Name: _____ Date: _____

Transformations

Objective

In this lesson, you will develop definitions of transformations and determine transformations that result in congruent figures.

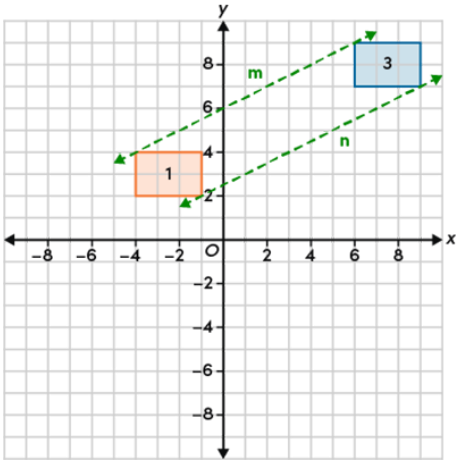
Types of Transformations

Geometric transformations move, flip, or turn figures in a specified direction. They can also change the size and shape of a figure.

The original figure being transformed is called a **preimage**. After the transformation, the resulting figure is called an **image**.

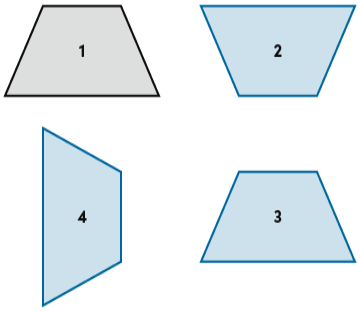
Translation

A translation is a transformation that moves points a specified **distance** along a line **parallel** to a specified line. A translation slides a figure horizontally, vertically, or both into a different **location** on a plane.



Question

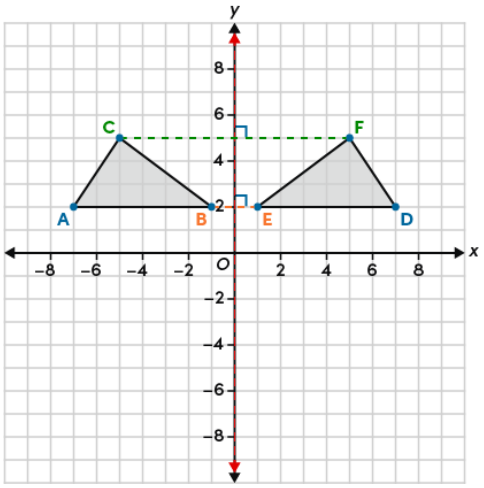
Which quadrilateral represents a translation of quadrilateral 1? l.



Quadrilateral 1 has been translated to the right (along a **horizontal** line) and down (along a **vertical** line) to produce quadrilateral **3**.

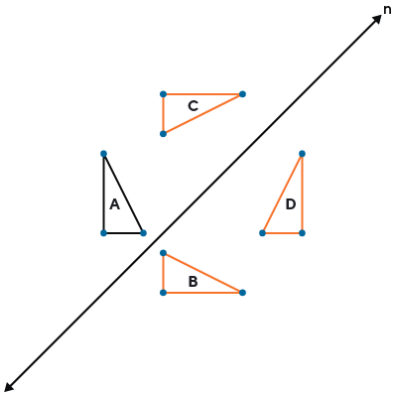
Reflection

In a reflection, each point in the **preimage** and its corresponding point in the **image** are **equidistant** from a given line, and the line segment joining the two points is **perpendicular** to the line.

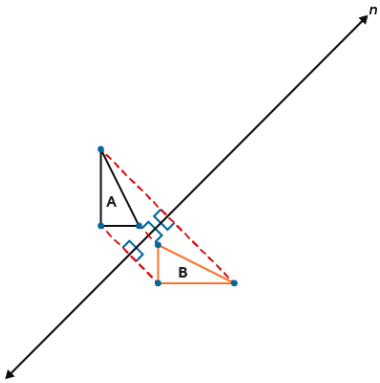


Question

Which triangle represents a reflection of triangle A across line n?

