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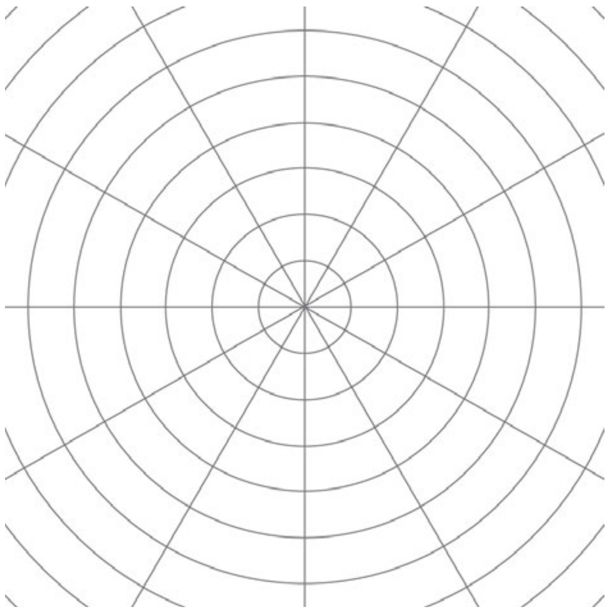
Unit 2, Lesson 2: Circular Grid

Let's dilate figures on circular grids.

2.1: Notice and Wonder: Concentric Circles



What do you notice? What do you wonder?

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2.2: A Droplet on the Surface

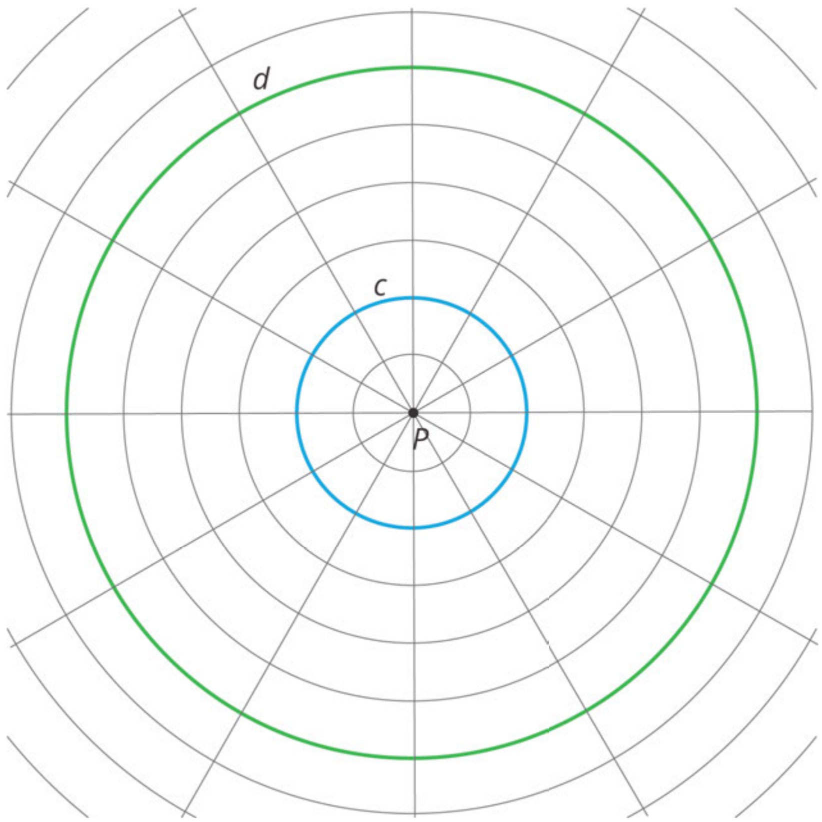
m.openup.org/1/8-2-2-2

The larger Circle d is a **dilation** of the smaller Circle c. P is the **center of dilation**.

1. Draw four points *on* the smaller circle (not inside the circle!), and label them E, F, G, and H.

2. Draw the rays from P through each of those four points.

3. Label the points where the rays meet the larger circle E', F', G', and H'.



4. Complete the table. In the row labeled S, write the distance between P and the point on the smaller circle in grid units. In the row labeled L, write the distance between P and the corresponding point on the larger circle in grid units.

	E	F	G	H
S				
L				

5. The center of dilation is point P. What is the *scale factor* that takes the smaller circle to the larger circle? Explain your reasoning.

