

Grade 7

Properties of triangles – LP

Objectives:

1. SWBAT identify all the elements in a triangle and illustrate them.
2. SWBAT identify/illustrate medians and altitudes of triangles.
3. SWBAT state and verify exterior angle property of triangle.
4. SWBAT state and verify angle sum property of triangle.
5. SWBAT state and verify sum of two sides of a triangle is greater than its third side.
6. SWBAT articulate the differences between the Equilateral, Isosceles and Right angled triangle

Revision: (through oral questions and worksheets)

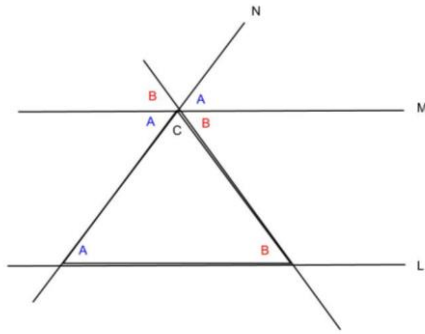
1. Triangle is a closed figure with has three angles, three sides, three vertices.
2. How to name and read an angle and a triangle .
3. Sum of all angles of a triangle is 180 degree irrespective of type / size of the triangle.
4. Acute angled triangle: all three angles of the triangle are acute
5. Obtuse angled triangle: one angle out of the three is obtuse.
6. Right angled triangle : one out of the three angles of a triangle is right angle.
7. Isosceles , equilateral and scalene triangles.
CFU: can an equilateral / isosceles triangle be a right angled triangle ?
CFU: can two / three angles of a triangle be acute / obtuse / right?
8. Angles made by a transversal and two parallel lines:
 - a) Corresponding angles : equal
 - b) Alternate angles: equal
 - c) Interior angles: sum 180 degrees
 - d) Vertically opposite angles: equal
 - e) Linear angles: sum 180 degrees

A] Sum of the measure of all angles of a triangle is always 180 degree.

Activity: Ask students to draw small triangles in their books (2 triangles each) . Let them measure every angle of both the triangles (using a protractor) and find out the sum of the measure of the angles of each of the triangle respectively. Let them share their observations.

All students will find out that the sum of the measure of all the three angles of a triangle is always 180 degree irrespective of the shape, size or type of the triangle.

Ask them to think and find out for themselves why it is so. How is it that the total is 180 degree every time for every triangle? (Let students take an entire day to come up with the proof by themselves. You can give them a hint as support : they should make the triangle between two parallel lines with the sides of the triangles as a transversal (as shown below)



Let them use their understanding about the various angles made by the transversal with the two parallel lines and find out the proof for themselves.

In the next session invite students to present their proof on the board. If none of them are being able to explain it correctly, explain it step wise to them.

B] Measure of the exterior angle of a triangle is always equal to the sum of the measure of the two interior angles of the triangle:

Ask students to draw a triangle and name it ABC. Let them extend BC to D.

Ask students to observe the triangle and note down their observations about

- the total of the measures of all three angles of the triangle and
- the relationship between angle ACB and angle ACD

(Give students around 4-5 mins to find it out themselves)

- $m\angle ABC + m\angle BCA + m\angle CAB = 180^\circ$ - sum of the measures of a triangle
- $m\angle ACB + m\angle ACD = 180^\circ$ linear pair of angles.
- If R.H.S of both 'a' and 'b' is 180° , then L.H.S of both the equations is also equal to each other. Thus,

$$m\angle ABC + m\angle BCA + m\angle CAB = m\angle ACB + m\angle ACD$$

Here, $m\angle BCA$ on the L.H.S = $m\angle ACB$ in the R.H.S hence they get cancelled.

Thus, $m\angle ABC + m\angle CAB = m\angle ACD$ where $\angle ACD$ is the exterior angle of $\triangle ABC$ and $\angle ABC$ and $\angle CAB$ are the interior angles of $\triangle ABC$.

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

Activity : Take a small piece of thermocol sheet to the class along with 3 board pins. Also carry a long piece of thread/ ribbon (around 30 cm). Place two pins in a straight line at a distance of 14 cm from each other.