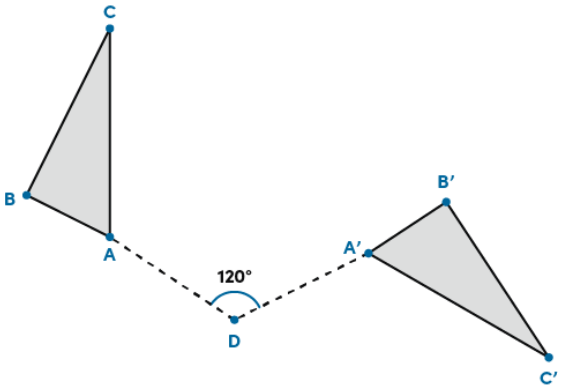


- **Corresponding** vertices of triangle **B** and triangle A are equidistant from line n.
- the line segments connecting the corresponding preimage and image points are **perpendicular** to line n.



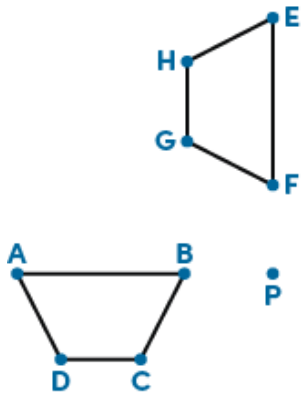
Rotation

A rotation is a transformation that moves a figure in a **circular** arc around a point, called the center of rotation, either in a **clockwise** or **counterclockwise** direction.



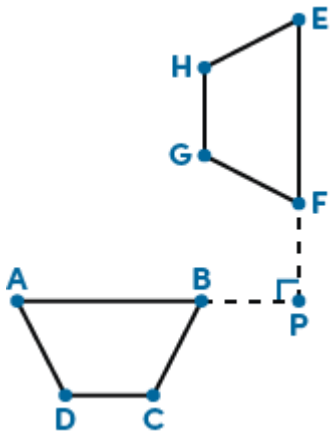
Question

Trapezoid ABCD was transformed to produce trapezoid EFGH. Which statement describes the transformation?

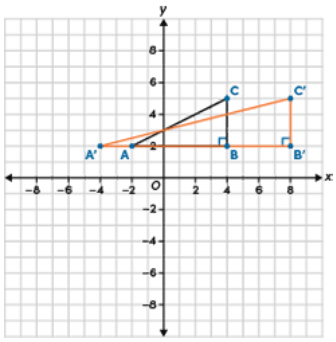
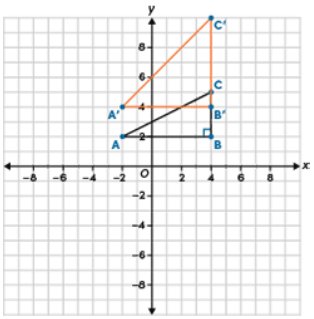
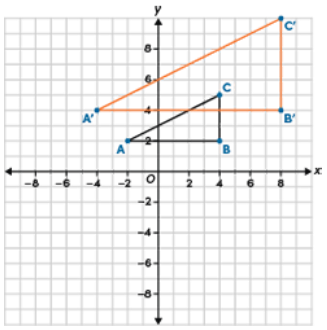


Vertices B and F are **corresponding** vertices in the preimage and image, and point **P** is the center of rotation. The angle between line segment BP and line segment FP is a **90** ° angle.

So, EFGH is a **90** ° **clockwise** rotation of ABCD about point **P**.



OTHER TRANSFORMATIONS

Horizontal Stretch 	• occurs when the **scale factor** is greater than **1**. • Horizontal change may also be a compression when the scale factor is between **0** and **1**.
Vertical Stretch 	• occurs when the scale factor is **greater** than **1**. • Vertical change may also be a **compression** when the scale factor is between 0 and 1.
Dilation 	• A **horizontal** and **vertical** stretch or compression by the same **factor** is called a dilation. • A dilation proportionally **enlarges** or **reduces** an object based on a given scale factor.

