPTER WILL BE EXPLAINED THROUGH POWER POINT PRESENTATION AND VIDEOS THROUGH ZOOM CLASSES,

CLICK ON THE LINKS BELOW TO UNDERSTAND THE CONCEPTS MORE

- https://youtu.be/xzWA36_EUaU
- https://youtu.be/qnYh7UNGcFo
- https://youtu.be/J6sxf9LH7mQ
- https://youtu.be/GBUhADQim7o
- https://youtu.be/muw-MQeIkO4

LEARNING OBJECTIVES:

AT THE END OF THE LESSON EACH CHILD WILL BE ABLE TO

- understand area, perimeter, volume of various geometrical shapes
- Derive the surface area of the various geometrical shapes

DEVELOPMENT OF THE CHAPTER:

Mensuration

It is all about the measurement of area, perimeter and volume of the plane and solid figures.

Area

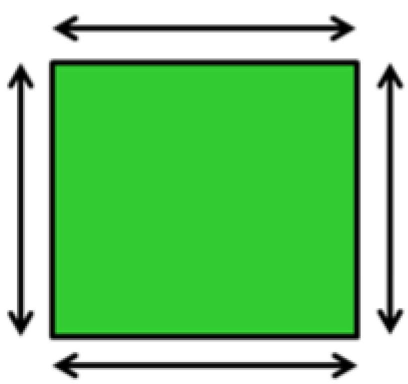
The surface covered by the border line of the figure is the area of the plain shape.

Unit of the area is square if the length unit.

Perimeter

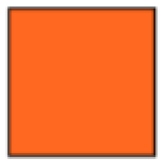
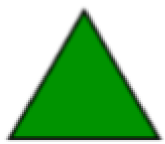
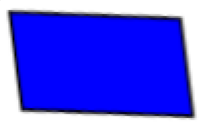
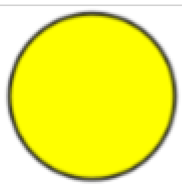
The perimeter is the length of the boundary of the plane shape.

The unit of the perimeter is same as the length unit.



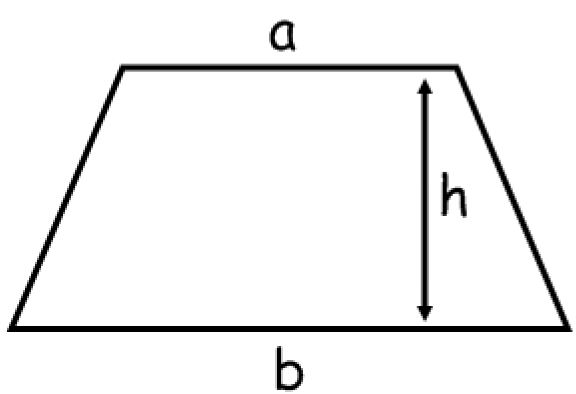
The green part is the area of the square and the distance all the way around the outside is the perimeter.

Area and Perimeter of Some 2D Shapes

Shape	Image	Area	Perimeter
Square		$(\text{Side})^2$	4 × Side
Rectangle		Length × Breadth	2(Length + Breadth)
Triangle		(1/2) × Base × Height where, a, b and c are the three sides of the triangle)	a + b + c
Parallelogram		Base × Height	2(sum of adjacent sides)
Circle		πr^2	$2\pi r$ Where, r = radius of the circle

