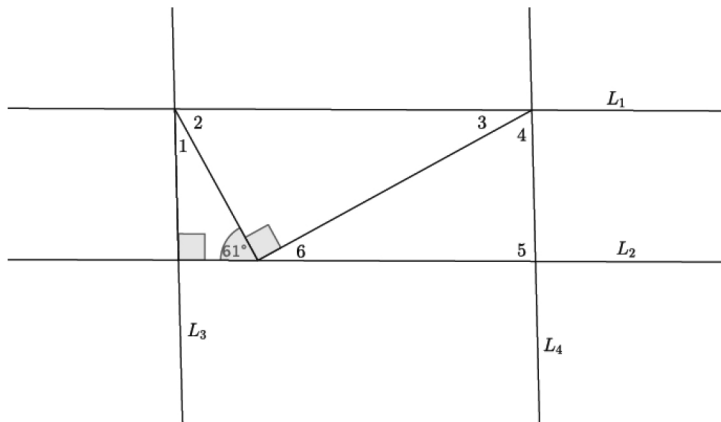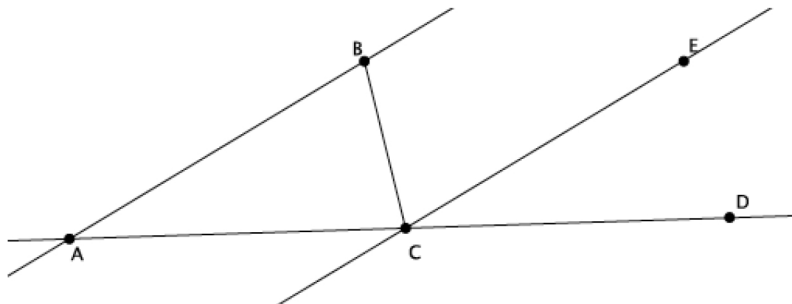Name _____   Date _____

Angle Sum of a Triangle

1. If $L_1 \parallel L_2$, and $L_3 \parallel L_4$, what is the measure of $\angle 1$? Explain how you arrived at your answer.
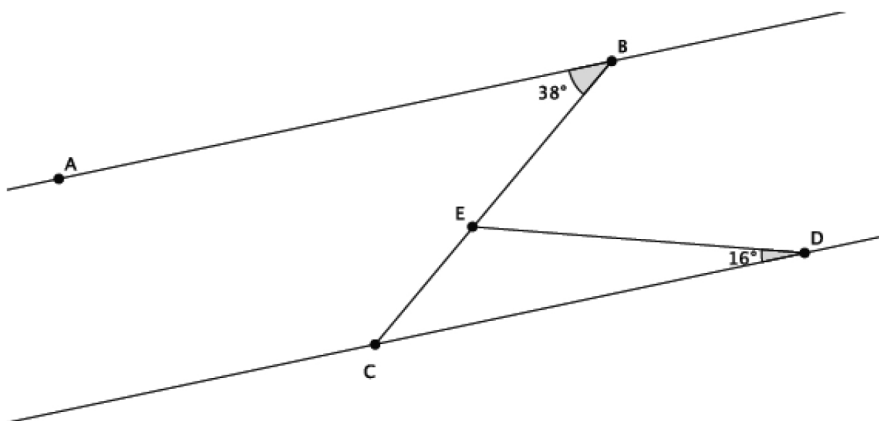

