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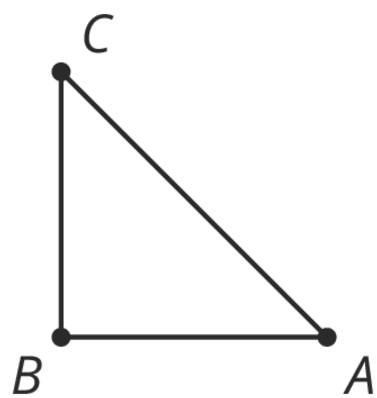
Unit 1, Lesson 8: Rotation Patterns

Let's rotate figures in a plane.

8.1: Building a Quadrilateral

Here is a right isosceles triangle:



1. Rotate triangle ABC 90 degrees clockwise around B.
2. Rotate triangle ABC 180 degrees clockwise round B.
3. Rotate triangle ABC 270 degrees clockwise around B.
4. What would it look like when you rotate the four triangles 90 degrees clockwise around B? 180 degrees? 270 degrees clockwise?

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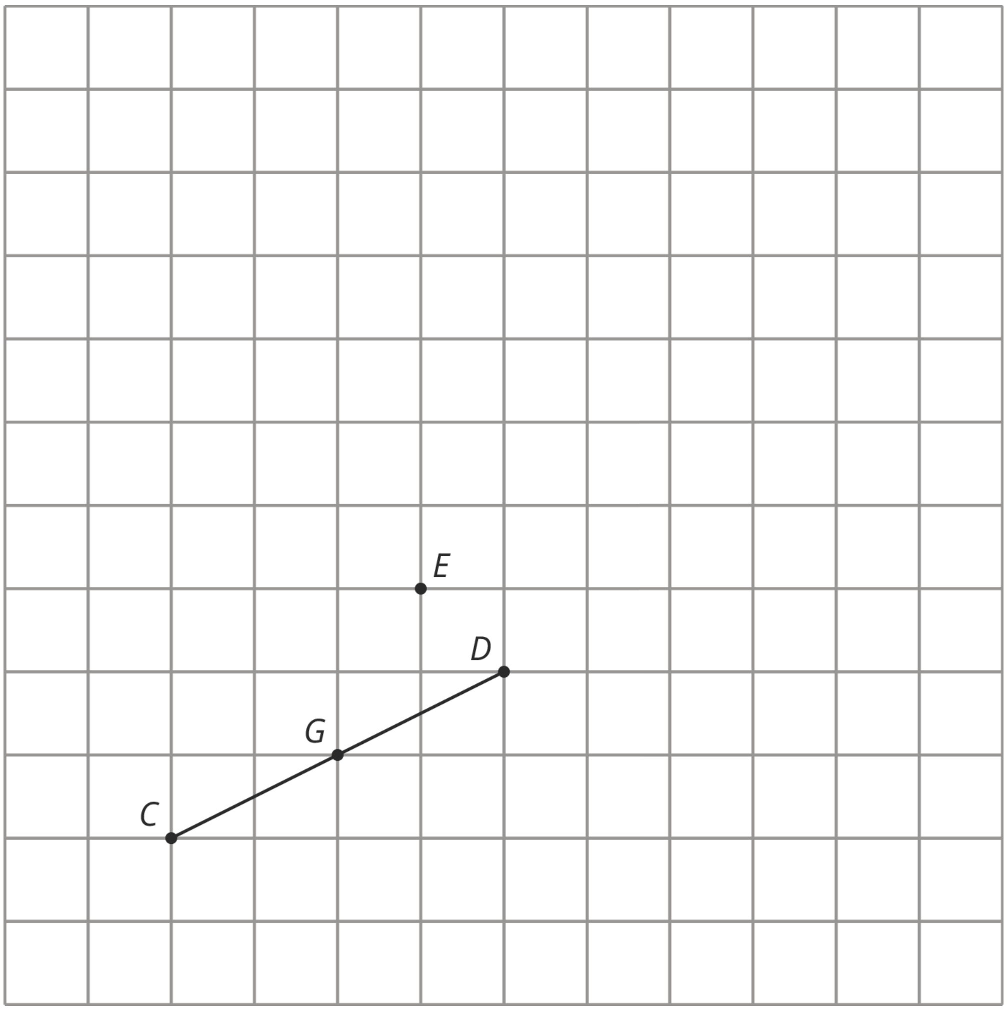
8.2: Rotating a Segment