Area of Trapezium

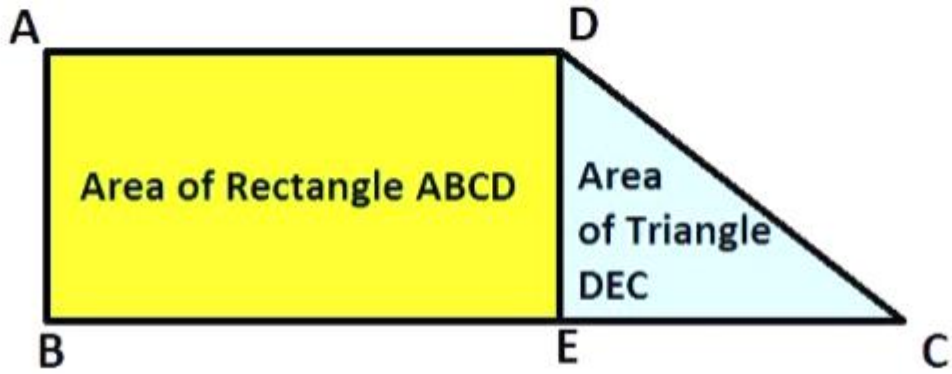
A trapezium is a quadrilateral whose two sides are parallel. And if its non-parallel sides are equal then it is said to be an isosceles trapezium.



Area of Trapezium can be found,

1. By Splitting the figure

One way to find the Area of trapezium is to divide it into two or three plane figures and then find the area.



In the trapezium ABCD,

It can be divided into two parts i.e. a rectangle and a triangle.

Area of ABCD = Area of ABED + Area of DEC

2. By using formula

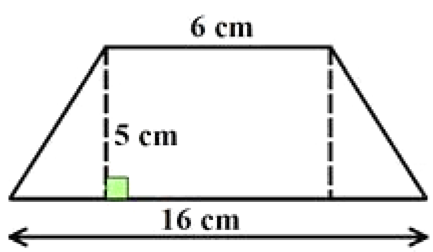
Another way is to calculate the area by using formula.

$$\text{Area of Trapezium} = \frac{1}{2}(a + b) \times h$$

Area of trapezium is half of the product of the summation of the parallel sides and the perpendicular distance between them.

Example

Find the area of the trapezium whose parallel sides are 6 cm and 16 cm, with a height of 5 cm. Calculate the area using both the methods.



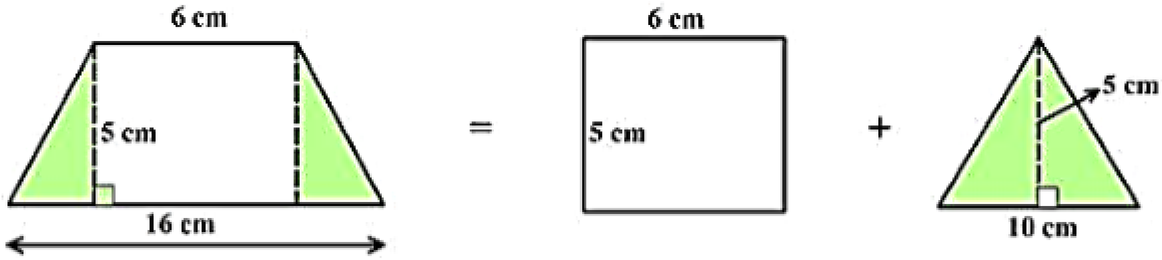
Solution:

$$\text{Area of Trapezium} = \frac{1}{2}(a+b)\times h$$

$$= \frac{1}{2}\times(6+16)\times 5$$

$$= 55\ cm^2$$

Splitting the trapezium we get –



Area of the trapezium = Area of rectangle + Area of a triangle

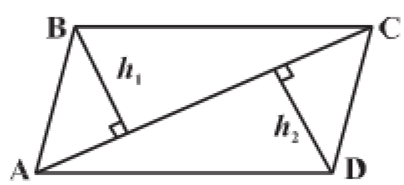
= (6 x 5) + (1/2) x 5 x 10

= 30 + 25

= 55 cm^2

Remark: We should use the formula most of the time if possible as it is the quick and easy method.

Area of a General Quadrilateral



To find the area of any quadrilateral we can divide it into two triangles and then the area can be easily calculated by calculating the area of both the triangles separately.

