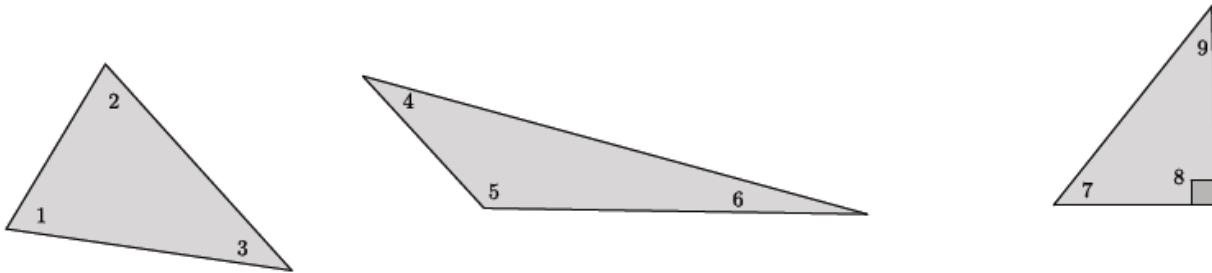


## Lesson 13: Angle Sum of a Triangle

### Classwork

#### Concept Development



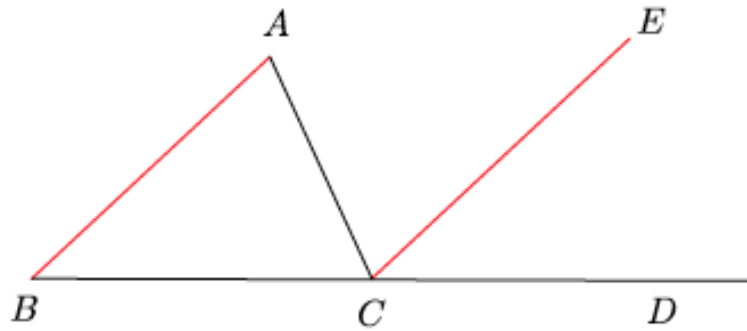
$$\angle 1 + \angle 2 + \angle 3 = \angle 4 + \angle 5 + \angle 6 = \angle 7 + \angle 8 + \angle 9 = 180$$

Note that the sum of angles 7 and 9 must equal  $90^\circ$  because of the known right angle in the right triangle.

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**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 line parallel to  $AB$  as shown. Extend the parallel lines  $AB$  and  $CE$ . Line  $AC$  is the transversal that intersects the parallel lines.

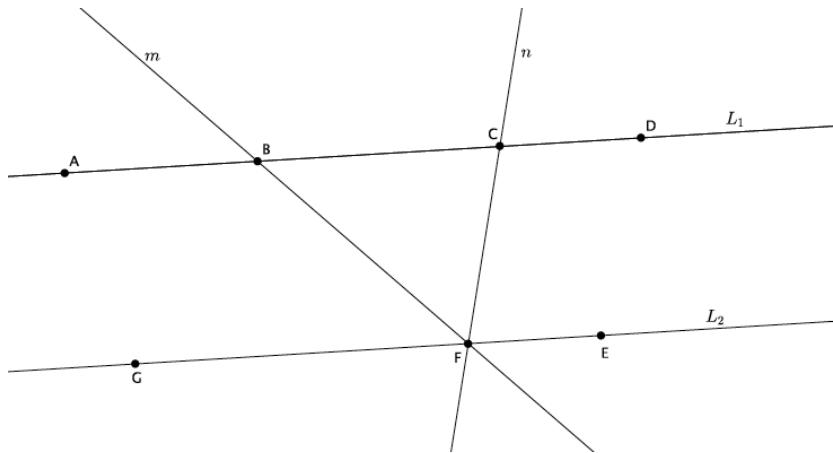


- Name the three interior angles of triangle  $ABC$ .
- Name the straight angle.
- What kinds of angles are  $\angle ABC$  and  $\angle ECD$ ? What does that mean about their measures?
- What kinds of angles are  $\angle BAC$  and  $\angle ECA$ ? What does that mean about their measures?
- We know that  $\angle BCD = \angle BCA + \angle ECA + \angle ECD = 180^\circ$ . Use substitution to show that the three interior angles of the triangle have a sum of  $180^\circ$ .

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### 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  $F$ .



