

TITLE OF LESSON

Geometry Unit 1 Lesson 23 – Triangles, Part 3

Prove it! What's on the outside? What's on the inside? Of Geometry

TIME ESTIMATE FOR THIS LESSON

One class period

ALIGNMENT WITH STANDARDS

California – Geometry

4.0 Students prove basic theorems involving congruence and similarity.

8.0 Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures

MATERIALS

None

LESSON OBJECTIVES

To introduce the following concepts:

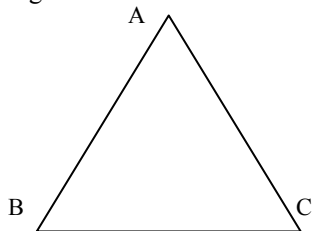
- Base
 - Leg
 - Base of an isosceles triangle
 - Legs of an isosceles triangle
 - Base Angle
 - Vertex Angle
 - Perpendicular
 - Altitude
 - Hypotenuses
 - Legs of a right triangle
 - Median
 - Angle Bisector
-

FOCUS AND MOTIVATE STUDENTS

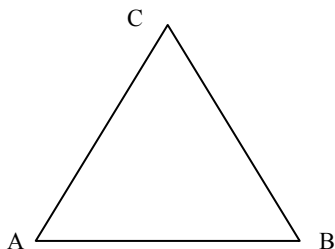
- 1) Homework Check – Stamp/initial complete homework assignment. Pass back graded work and have students place in the appropriate sections of their binders.
 - 2) [Agenda](#) – Have students copy the agenda.
 - 3) Review Homework – (5 minutes) Review homework from Lesson 22. Each student will present to the class one example of two of the following and explain how it works as that particular triangle:
Equilateral Triangle
Isosceles Triangle
Acute Triangle
Obtuse Triangle
Scalene Triangle
Right Triangle
-

ACTIVITIES – INDIVIDUAL AND GROUP

1. Teacher Demo: What is the base of a triangle?– (10 minutes) Divide students into groups of three or four. State the following to the class: *The base of a triangle is the side that is drawn at the bottom of the triangle. Every triangle has three sides. Each of these sides can be thought of as the base of the triangle. We can therefore state that each triangle has three bases since it has three sides.* For instance, the triangle ABC is drawn so that the base of the triangle is the side CB. The base is the side of the triangle that is at the bottom of the triangle.



However we could have drawn the same triangle from a different perspective. We could have drawn the triangle so that the side AB is at the bottom. In this case we would say that the base is AB.



2. Definition: Base – Write the following definition on the board and have students write it in the *terms and definitions* section of their binders. *The base of a triangle is any one of its sides.* The base is generally considered to be the side that is drawn at the bottom of the triangle.

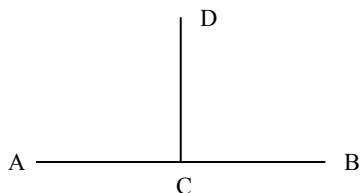
In the case of an isosceles triangle, the base is the third side as distinguished from the two equal sides. Ask for a student to remind the class what an isosceles triangle is.

3. Definition: Legs – Write the following definition on the board and have students write it in the *terms and definitions* section of their binders. *The legs of a triangle are the two sides that are not the base.* In the case of an isosceles triangle, the legs are the two equal sides of a triangle.
4. Group Work: Base and Legs – Now, working in their groups, have each group draw two different kinds of triangles and label the vertices of each A, B, and C. Next, they should label the *base* and the two *legs* of each triangle. Now, have them redraw both triangles so that a different side of each is drawn at the bottom. Relabel the base and the two legs.

Have each group draw an isosceles triangle. Label the base and the legs. Have a representative from one group do the first drawing on the board, being sure to label the legs and the base. Have someone from another group redraw the triangle and relabel the legs and the base. Have a third group redraw the triangle again and relabel the legs and the base.

5. Lecture: Altitude – (15 minutes) Next you'll introduce the concept of the *altitude* of a triangle. Every triangle has three altitudes. In order to understand the concept of an altitude you have to understand the idea of a perpendicular angle.

A *perpendicular angle* is a 90° angle. When we draw a line that is perpendicular to another line we are forming a perpendicular, or 90° angle with the two lines (or line segments). For instance in the drawing below, line segment AB is perpendicular to line segment CD. We also say that line segment CD is perpendicular to line segment AB since the property of being perpendicular is symmetric. Refresh the students' memory regarding the idea of symmetric property. The symbol for perpendicular is \perp . Draw this symbol on the board. We say that the angle ACD is a perpendicular angle.

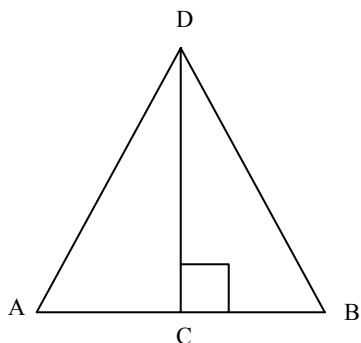


Perpendicular:
AB is perpendicular to CD and
CD is perpendicular to AB.

Have the students write the definition of a perpendicular angle into their binders under *terms and definitions*.