Area of ABCD = Area of ΔABC + Area of ΔACD

= (1/2) × AC × h_1 + (1/2) × AC× h_2

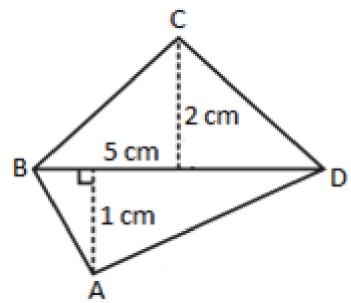
The formula for the Area of a General Quadrilateral

$$\text{Area of quadrilateral} = \frac{1}{2}(h_1 + h_2)d$$

Where h_1 and h_2 are the height of both the triangles and d is the length of common diagonal i.e.AC.

Example

Find the area of quadrilateral ABCD.



Solution:

In the quadrilateral ABCD,

BD is the common diagonal so d = 5 cm.

Height of the two triangles are h_1 = 2 cm and h_2 = 1 cm.

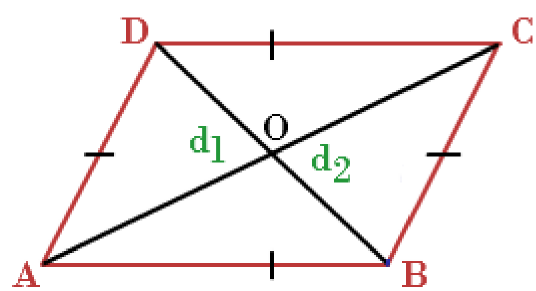
$$\text{Area of quadrilateral ABCD} = \frac{1}{2} \times (h_1 + h_2)d$$

$$= \frac{1}{2}(5)(2 + 1)$$

$$= 7.5 \text{ cm}^2$$

Area of Special Quadrilaterals (Rhombus)

A rhombus is a quadrilateral with all the sides are equal and parallel but not the right angle. Its two diagonals are the perpendicular bisector to each other.



In this also we can split the rhombus into two triangles and can find the area of rhombus easily.

Formula of Area of Rhombus

$$\text{Area of Rhombus ABCD} = \frac{1}{2} \times d_1 \times d_2$$

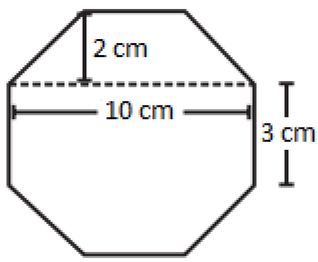
Area of rhombus is half of the product of its two diagonals.

Area of a Polygon

There is no particular formula for the area of the polygon so we need to divide it in a possible number of figures like a triangle, rectangle, trapezium and so on. By adding the area of all the split figures we will get the area of the required polygon.

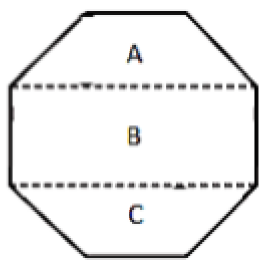
Example

Find the area of the given octagon.



Solution:

We can divide the given octagon into three parts.



Two trapezium A and B and one rectangle shown by part B.

Two trapezium A and B and one rectangle shown by part B.

Area of A = Area of B = (1/2) × (a + b) × h

= (1/2) x (10 + 3) × 2

= 13 cm^2.

Area of B = Length x Breadth

= 10 x 3

= 30 cm^2.

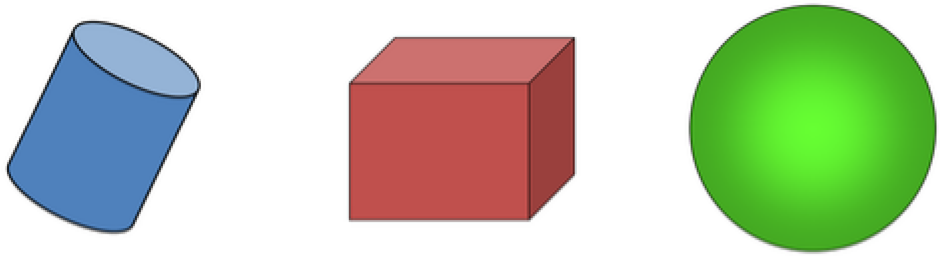
So, the area of Octagon = 2A + B

$= 2 \times 13 + 30$

$= 56\ cm^2$.