2. Given Line AB is parallel to Line CE, present an informal argument to prove that the interior angles of triangle ABC have a sum of 180°.
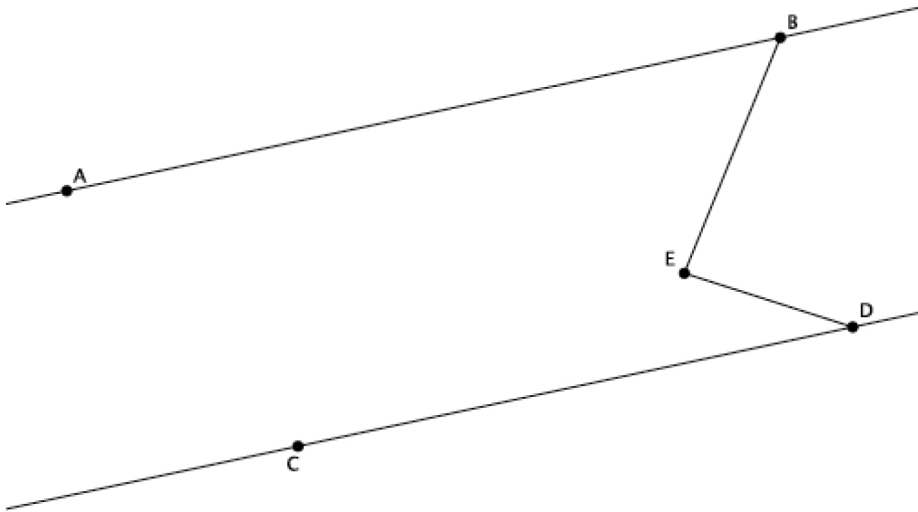
1. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABC = 28°$, and the measure of angle $\angle EDC = 42°$. Find the measure of angle $\angle CED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle.
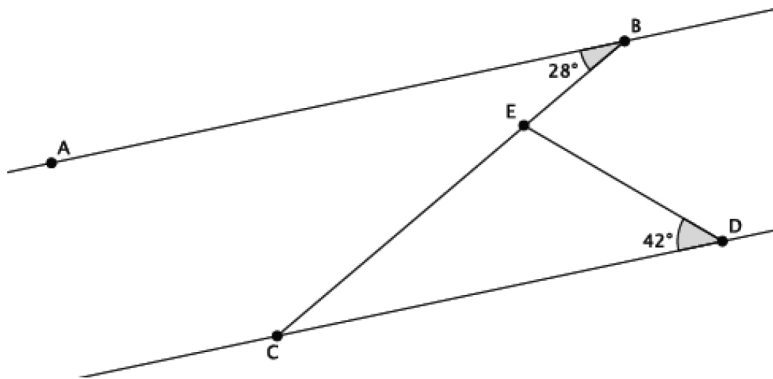
2. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABE = 38°$, and the measure of angle $\angle EDC = 16°$. Find the measure of angle $\angle BED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle. (Hint: Find the measure of angle $\angle CED$ first, and then use that measure to find the measure of angle $\angle BED$.)
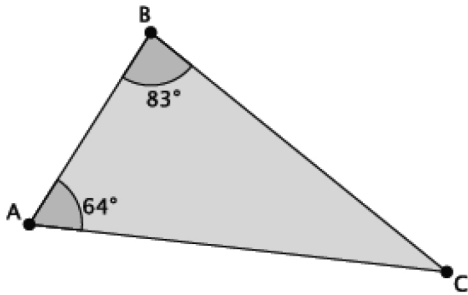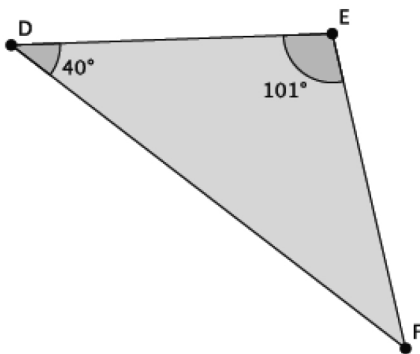
3. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABE = 56°$, and the measure of angle $\angle EDC = 22°$. Find the measure of angle $\angle BED$. Explain why you are correct by presenting an informal argument that uses the angle sum of a triangle. (Hint: Extend the segment BE so that it intersects line CD.)
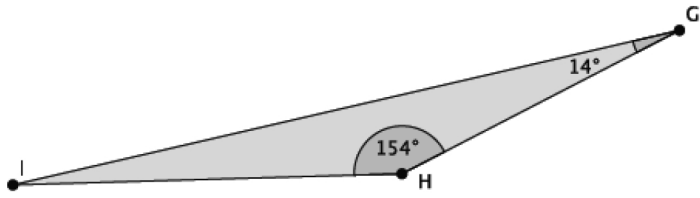
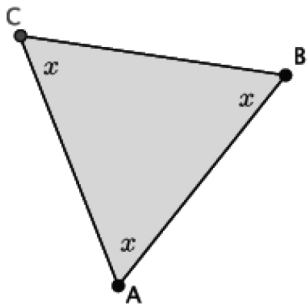4. What is the measure of $\angle ACB$?