- Name the triangle in the figure.
- Name a straight angle that will be useful in proving that the sum of the interior angles of the triangle is  $180^\circ$ .
- Write your proof below.

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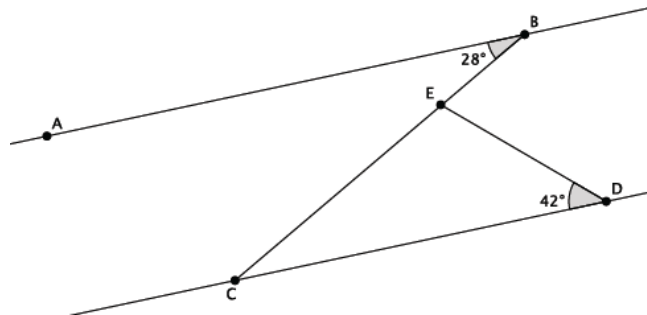
### Lesson Summary

All triangles have a sum of interior angles equal to  $180^\circ$ .

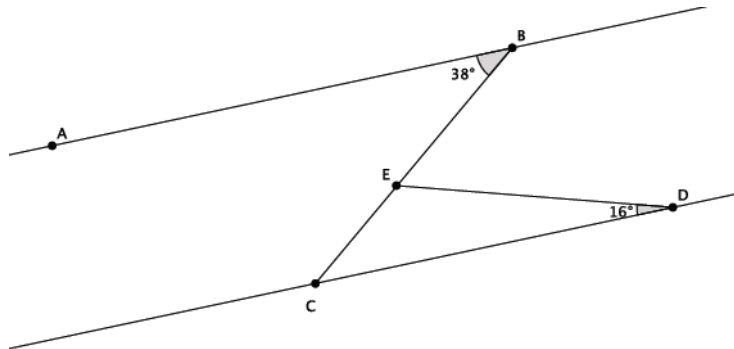
The proof that a triangle has a sum of interior angles equal to  $180^\circ$  is dependent upon the knowledge of straight angles and angles relationships of parallel lines cut by a transversal.

### Problem Set

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

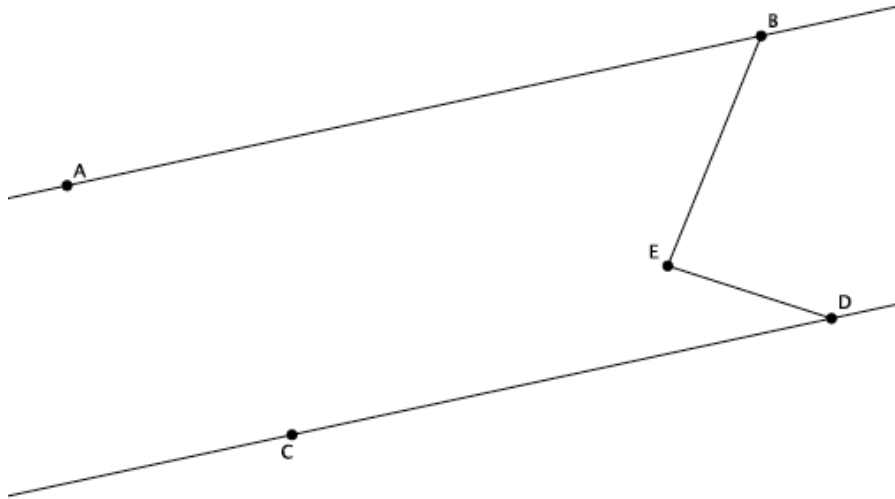


2. In the diagram below, line  $AB$  is parallel to line  $CD$ , i.e.,  $L_{AB} \parallel L_{CD}$ . The measure of angle  $\angle ABE = 38^\circ$  and the measure of angle  $\angle EDC = 16^\circ$ . Find the measure of angle  $\angle BED$ . Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle. (Hint: find the measure of angle  $\angle CED$  first, then use that measure to find the measure of angle  $\angle BED$ .)