Solid Shapes

The 3-dimensional shapes which occupy some space are called solid shapes. Example- Cube, Cylinder, Sphere etc.



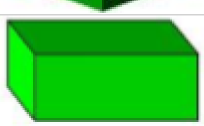
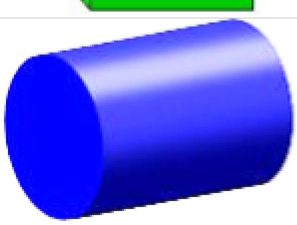
Surface Area

If we draw the net of the solid shape then we can see it's all the faces clearly and if we add the areas of all the faces then we get the total surface area of that solid shape. The unit of surface area is a square unit.

Lateral or Curved Surface Area

If we leave the top and bottom faces of the solid shape then the area of the rest of the figure is the lateral surface of the shape. The unit of lateral surface area is a square unit.

Surface Area of Cube, Cuboid and Cylinder

Name	Figure	Lateral or Curved Surface Area	Total Surface Area	Nomenclature
Cube		$4l^2$	$6l^2$	l = Edge of the cube
Cuboid		$2h(l + b)$	$2(lb + bh + lh)$	l = Length, b = Breadth, h = Height
Cylinder		$2\pi rh$	$2\pi r^2 + 2\pi rh = 2\pi r(r + h)$	r = Radius, h = Height

Volume

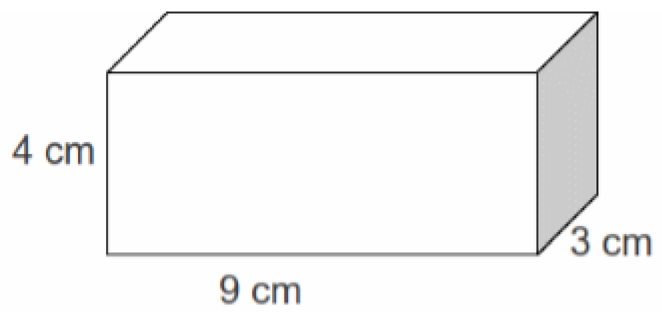
Volume is the space occupied by any solid figure i.e. the amount of capacity to carry something is the volume of that solid shape. The unit of volume is a cubic unit.

Volume of Cube, Cuboid and Cylinder

Name	Volume	Nomenclature
Cube	l^3	l = Edge of the cube
Cuboid	lbh	l = Length, b = Breadth, h = Height
Cylinder	$\pi r^2 h$	r = Radius, h = Height

Example 1

There is a shoe box whose length, breadth and height is 9 cm, 3 cm and 4 cm respectively. Find the surface area and volume of the shoe box.



Solution:

Given,

length = 9 cm

Breadth = 3 cm

Height = 4 cm

Area of cuboid = 2(lb + bh + lh)

= 2(9 × 3 + 3×4 + 9 × 4)

= 2(27 + 12 + 36)

= 2(75)

= 150 cm^2

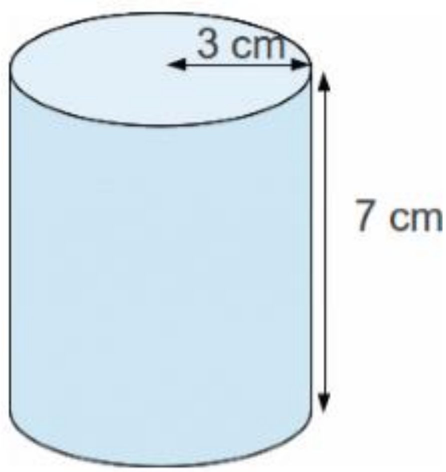
Volume of cuboid = lbh

= 9 × 3 × 4

= 108 cm^3

Example 2

If there is a cold drink can whose height is 7 cm and the radius of its round top is 3 cm then what will be the lateral surface area and volume of that cylinder? ($\pi = 3.14$)



