Lesson 13: Angle Sum of a Triangle

Classwork

Concept Development

\[ m\angle 1 + m\angle 2 + m\angle 3 = m\angle 4 + m\angle 5 + m\angle 6 = m\angle 7 + m\angle 8 + m\angle 9 = 180^\circ \]

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.

![Diagram of triangle ABC with points A, B, C, D, and E, and 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 $m\angle BCD = m\angle BCA + m\angle ECA + m\angle ECD = 180^\circ$. Use substitution to show that the measures of the three interior angles of the triangle have a sum of $180^\circ$. 
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 $180^\circ$.

c. Write your proof below.