

Special Segments in Triangles

You will need

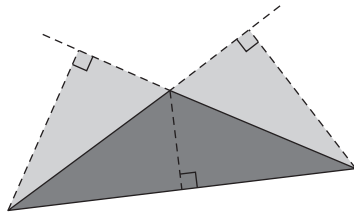
- a protractor
- a ruler

► GOAL

Identify the altitudes, medians, and angle bisectors in a triangle.

Learn about the Math

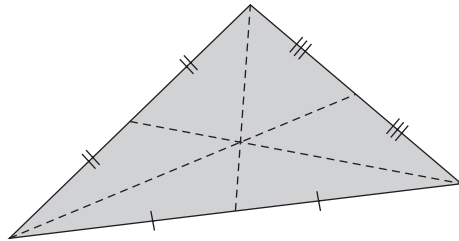
Every triangle has three bases and three **altitudes** (or heights). Every altitude is the perpendicular segment from a vertex to its opposite side (or the extension of the opposite side). Some altitudes overlap with a side of the triangle or meet an extended base outside the triangle.



altitude

the perpendicular segment from a vertex to its opposite side

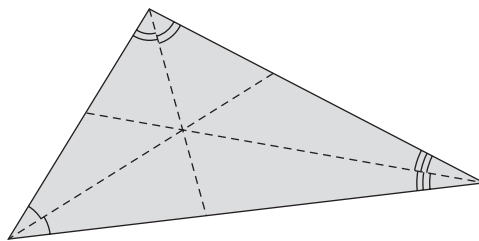
Every triangle also has three **medians**.



median

the line segment drawn from a vertex to the midpoint of its opposite side

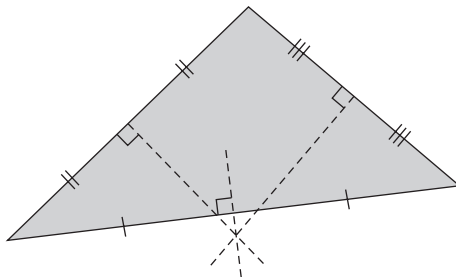
Another important line in a triangle is an **angle bisector**. Every angle in a triangle has a bisector; therefore, there are also three angle bisectors in every triangle.



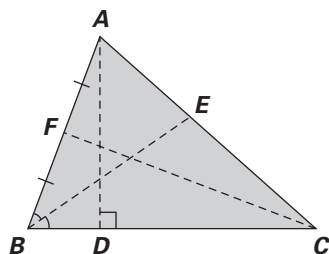
angle bisector

a line segment drawn from a vertex that cuts that vertex angle in half

Another special segment in a triangle is the **perpendicular bisector**. The perpendicular bisectors of a triangle may meet inside, outside, or on the triangle.



Kurt is trying to label an altitude, median, and angle bisector for this triangle.



? How can Kurt determine which lines are the altitudes, medians, or angle bisectors in a triangle?

Example 1: Identifying an altitude, a median, and an angle bisector in a triangle

Which line in the above triangle is an altitude? a median? an angle bisector?

Raven's Solution

I can determine which line is an altitude because an altitude is the perpendicular segment from a vertex to its opposite side. The altitude is the same as the height of a triangle; therefore, the altitude of $\triangle ABC$ is AD .

I can determine which line is a median by locating the segment that has been drawn from a vertex of the triangle to the midpoint of its opposite side. Since point F is a midpoint, I can determine that the median of $\triangle ABC$ is CF .

An angle bisector is a segment drawn from a vertex, which cuts the vertex angle in half. I can determine from $\triangle ABC$ that the angle bisector is BE .



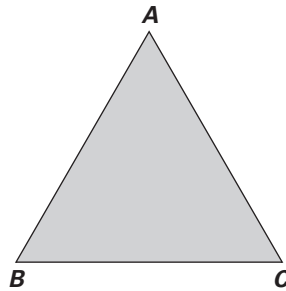
Reflecting

1. What is another name for the height of a triangle?
2. How many medians are found in every triangle?
3. Are the altitudes and the medians of a triangle ever the same line?

Work with the Math

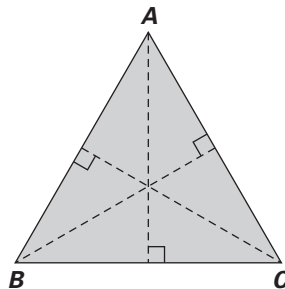
Example 2: Drawing the altitudes of a triangle

Using the triangle shown below, sketch the altitudes.



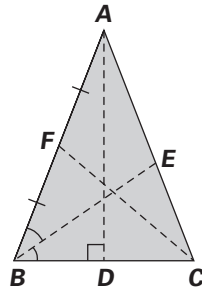
Maggie's Solution

I know the altitudes of a triangle must extend from each vertex and be perpendicular to the opposite side.



A Checking

4. Name the segments that represent the altitude, median, and angle bisector shown in this triangle.



B Practising

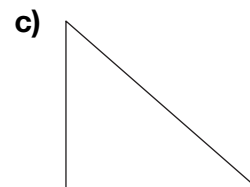
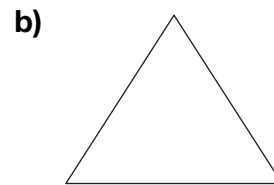
5. Fill in the blank with a word that will make each statement true.

- A _____ is a line segment drawn from a vertex to the midpoint of its opposite side.
- An angle _____ cuts in half the vertex angle.
- _____ are sometimes the same as the side of the triangle or can sometimes meet an extended base outside the triangle.

6. Determine if each of the following statements is true or false.

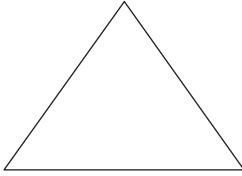
- The median is the same as the height of a triangle.
- An angle bisector cuts an angle into two equal angles.
- An altitude always begins at a vertex and ends at the midpoint of one side of the triangle.
- Every triangle has exactly three altitudes.
- The altitude and the median of a triangle are never the same line.
- In an obtuse triangle, an altitude may extend from a vertex to a point outside of the triangle.
- An angle bisector and a median may sometimes be the same line.

7. Trace the following triangles onto a sheet of paper, and then draw the three altitudes for each triangle.

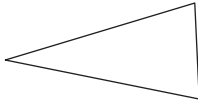


8. Trace the following triangles onto a sheet of paper, and then draw the three medians for each triangle.

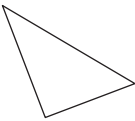
a)



b)

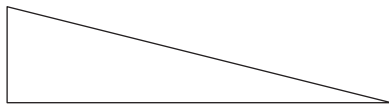


c)

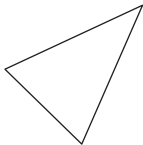


9. Trace the following triangles onto a sheet of paper, and then draw the three angle bisectors for each triangle.

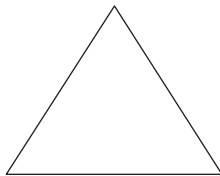
a)



b)



c)



© Extending

10. Draw a right triangle, an acute triangle, and an obtuse triangle. Then draw and label one altitude, median, and angle bisector for each triangle.