Rigid Transformations

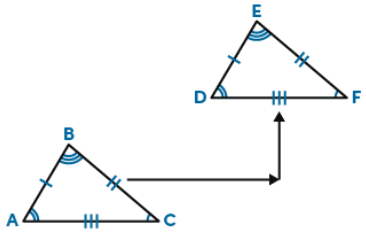
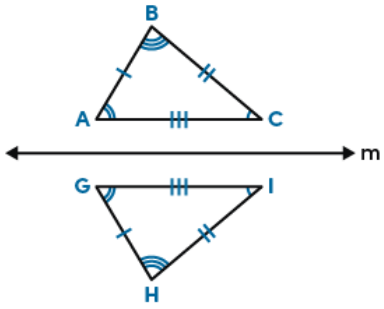
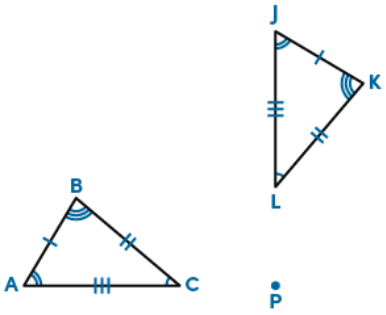
In congruent figures, **corresponding** sides and angles are congruent.

- represent congruent side lengths on a diagram using **tick marks**.
- represent congruent angle measures on a diagram using **arcs**.

Establishing Congruent Sides

After a figure is translated, reflected, or rotated, we can use the distance formula to find the lengths of the sides of the preimage and image. Then, we can compare the sides to determine the congruent sides.

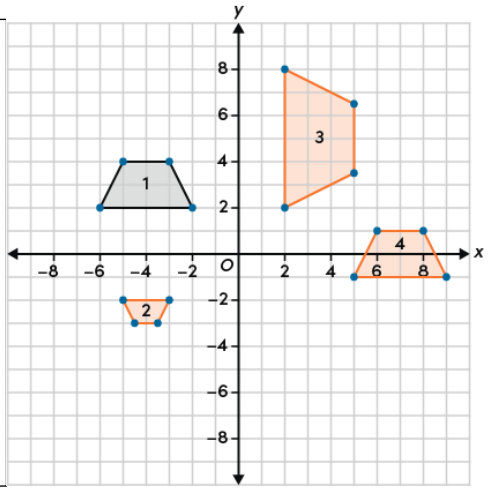
Translations, reflections, and rotations result in images that are **congruent** to the **preimage**. These three transformations are called **rigid** transformations and preserve **angles** and **side lengths**.

Translation	Reflection	Rotation
		

Question

Which figure is congruent to figure 1?

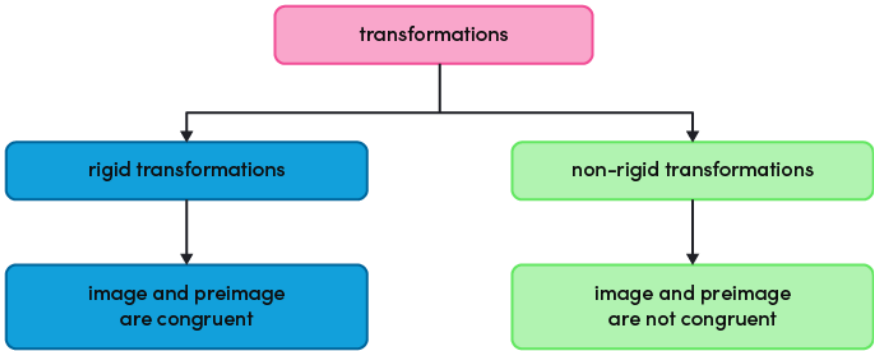
- Since **side lengths** are not preserved, figures 2 and 3 are not the same size as figure 1.
- Figure **4** is a **translation** of figure 1 to the right 11 units and 3 units down.
- Since a translation is a **rigid transformation**, figure 4 is **congruent** to figure 1.



Non-Rigid Transformations

A non-rigid transformation is a transformation that does not produce images that are **congruent** to the preimage.

- Stretches, **compressions**, and **dilations** are non-rigid transformations.
- The one exception is when the scale factor of a stretch, compression, or dilation is **1**.



Question

Which transformations preserve side lengths and angles?

- ☐ horizontal stretch by a factor of 0.6
- ☒ reflection across a given line k
- ☐ vertical stretch by a factor of 0.75
- ☒ translation 7 units left and 3 units down
- ☒ rotation of 75° clockwise about a given point P
- ☐ dilation by a scale factor of 6

- Only **rigid transformations** preserve side lengths and angles.
- Since translations, **reflections**, and rotations are rigid transformations, they are the only transformations that preserve side lengths and angles.