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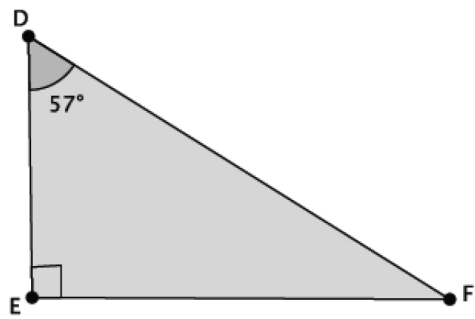
6. What is the measure of ∠HIG?
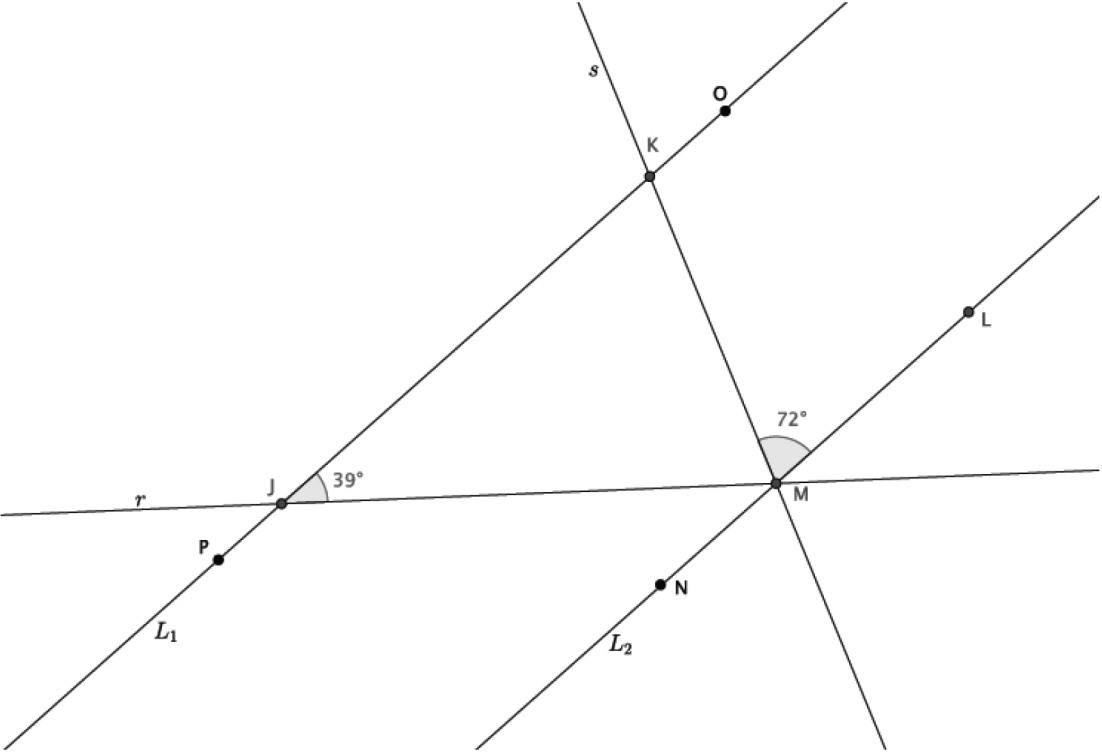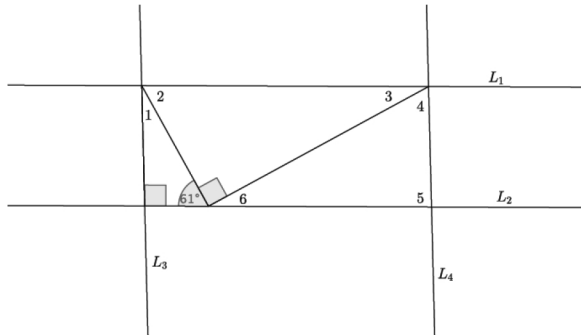