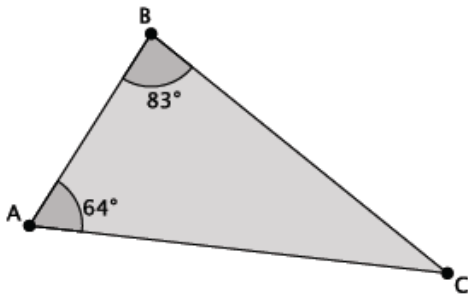


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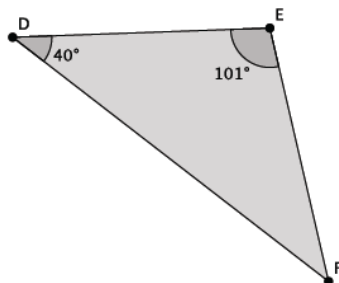
3. In the diagram below, line  $AB$  is parallel to line  $CD$ , i.e.,  $L_{AB} \parallel L_{CD}$ . The measure of angle  $\angle ABE = 56^\circ$ , and the measure of angle  $\angle EDC = 22^\circ$ . Find the measure of angle  $\angle BED$ . Explain why you are correct by presenting an informal argument 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  $\angle ACB$ ?

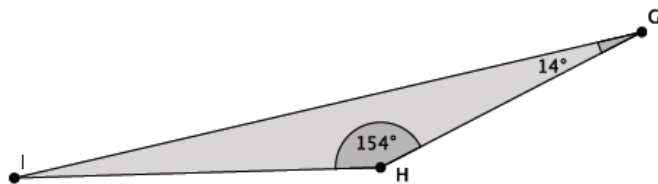


5. What is the measure of  $\angle EFD$ ?

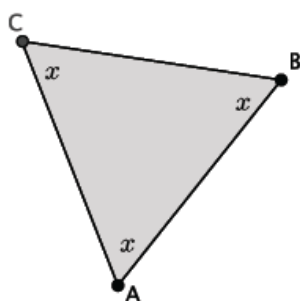


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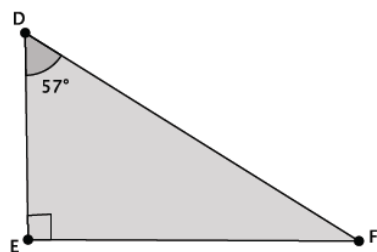
6. What is the measure of  $\angle HIG$ ?



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

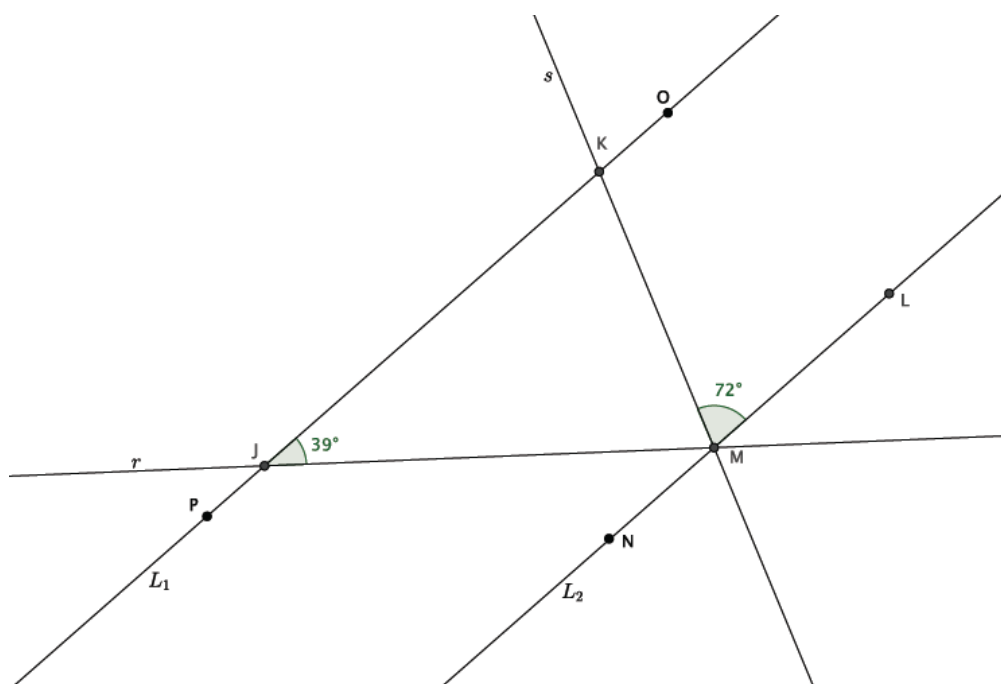


8. Triangle  $DEF$  is a right triangle. What is the measure of  $\angle EFD$ ?



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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.



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