IM 9–12 MATH v.1

Unit 1

Constructions and Rigid Transformations

GEOMETRY

Lesson 20

Transformations, Transversals, and Proof

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Let's prove statements about parallel lines.

Geometry

Angle Relationships

Warm-up: Math Talk

Lines ℓ and m are parallel. Mentally evaluate the measure x in each figure.

Figure A

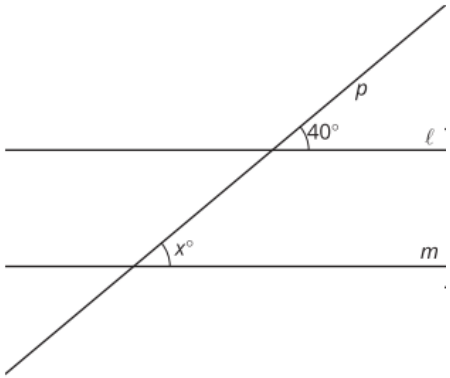


Figure B

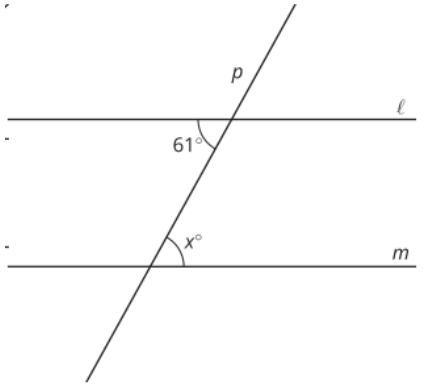


Figure C

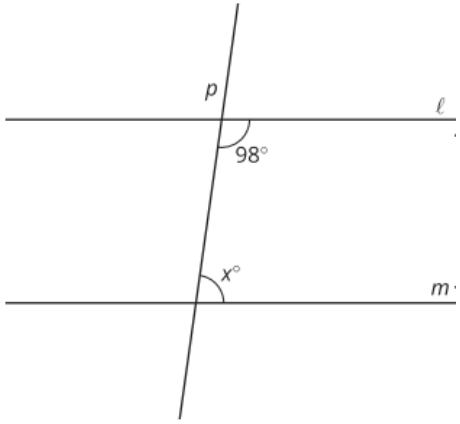
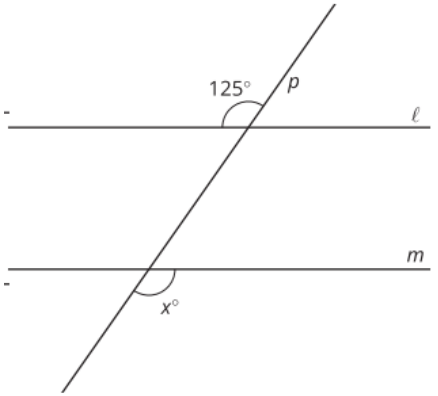
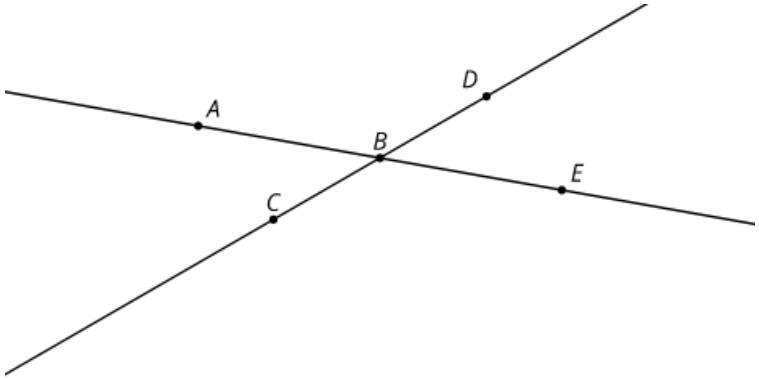


Figure D



Make a Mark? Give a Reason

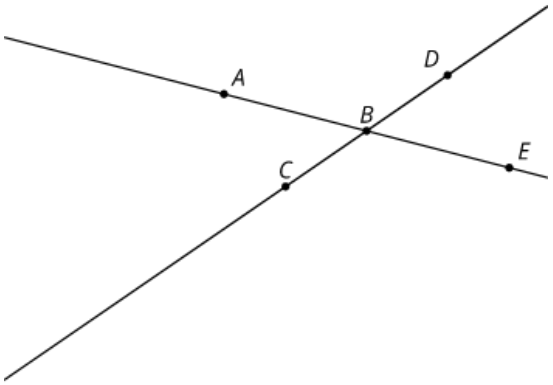
Here are intersecting lines AE and CD:



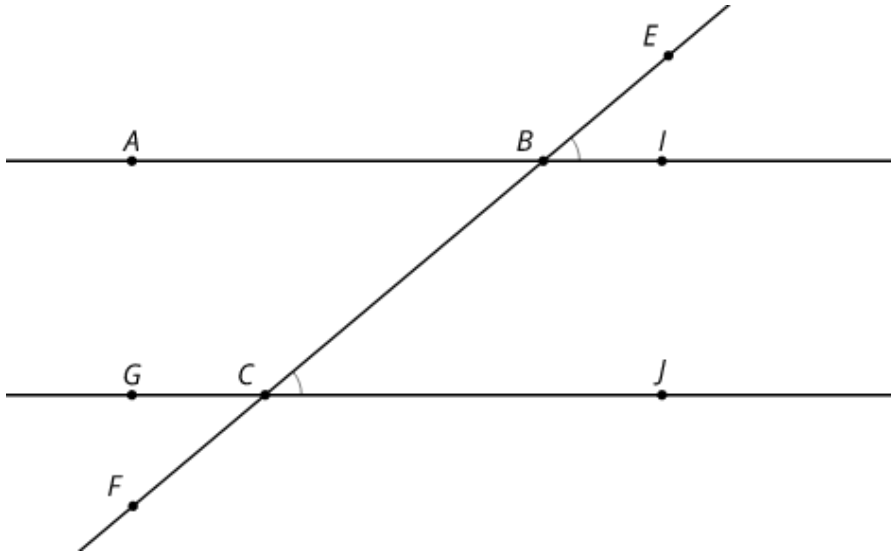
1. Translate lines AE and CD by the directed line segment from B to C. Label the images of A, B, C, D, E as A', B', C', D', E'.
2. What is true about lines AE and $A'E'$? Explain your reasoning.
3. Take turns with your partner to identify congruent angles.
    a. For each pair of congruent angles that you find, explain to your partner how you know the angles are congruent.
    b. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.

An Alternate Explanation

1. Rotate line AE by 180 degrees around point C. Label the images of A, B, C, D, E as A', B', C', D', E'.
2. What is true about lines AB and $A'B'$? Explain your reasoning.
3. Take turns with your partner to identify congruent angles.
   a. For each pair of congruent angles that you find, explain to your partner how you know the angles are congruent.
   b. For each match that your partner finds, listen carefully to their explanation. If you disagree, discuss your thinking and work to reach an agreement.



Lesson Synthesis

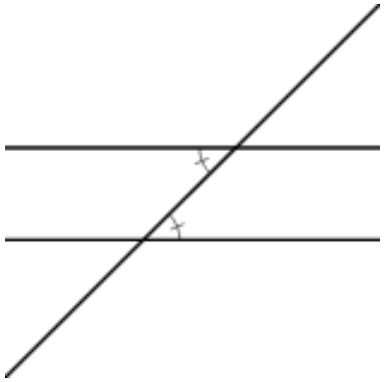


- What transformation would take angle *EBI* to angle *BCJ*?
- How do we know that a translation along the directed line segment from *B* to *C* takes line *AI* to line *GJ*?

Lesson Synthesis

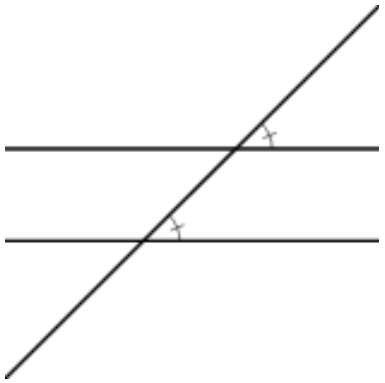
Alternate Interior Angle Theorem: If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

Conversely, if two lines are cut by a transversal and alternate interior angles are congruent, then the lines have to be parallel.



Corresponding Angle Theorem: If two parallel lines are cut by a transversal, then corresponding angles are congruent.

Conversely, if two lines are cut by a transversal and corresponding angles are congruent, then the lines have to be parallel.

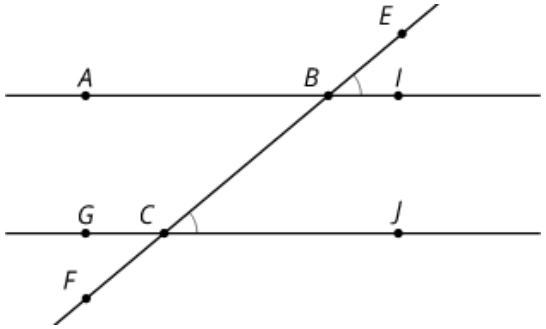


Transformations on Parallel Lines

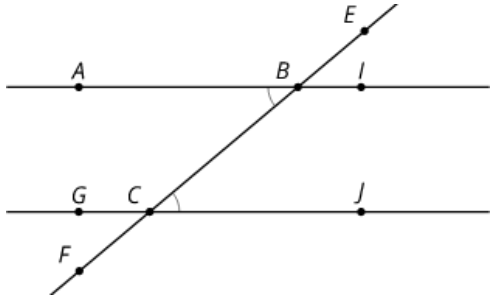
Cool-down

In each question, lines *AI* and *GJ* are parallel and intersected by the transversal line *FE*.

1. Angles *EBI* and *BCJ* are corresponding angles. Use a transformation that takes angle *EBI* to angle *BCJ* to prove that corresponding angles are congruent.



1. Angles *ABC* and *BCJ* are alternate interior angles. Use a transformation that takes angle *ABC* to angle *BCJ* to prove that alternate interior angles are congruent. Label any other points on the figure that will help to define a transformation.



- I can prove alternate interior angles are congruent.
- I can prove corresponding angles are congruent.

Learning Targets

Geometry