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2.3: Quadrilateral on a Circular Grid

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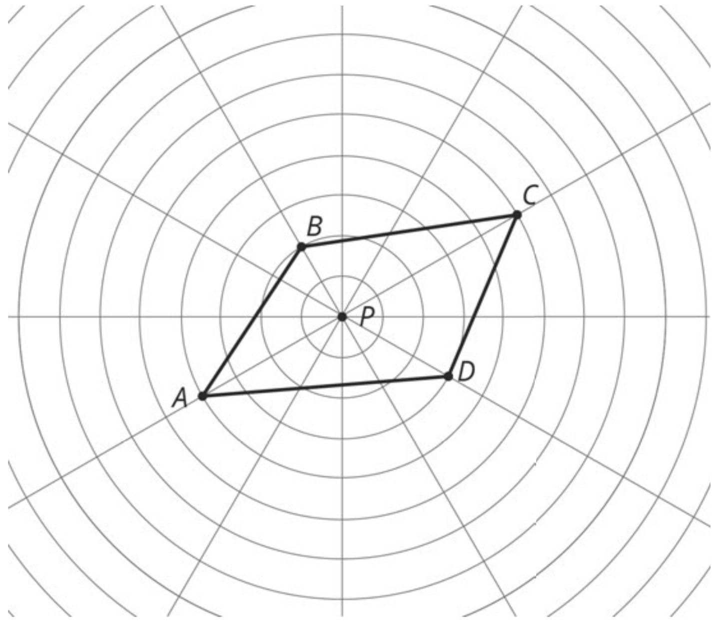
Here is a polygon $ABCD$.



1. Dilate each vertex of polygon $ABCD$ using P as the center of dilation and a scale factor of 2. Label the image of A as A', and label the images of the remaining three vertices as B', C', and D'.
2. Draw segments between the dilated points to create polygon $A'B'C'D'$.
3. What are some things you notice about the new polygon?
4. Choose a few more points on the sides of the original polygon and transform them using the same dilation. What do you notice?
5. Dilate each vertex of polygon $ABCD$ using P as the center of dilation and a scale factor of $\frac{1}{2}$. Label the image of A as E, the image of B as F, the image of C as G and the image of D as H.
6. What do you notice about polygon $EFGH$?

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Are you ready for more?

Suppose P is a point not on line segment $\overline{WX}$. Let $\overline{YZ}$ be the dilation of line segment $\overline{WX}$ using P as the center with scale factor 2. Experiment using a circular grid to make predictions about whether each of the following statements must be true, might be true, or must be false.

1. $\overline{YZ}$ is twice as long $\overline{WX}$.
2. $\overline{YZ}$ is five units longer than $\overline{WX}$.
3. The point P is on $\overline{YZ}$.
4. $\overline{YZ}$ and $\overline{WX}$ intersect.

2.4: A Quadrilateral and Concentric Circles

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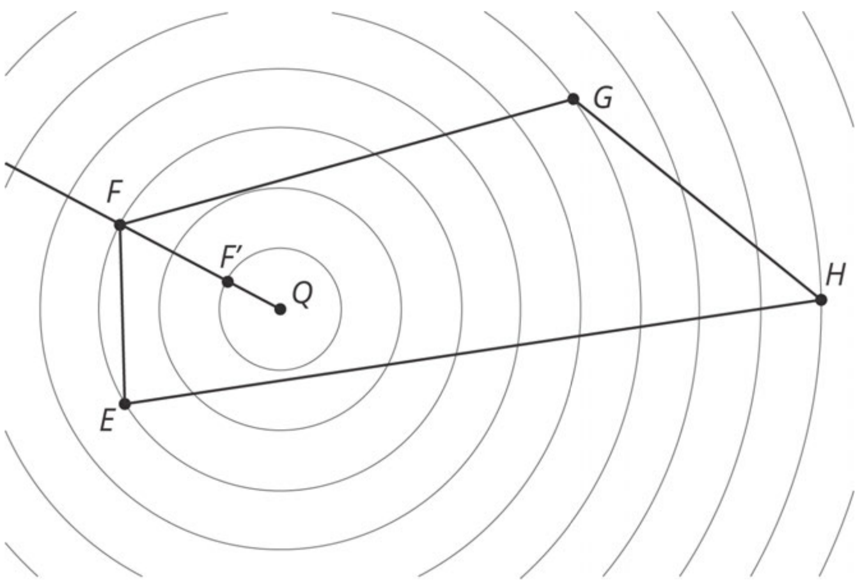

Dilate polygon $EFGH$ using Q as the center of dilation and a scale factor of $\frac{1}{3}$. The image of F is already shown on the diagram. (You may need to draw more rays from Q in order to find the images of other points.)