Solution:

Given,

radius = 3 cm

Height = 7 cm

Lateral surface area of cylinder = $2\pi rh$

$= 2 \times 3.14 \times 3 \times 7$

$= 131.88\ cm^2$

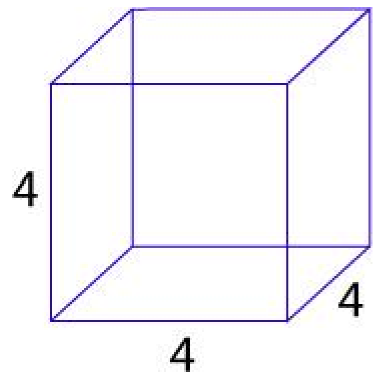
Volume of cylinder = $\pi r^2 h$

$= 3.14 \times 3 \times 3 \times 7$

$= 197.82\ cm^3$

Example 3

If there is a box of cube shape with the length of 4 cm then what will be the capacity of this box. Also, find the surface area of the box if it is open from the top.



Solution:

Given, side = 4 cm

Capacity or volume of the box = s^3

$= 4^3 = 64\ cm^3$

The total surface area of the box = $6s^2$

But, if the box is open from the top then the surface area will be total surface area minus the area of one face of the cube.

Surface Area = Total Surface Area - Area of one face

$= 6s^2 – s^2$

$= 5s^2 = 5 \times 4^2$

$= 80\ cm^2$

Volume and Capacity

Volume and capacity are one and the same thing.

Volume is the amount of space occupied by a shape.

Capacity is the quantity that a container can hold.

Capacity can be measured in form of liters.

We can see the relation between liter and cm^3 as,

1 L = 1000 mL

1 mL = 1 cm^3,

1 L = 1000 cm^3.

Thus, 1 m^3 = 1000000 cm^3 = 1000 L.

ASSIGNMENTS

1. The parallel sides of a trapezium measure 12 cm and 20 cm. Calculate its area if the distance between the parallel lines is 15 cm.

2. Calculate the height of a cuboid which has a base area of 180 cm^2 and volume is 900 cm^3.

3. A square and a rectangle have the same perimeter. Calculate the area of the rectangle if the side of the square is 60 cm and the length of the rectangle is 80 cm.

4. A lawnmower takes 750 complete revolutions to cut grass on a field. Calculate the area of the field if the diameter of the lawnmower is 84 cm and length is 1 m.

5. The area of a rhombus is 16 cm^2 and the length of one of its diagonal is 4 cm. Calculate the length of other the diagonal.

Long Answer Type Questions:

6. From a circular sheet of radius 4 cm, a circle of radius 3 cm is cut out. Calculate the area of the remaining sheet after the smaller circle is removed.

7. A cuboidal box of dimensions 1 m × 2 m × 1.5 m is to be painted except its bottom. Calculate how much area of the box has to be painted.

8. In a trapezium, the parallel sides measure 40 cm and 20 cm. Calculate the area of the trapezium if its non-parallel sides are equal having the lengths of 26 cm.

9. A flooring tile is in the shape of a parallelogram with 24 cm base and the corresponding 10 cm height. Calculate the number of tiles required to cover a floor of area 1080 m^2 (If required you can split the tiles in whatever way you want to fill up the corners).

10. Two cubes are joined end to end. Now, calculate the volume of the resulting cuboid, if each side of the cubes is 6 cm.

11. How many bricks each 25 cm by 15 cm by 8 cm, are required for a wall 32 m long, 3 m high and 40 cm thick?