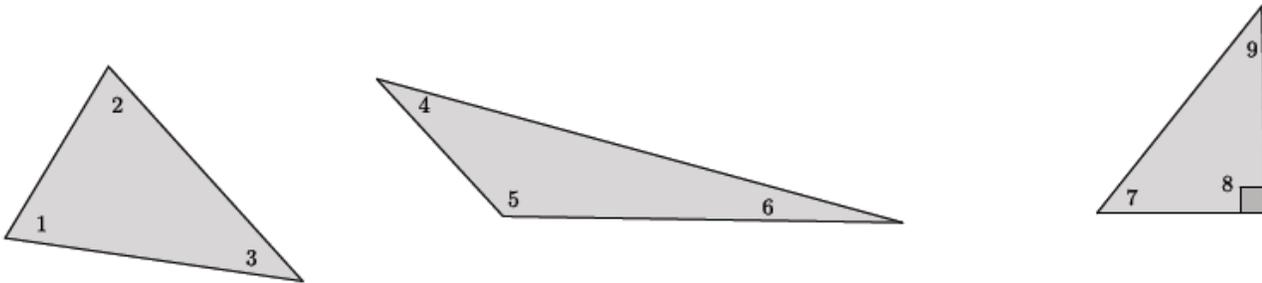# Lesson 13: Angle Sum of a Triangle

Classwork

Concept Development

$$m\angle 1 + m\angle 2 + m\angle 3 = m\angle 4 + m\angle 5 + m\angle 6 = m\angle 7 + m\angle 8 + m\angle 9 = 180°$$

Note that the sum of the measures of angles 7 and 9 must equal 90° because of the known right angle in the right triangle.

Exploratory Challenge 1

Let triangle ABC be given. On the ray from B to C, take a point D so that C is between B and D. Through point C, draw a segment parallel to $\overline{AB}$, as shown. Extend the segments AB and CE. Line AC is the transversal that intersects the parallel lines.
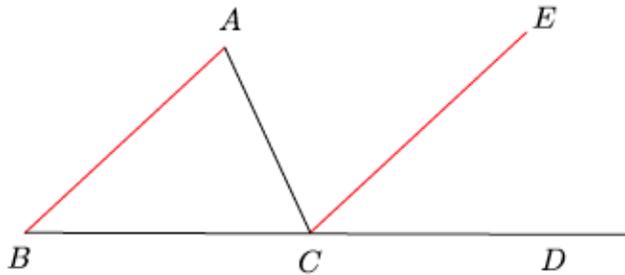
a. Name the three interior angles of triangle ABC.

b. Name the straight angle.

c. What kinds of angles are $\angle ABC$ and $\angle ECD$? What does that mean about their measures?

d. What kinds of angles are $\angle BAC$ and $\angle ECA$? What does that mean about their measures?

e. We know that $m\angle BCD = m\angle BCA + m\angle ECA + m\angle ECD = 180°$. Use substitution to show that the measures of the three interior angles of the triangle have a sum of $180°$.

Exploratory Challenge 2

The figure below shows parallel lines L_1 and L_2. Let m and n be transversals that intersect L_1 at points B and C, respectively, and L_2 at point F, as shown. Let A be a point on L_1 to the left of B, D be a point on L_1 to the right of C, G be a point on L_2 to the left of F, and E be a point on L_2 to the right of F.
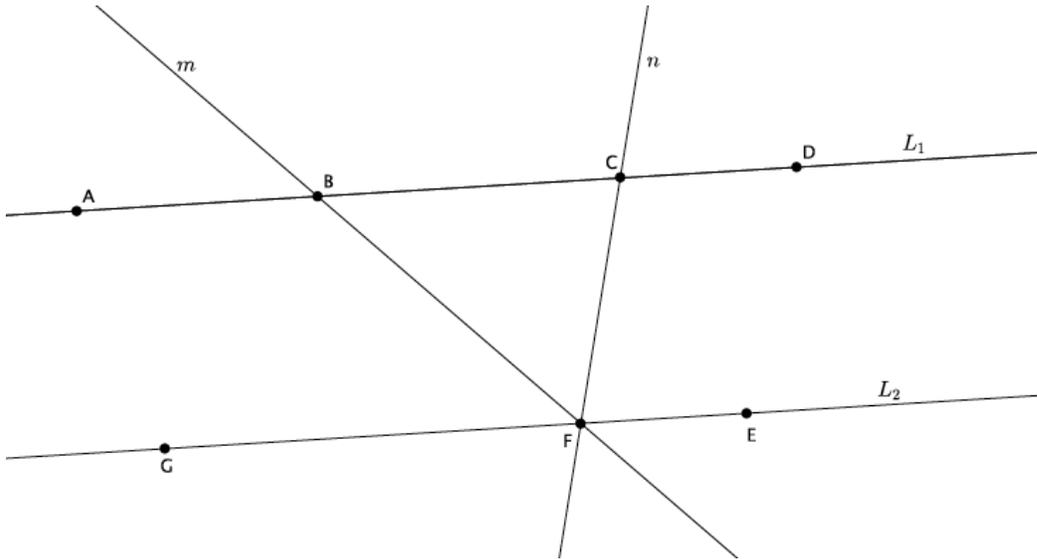
a. Name the triangle in the figure.