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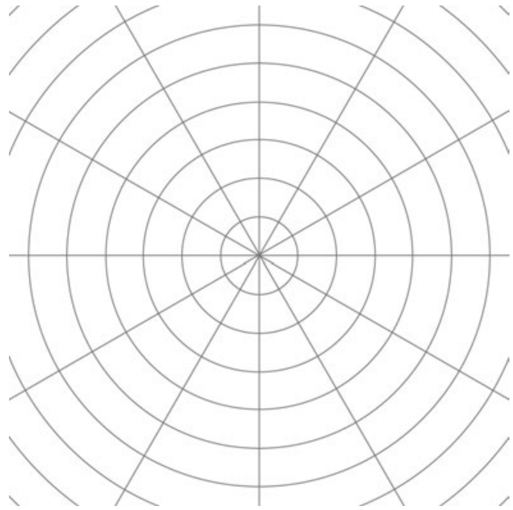
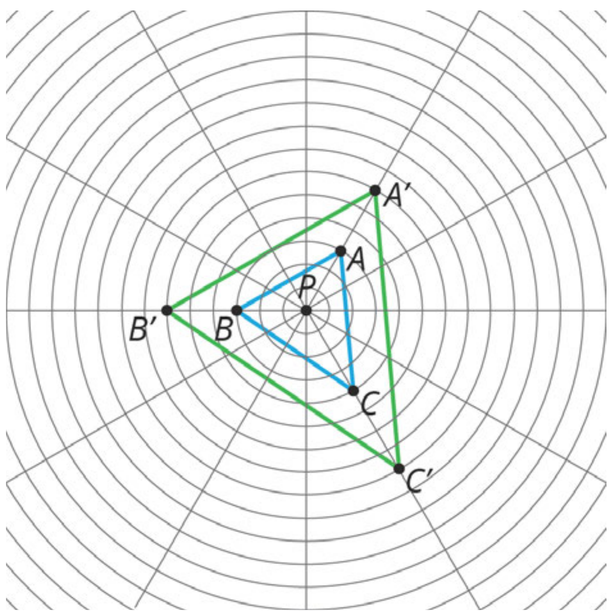
Lesson 2 Summary

A circular grid like this one can be helpful for performing **dilations**.

The radius of the smallest circle is one unit, and the radius of each successive circle is one unit more than the previous one.



To perform a dilation, we need a **center of dilation**, a scale factor, and a point to dilate. In the picture, P is the center of dilation. With a scale factor of 2, each point stays on the same ray from P, but its distance from P doubles:



Since the circles on the grid are the same distance apart, segment PA' has twice the length of segment PA, and the same holds for the other points.

Lesson 2 Glossary Terms

- dilation
- center (of a dilation)

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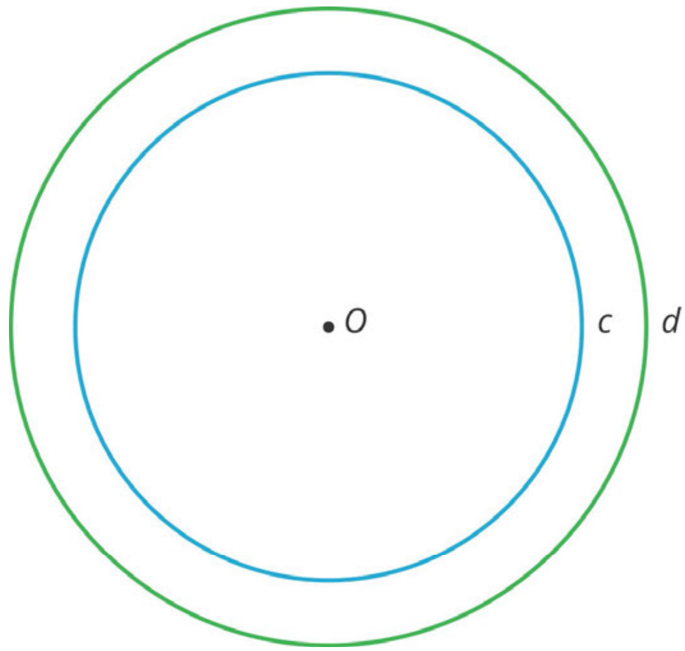
Unit 2, Lesson 2: Circular Grid

1. Here are Circles c and d. Point O is the center of dilation, and the dilation takes Circle c to Circle d.

   a. Plot a point on Circle c. Label the point P. Plot where P goes when the dilation is applied.

   b. Plot a point on Circle d. Label the point Q. Plot a point that the dilation takes to Q.