Ask: Can I place the third pin between these two pins in a straight line if I want to make a triangle?

No. Which means we'll need to place the third pin slightly or more away from the straight line made by the two pins. Suppose I want the measure of the second side to be 8 cm. Here, we see that the third side cannot be 6cm or lesser ($8+6=14$) else the third pin would fall on the straight line. It also cannot be more than ($14+8=22$), thus the measure of the third side of this triangle can should be more than 6 cm but less than 22 cm.

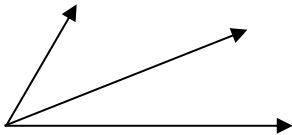
Thus the sum of the lengths of any two sides of a triangle is always greater than the third side.

Median, Altitude of a triangle:

a) **Midpoint:** The point that divides a given line segment into exactly two halves. Midpoint of a segment which is 8 cm long will be the point on that segment which is at 4 cm from both the ends.

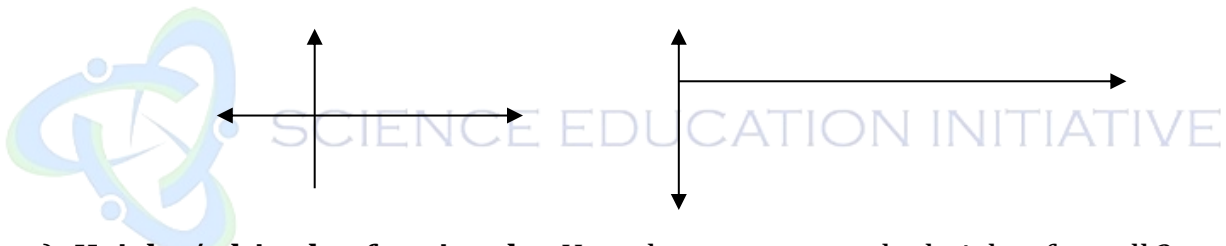
b) **Bisector:** The line passing through the midpoint of a segment thus dividing it into two equal halves is the bisector of that segment / segment bisector.

- The line that divides an angle into two halves is called an **angle bisector**.



c) **Concurrent lines :** Lines which pass from a common point . The point where these lines meet is called the point of concurrence.

d) **Perpendicular lines :** when lines meet at a right angle (90°), they are said to be perpendicular lines .



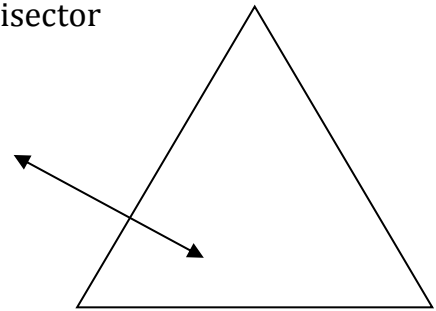
e) **Height / altitude of a triangle :** How do we measure the height of a wall ? or our own height ? from the ground level to the peak of the object of which height is to be measured. Similarly in a triangle , consider one of its side at a time as the base. The segment that joins the vertex to the side opposite to it is called the altitude of the triangle. (one of the three altitudes that a triangle can have)

- Every triangle will have three altitudes. (one from each vertex to its opposite side)
- All three altitudes of a triangle are always concurrent. (make students draw and check this)
- The altitude determines the height of the triangle w.r.t. that particular base
- An altitude does not necessary join the midpoint of the side of the triangle.

f) **Perpendicular bisector :**

A perpendicular that divides a segment into two equal halves:
in this case, the perpendicular that divides the side of the triangle into two equal parts is the perpendicular bisector of that side of the triangle.

- Every triangle will have three Perpendicular Bisectors (One each for all the three sides)
- All three perpendicular bisectors of a triangle are concurrent.



g) **Median of a triangle:**

The segment from the midpoint of the side of the triangle to the opposite vertex is called the median of the triangle.

- Every triangle always has three medians (One each for all the three sides)
- All three medians of a triangle are concurrent