7. What is the measure of ∠ABC?

8. Triangle DEF is a right triangle. What is the measure of ∠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.
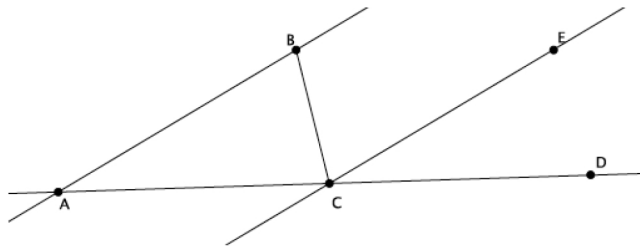
1. If $L_1 \parallel L_2$, and $L_3 \parallel L_4$, what is the measure of $\angle 1$? Explain how you arrived at your answer.

The measure of angle 1 is 29°. I know that the angle sum of triangles is 180°. I already know that two of the angles of the triangle are 90° and 61°.

2. Given Line AB is parallel to Line CE, present an informal argument to prove that the interior angles of triangle ABC have a sum of $180°$.

Since AB is parallel to CE, then the corresponding angles $\angle BAC$ and $\angle ECD$ are equal in measure. Similarly, angles $\angle ABC$ and $\angle ECB$ are equal in measure because they are alternate interior angles. Since $\angle ACD$ is a straight angle, i.e., equal to 180° in measure, substitution shows that triangle ABC has a sum of 180°. Specifically, the straight angle is made up of angles $\angle ACB$, $\angle ECB$, and $\angle ECD$. $\angle ACB$ is one of the interior angles of the triangle and one of the angles of the straight angle. We know that angle $\angle ABC$ has the same measure as angle $\angle ECB$ and that angle $\angle BAC$ has the same measure as $\angle ECD$. Therefore, the sum of the interior angles will be the same as the angles of the straight angle, which is 180°.

Students practice presenting informal arguments about the sum of the angles of a triangle using the theorem to find the measures of missing angles.

1. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABC = 28°$, and the measure of angle $\angle EDC = 42°$. 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.
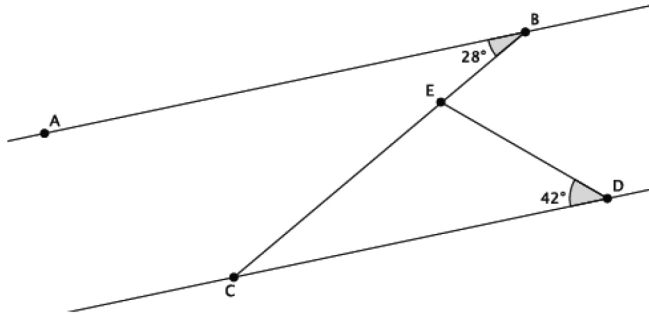
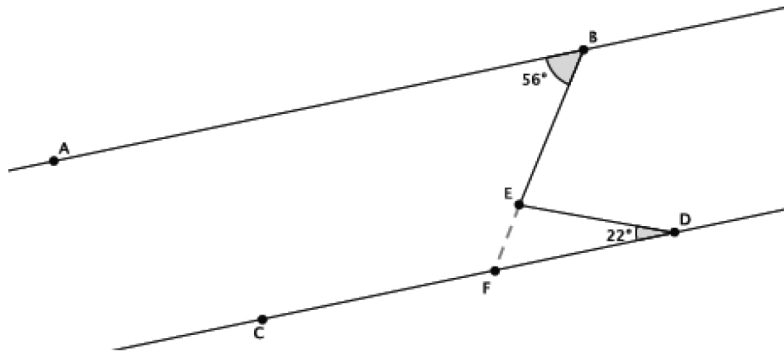   *The measure of angle $\angle CED = 110°$. This is the correct measure for the angle because $\angle ABC$ and $\angle DCE$ are alternate interior angles of parallel lines. That means that the angles are congruent and have the same measure. Since the angle sum of a triangle is $180°$, then the measure of $\angle CED = 180° - (28° + 42°) = 110°$.*

2. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABE = 38°$, and the measure of angle $\angle EDC = 16°$. 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, and then use that measure to find the measure of angle $\angle BED$.)
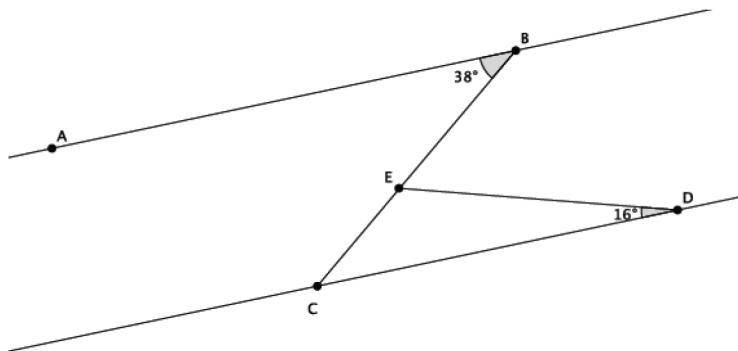

    The measure of angle $\angle BED = 54°$. This is the correct measure for the angle because $\angle ABC$ and $\angle DCE$ are alternate interior angles of parallel lines. That means that the angles are congruent and have the same measure. Since the angle sum of a triangle is $180°$, then the measure of $\angle CED = 180° - (38° + 16°) = 126°$. The straight angle $\angle BEC$ is made up of $\angle CED$ and $\angle BED$. Since we know straight angles are $180°$ in measure, and angle $\angle CED = 126°$, then $\angle BED = 54°$.

3. In the diagram below, line AB is parallel to line CD, i.e., $L_{AB} \parallel L_{CD}$. The measure of angle $\angle ABE = 56°$, and the measure of angle $\angle EDC = 22°$. 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.)


The measure of angle $\angle BED = 78°$. This is the correct measure for the angle because $\angle ABE$ and $\angle DFE$ are alternate interior angles of parallel lines. That means that the angles are congruent and have the same measure. Since the angle sum of a triangle is $180°$, then the measure of $\angle FED = 180° - (56° + 22°) = 102°$. The straight angle $\angle BEF$ is made up of $\angle FED$ and $\angle BED$. Since straight angles are $180°$ in measure, and angle $\angle FED = 102°$, then $\angle BED = 78°$.
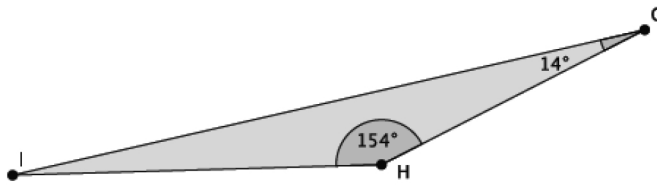
4. What is the measure of $\angle ACB$?
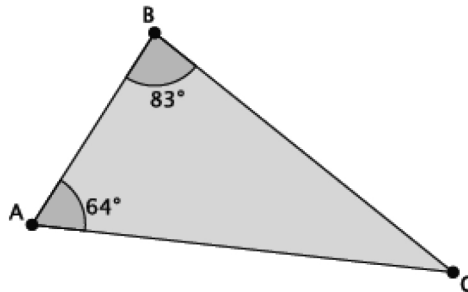
The measure of $\angle ACB$ is $180° - (83° + 64°) = 33°$.