b. Name a straight angle that will be useful in proving that the sum of the measures of the interior angles of the triangle is 180°.

c. Write your proof below.

Lesson Summary

All triangles have a sum of measures of the interior angles equal to 180°.

The proof that a triangle has a sum of measures of the interior angles equal to 180° is dependent upon the knowledge of straight angles and angle relationships of parallel lines cut by a transversal.

Problem Set

1. In the diagram below, line AB is parallel to line CD, that is, $L_{AB} \parallel L_{CD}$. The measure of $\angle ABC$ is 28°, and the measure of $\angle EDC$ is 42°. Find the measure of $\angle CED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle.
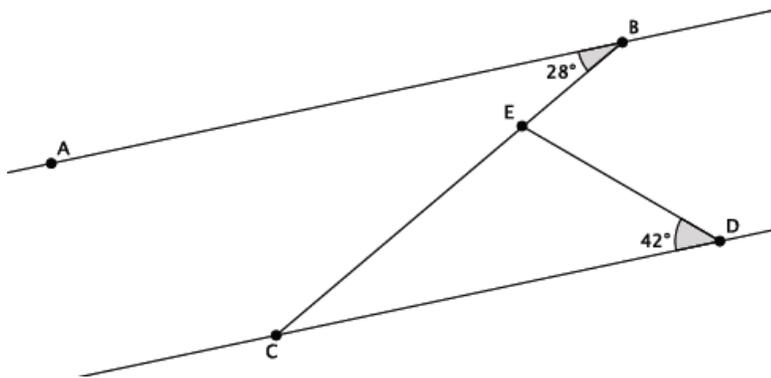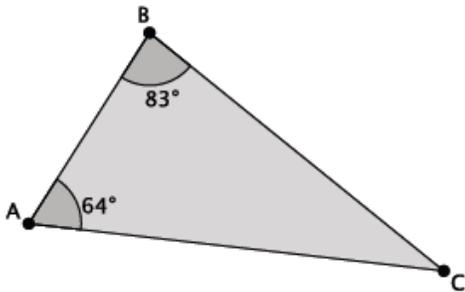

