

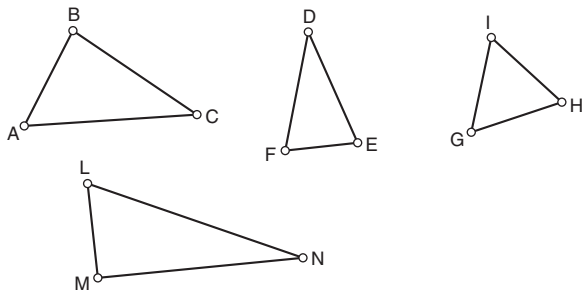
Lesson 1.5 • Triangles and Special Quadrilaterals

In this lesson, you'll experiment with both ordinary figures and figures that were constructed with constraints. The constraints limit what you can change in the figure when you drag so that certain relationships among angles and sides always hold. By observing these relationships, you will classify the figures. The lesson is divided into four parts—the first two deal with triangles and the last two with quadrilaterals.

Investigation 1: Classifying Triangles

Sketch

- Step 1** Open the sketch [Triangles and Special Quads.gsp](#) to the page [Classify Triangles](#).
- Step 2** Drag different vertices of each of the four triangles to observe and compare how the triangles are constrained.



Investigate

1. Which of the triangles seems the least constrained (the easiest to change by dragging)? Explain.
2. Which of the triangles seems the most constrained (the hardest to change by dragging)? Explain.
3. Recall the definitions of *acute*, *obtuse*, and *right* angles. These terms are also used to classify triangles. Measure the three angles in $\triangle ABC$. (To measure an angle, select only three points on the angle, with the vertex as your middle selection, and choose **Angle** from the Measure menu.) Determine whether each angle is acute or obtuse. Now drag a vertex of your triangle. How many acute angles can a triangle have?
4. How many obtuse angles can a triangle have?
5. Triangle ABC can be either an obtuse triangle or an acute triangle. One other triangle in the sketch can also be either acute or obtuse. Which triangle is it?
6. Which triangle is always a right triangle, no matter what you drag?
7. Which triangle is always an equiangular triangle, no matter what you drag?

(continued)

Lesson 1.5 • Triangles and Special Quadrilaterals (continued)

8. *Scalene*, *isosceles*, and *equilateral* are terms used to classify triangles by relationships among their sides. Measure the lengths of the three sides of $\triangle ABC$. If none of the side lengths are equal, the triangle is a scalene triangle. If two or more of the sides are equal in length, the triangle is isosceles. If all three sides are equal in length, it is equilateral. Because $\triangle ABC$ has no constraints, it can be any type of triangle. But which type of triangle is $\triangle ABC$ most of the time?
9. Name a triangle other than $\triangle ABC$ that is scalene most of the time.
10. Which triangle (or triangles) is (are) always isosceles, no matter what you drag?
11. Which triangle is always equilateral, no matter what you drag?

In Questions 12–16, tell whether the triangle described is possible or not possible. To check your answer, try manipulating the triangles in the sketch to make one that fits the description. If the triangle is possible, sketch an example on your paper.

12. Obtuse isosceles triangle
13. Acute right triangle
14. Obtuse equiangular triangle
15. Isosceles right triangle
16. Acute scalene triangle
17. Write definitions for *acute triangle*, *obtuse triangle*, *right triangle*, *scalene triangle*, *isosceles triangle*, and *equilateral triangle*.

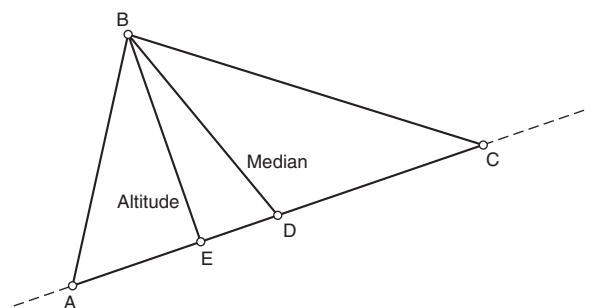
Investigation 2: Medians and Altitudes in Triangles

Sketch

- Step 1** Go to the page Altitude/Median.
 $\triangle ABC$ has no special constraints here.
- Step 2** Drag points A , B , and C and observe how segments BE and BD behave.

Investigate

1. Segment BD is a **median**. What do you think is the definition of *median of a triangle*? Make measurements to test or confirm your guess.
2. Segment BE is an **altitude**. When does \overline{BE} fall outside the triangle? When does it fall inside the triangle?
3. Define *altitude of a triangle*.
4. How many medians does a triangle have? How many altitudes?



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