2. Here is triangle ABC.

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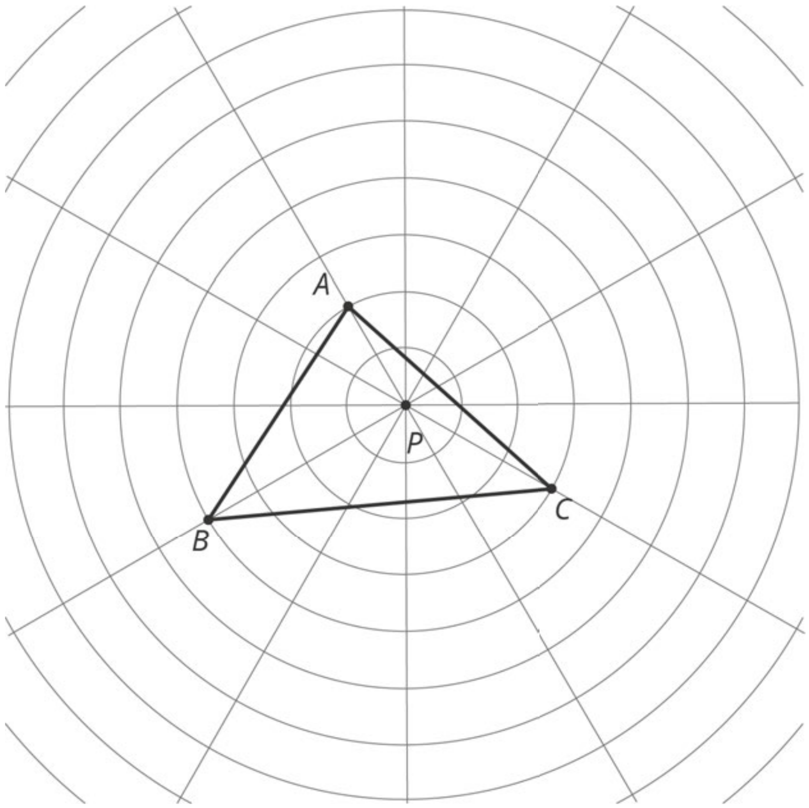

a. Dilate each vertex of triangle ABC using P as the center of dilation and a scale factor of 2. Draw the triangle connecting the three new points.

b. Dilate each vertex of triangle ABC using P as the center of dilation and a scale factor of $\frac{1}{2}$. Draw the triangle connecting the three new points.

c. Measure the longest side of each of the three triangles. What do you notice?

d. Measure the angles of each triangle. What do you notice?

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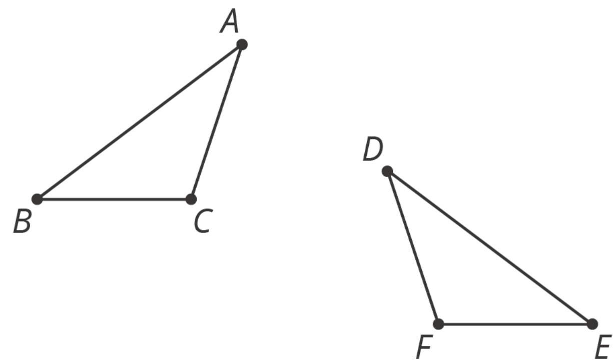
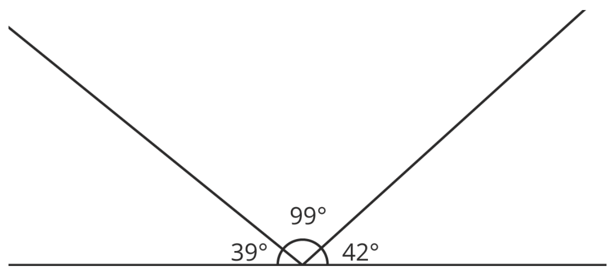
Describe a rigid transformation that you could use to show the polygons are congruent.



3. (from Unit 1, Lesson 12)

4. The line has been partitioned into three angles.



Is there a triangle with these three angle measures? Explain.

(from Unit 1, Lesson 15)