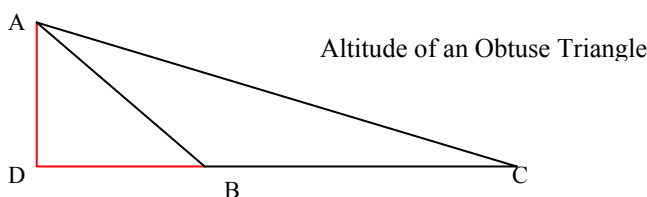
Looking at the picture you've drawn on the board and they've copied into their binders, have them tell you what the measurement of $\angle ACD$ is. (90°) And $m\angle BCD$? (90°)

7. Definition: Altitude – Write the following definition on the board: *An altitude is the perpendicular segment from a vertex to its opposite side.* In their groups still, have students discuss what they think this means. Ask for a volunteer to draw a representation of this idea on the board. The drawing should look like the following drawing:



If it is not done correctly ask if any other students have an idea of how it might be drawn. If you get to a drawing that is acceptable, congratulate the class, otherwise congratulate them for the effort and put this drawing on the board. Note the designation for the right angle DCB. Also note that the altitude is the segment CD. What do you notice about the altitude, what do you see? (It has divided the triangle ABD into two right triangles). What does this imply about angle ACD? (It is also a right angle.) What does this say about angles ACD and DCB? (They are complimentary angles since together they form a straight angle or their addition is 180° .)

For an obtuse triangle, draw triangle ABC (below), then as you demonstrate how to create a perpendicular angle with an obtuse triangle, add line segments CD and AD.

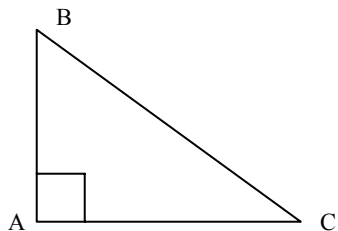


The altitude of the obtuse triangle ABC is the line segment AD. Note that this fulfills the definition of an altitude. It is drawn from vertex C and is perpendicular to the opposite side BC. Put this drawing on the board and point out the consistency with the definition of altitude. This is a little tricky so tell students that when they really can't find any way to create a perpendicular *within* a triangle, they have to think 'outside the box' and make their own.

6. Definition: Vertex and Base Angles – (5 minutes) Write the following on the board. In an isosceles triangle, the angle formed by the two equal sides is known as the *Vertex Angle*. The *Base Angles* are the other two angles. Have the students write these definitions into their binders. Make a drawing of an isosceles triangle on the board. Do not label it. Ask each group to draw the triangle and label the base, the legs, the vertex angle and the base angles. Have each group send one representative in succession to label the drawing on the board.
7. Definition – (5 minutes) In a right triangle the side opposite the right angle is called the *hypotenuse*. The other two sides are called legs. Write this definition on the board and have the students write the definition into their binders. Have each group come up with a drawing that describes the hypotenuse and the two legs of a right triangle.

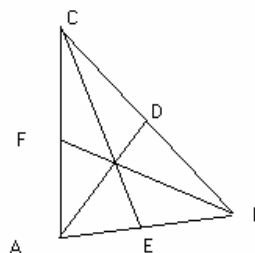
In the drawing above the side BC is the hypotenuse and the legs are sides AB and AC. The drawing on the

board should resemble this drawing. What can we say about angles ABC and BCA? (They add up to 90° and are therefore supplementary angles.)



8. Definition: Median – (5 minutes) Write the following definition on the board. Have the students copy it into their binders. A *Median in a triangle* is the line segment drawn from a vertex to the middle of the opposite side. Every triangle has three medians. An interesting property of the three medians is that they meet at the same point. We will prove this later. Note this property.
9. Group Work: Medians – Have each group draw a triangle and the three medians. Have each group replicate their drawing on the board. Remember that they will look slightly different since the triangle might look slightly different. Each vertex should be labeled and each median should be labeled. The three medians should intersect in one point. This might be a bit hard to work exactly so be a bit patient regarding this intersection point. If the

Medians of a Triangle

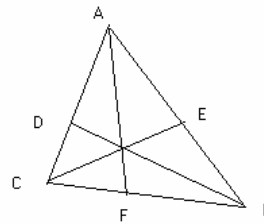


Medians of a triangle

drawing is close, that is good. If the three medians do not come close to intersecting there is a problem. The drawing below had triangle ABC with medians AD, BF and CE.

10. Definition: Angle Bisector – (5 minutes) Write the following definition on the board. Have the students copy it into their binders. An *angle bisector* in a triangle is a line segment drawn from a vertex to the opposite side in which the line segment bisects the vertex angle. An interesting property of the three angle bisectors is that they meet at the same point. We will prove this later. Note this property.
11. Group Work: Angle Bisectors – Have each group draw a triangle and the three angle bisectors. Have each group replicate their drawing on the board. Remember that they will look slightly different since the triangle might look slightly different. Each vertex should be labeled and each angle bisector should be labeled. The three angle bisectors should intersect in one point. Again, it can be difficult to get this exactly. If the drawing is close, that is good. If the three angle bisectors do not come close to intersecting there is a problem. The drawing below had triangle ABC with angle bisectors AF, BD and CE.

Angle Bisectors



Angle Bisectors

12. Homework Review – Explain the homework assignment. Answer any questions.

HOMEWORK

Make drawing to describe the following properties of triangle. Each drawing should be labeled completely so that someone can observe the drawing and understand what is being described. When we go over this homework it will be the task of someone else to interpret the drawing.

- Base
 - Leg
 - Base of an isosceles triangle
 - Legs of an isosceles triangle
 - Base Angle
 - Vertex Angle
 - Perpendicular
 - Altitude
 - Hypotenuses
 - Legs of a right triangle
 - Median
 - Angle Bisector
-

GROUP ROLES

Students will be working in groups during most of this class period.

DOCUMENTATION FOR PORTFOLIO

None