m.openup.org/1/8-1-8-2



1. Rotate segment CD 180 degrees around point D. Draw its image and label the image of C as A.

2. Rotate segment CD 180 degrees around point E. Draw its image and label the image of C as B and the image of D as F.

3. Rotate segment CD 180 degrees around its midpoint, G. What is the image of C?

4. What happens when you rotate a segment 180 degrees around a point?

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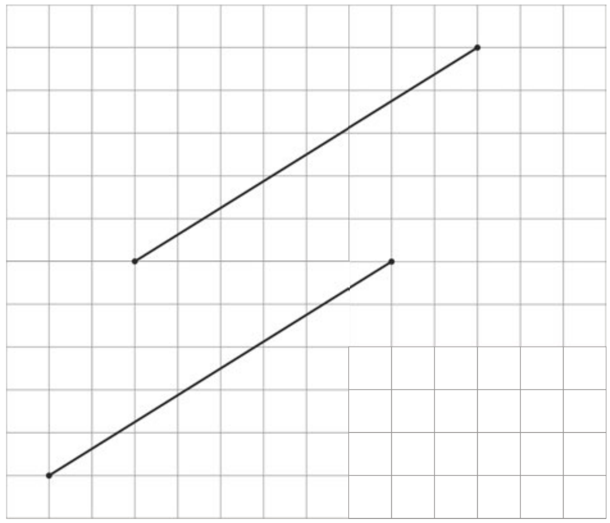
Are you ready for more?



Here are two line segments. Is it possible to rotate one line segment to the other? If so, find the center of such a rotation. If not, explain why not.

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8.3: A Pattern of Four Triangles

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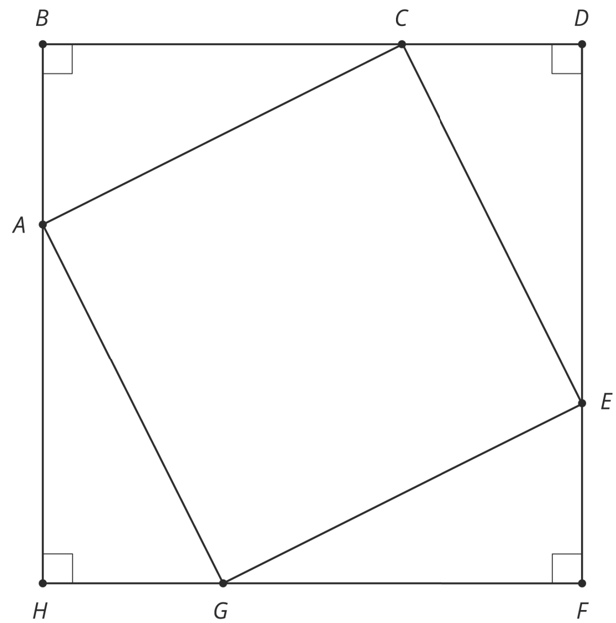

You can use rigid transformations of a figure to make patterns. Here is a diagram built with three different transformations of triangle ABC.

1. Describe a rigid transformation that takes triangle ABC to triangle CDE.

2. Describe a rigid transformation that takes triangle ABC to triangle EFG.

3. Describe a rigid transformation that takes triangle ABC to triangle GHA.

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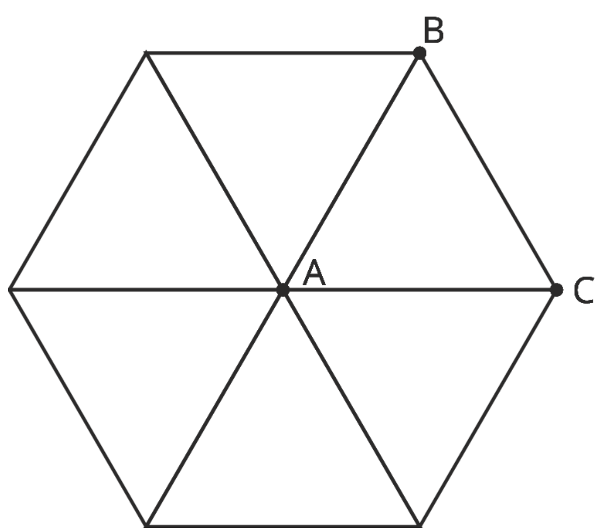
4. Do segments AC, CE, EG, and GA all have the same length? Explain your reasoning.

Lesson 8 Summary

When we apply a 180-degree rotation to a line segment, there are several possible outcomes:

- The segment maps to itself (if the center of rotation is the midpoint of the segment).
- The image of the segment overlaps with the segment and lies on the same line (if the center of rotation is a point on the segment).
- The image of the segment does not overlap with the segment (if the center of rotation is *not* on the segment).