2. In the diagram below, line AB is parallel to line CD, that is, $L_{AB} \parallel L_{CD}$. The measure of $\angle ABE$ is 38°, and the measure of $\angle EDC$ is 16°. Find the measure of $\angle BED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle. (Hint: Find the measure of $\angle CED$ first, and then use that measure to find the measure of $\angle BED$.)
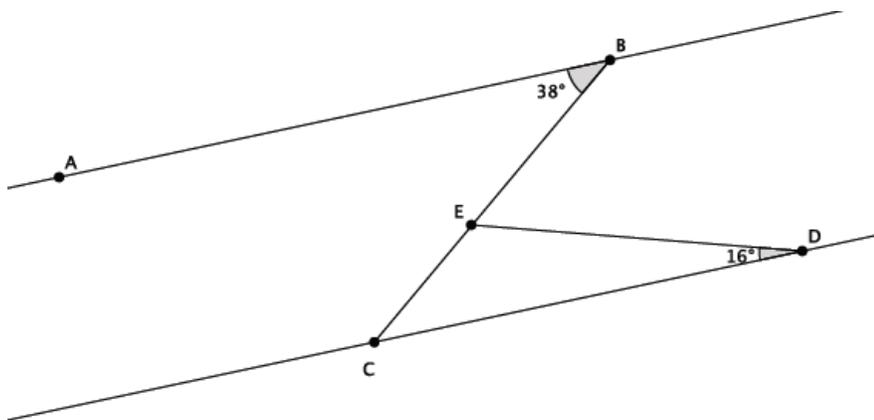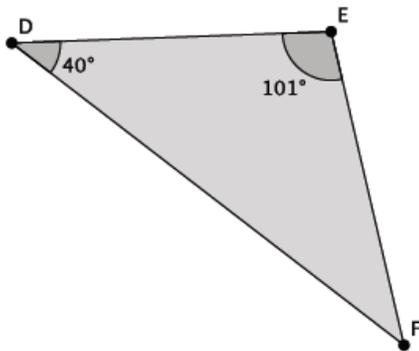
3. In the diagram below, line AB is parallel to line CD, that is, $L_{AB} \parallel L_{CD}$. The measure of $\angle ABE$ is 56°, and the measure of $\angle EDC$ is 22°. Find the measure of $\angle BED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle. (Hint: Extend the segment BE so that it intersects line CD.)
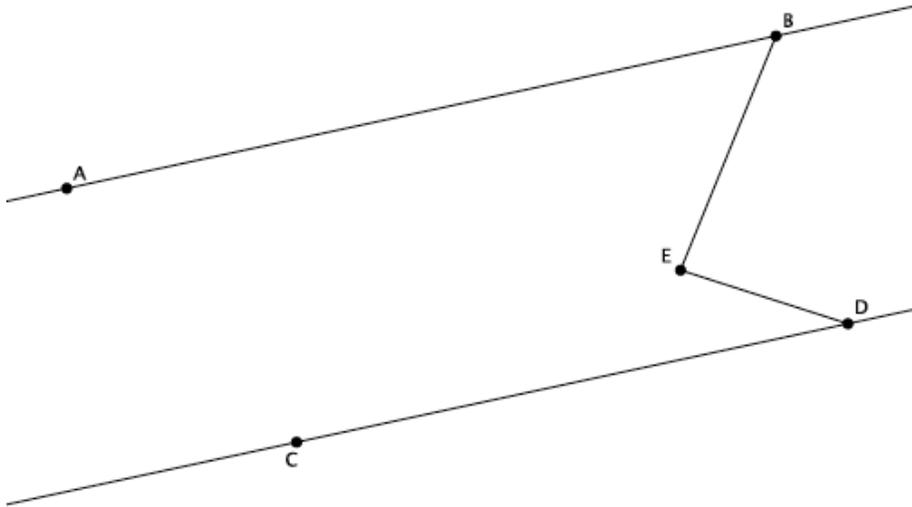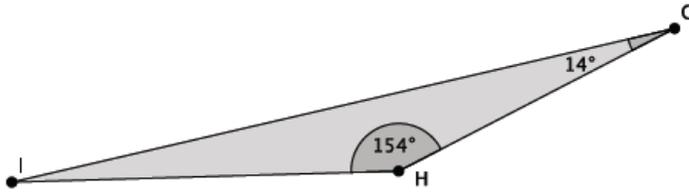

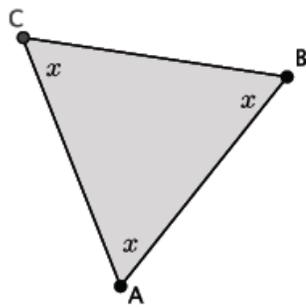4. What is the measure of $\angle ACB$?

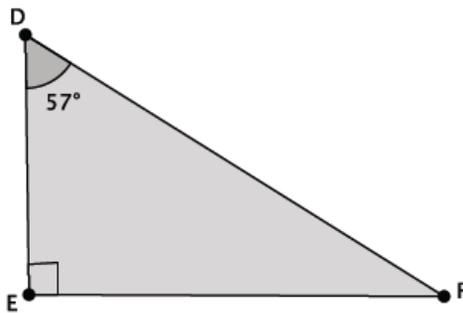5. What is the measure of $\angle EFD$?

6. What is the measure of $\angle HIG$?

7. What is the measure of $\angle ABC$?

8. Triangle DEF is a right triangle. What is the measure of $\angle EFD$?

9. In the diagram below, Lines L_1 and L_2 are parallel. Transversals r and s intersect both lines at the points shown below. Determine the measure of $\angle JMK$. Explain how you know you are correct.