5. What is the measure of $\angle EFD$?
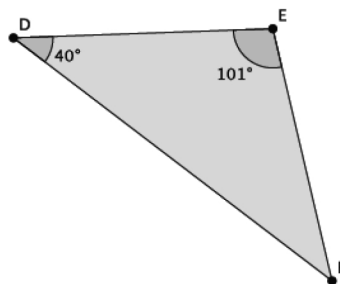
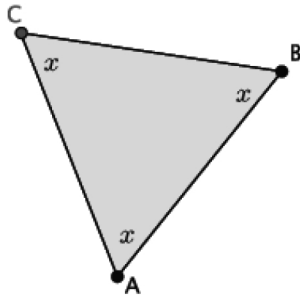*The measure of $\angle EFD$ is $180° - (101° + 40°) = 39°$.*

6. **What is the measure of ∠HIG?**

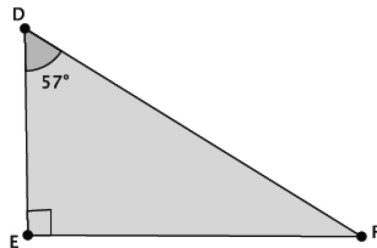*The measure of ∠HIG is $180° - (154° + 14°) = 12°$.*

7. **What is the measure of ∠ABC?**

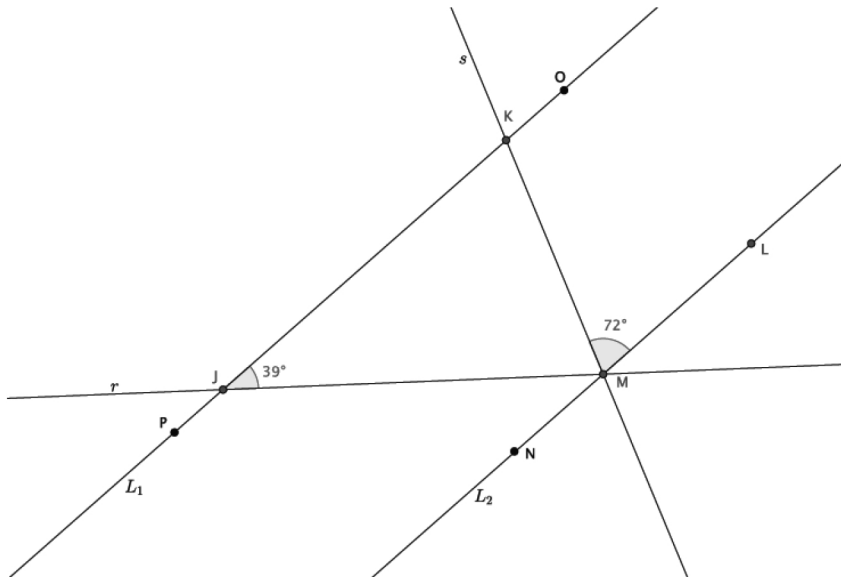*The measure of ∠ABC is $60°$ because $60 + 60 + 60 = 180$.*

8. **Triangle DEF is a right triangle. What is the measure of ∠EFD?**

The measure of ∠EFD is $90° - 57° = 33°$.

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.

The lines L_1 and L_2 are parallel, which means that the alternate interior angles formed by the transversals are equal. Specifically, $\angle LMK = \angle JKM = 72°$. Since triangle $\triangle JKM$ has a sum of interior angles equal to $180°$, then $\angle KJM + \angle JMK + \angle JKM = 180°$. By substitution, we have $39 + \angle JMK + 72 = 180$; therefore, $\angle JMK = 69°$.