We can also build patterns by rotating a shape. For example, triangle ABC shown here has $m(\angle A) = 60$. If we rotate triangle ABC 60 degrees, 120 degrees, 180 degrees, 240 degrees, and 300 degrees clockwise, we can build a hexagon.



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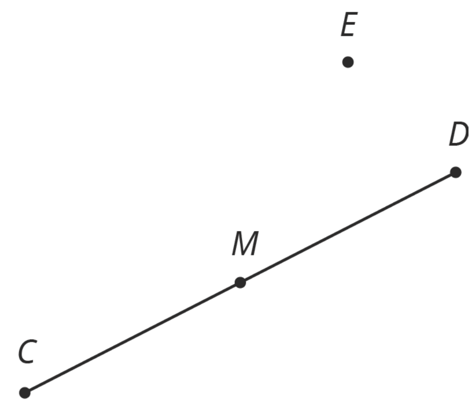
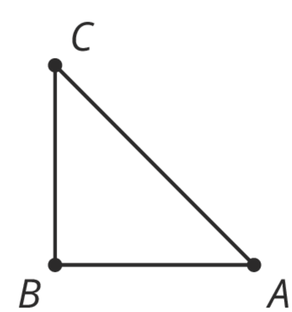
1. For the figure shown here,



   a. Rotate segment CD 180° around point D.
   b. Rotate segment CD 180° around point E.
   c. Rotate segment CD 180° around point M.

2. Here is an isosceles right triangle:

   Draw these three rotations of triangle ABC together.



   a. Rotate triangle ABC 90 degrees clockwise around A.
   b. Rotate triangle ABC 180 degrees around A.
   c. Rotate triangle ABC 270 degrees clockwise around A.

3. Each graph shows two polygons $ABCD$ and $A'B'C'D'$. In each case, describe a sequence of transformations that takes $ABCD$ to $A'B'C'D'$.

   a.

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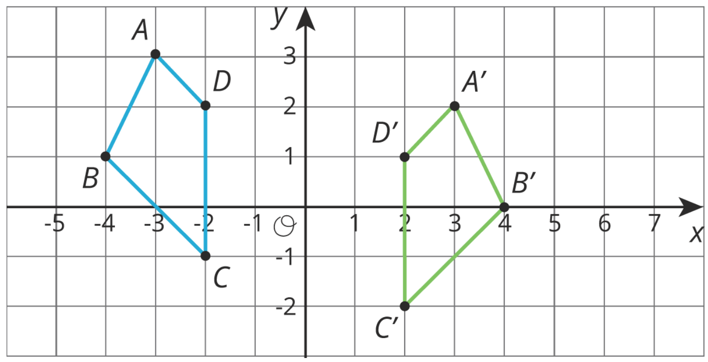
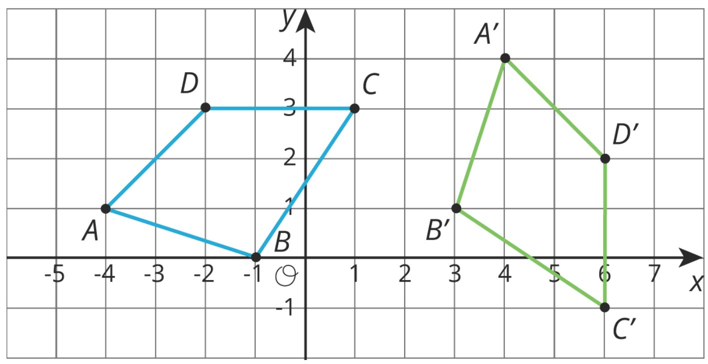
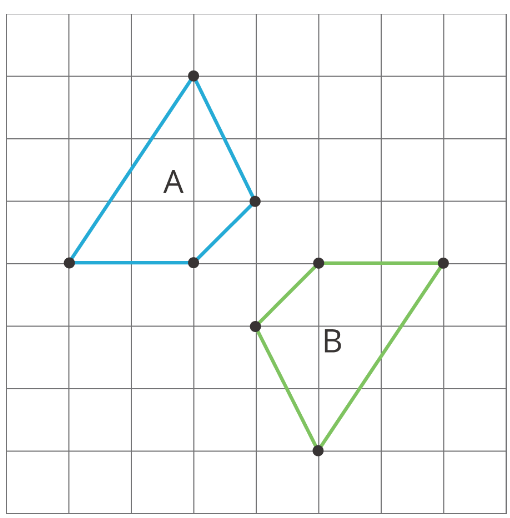


b.



(from Unit 1, Lesson 5)

4. Lin says that she can map Polygon A to Polygon B using *only* reflections. Do you agree with Lin? Explain your reasoning.



(from Unit 1, Lesson 4)