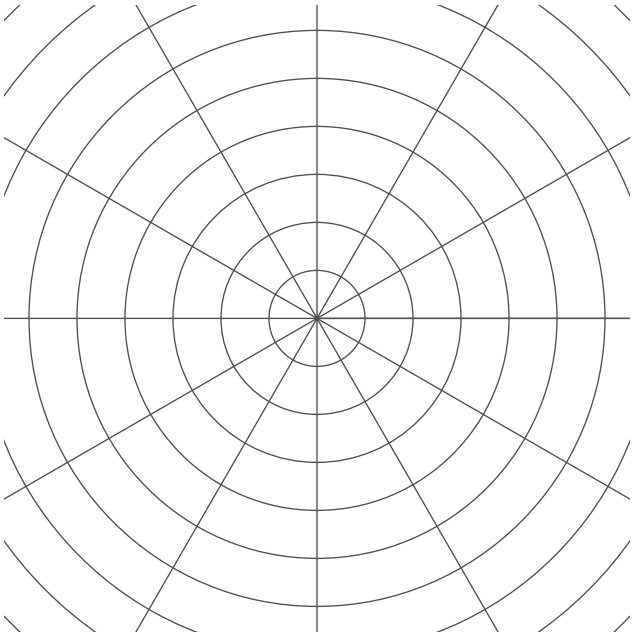
Dilations

Let's dilate figures.

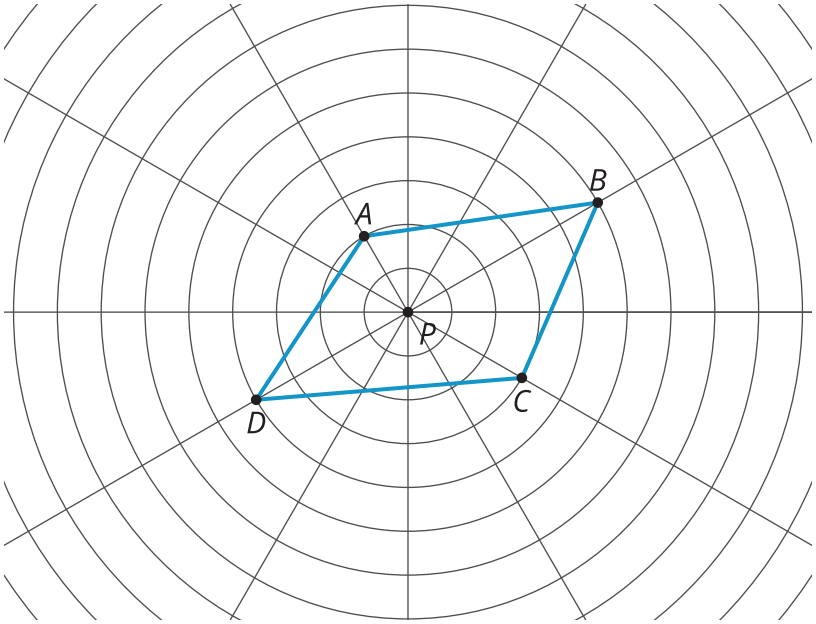
9.1 Notice and Wonder: Concentric Circles

What do you notice? What do you wonder?



9.2 Quadrilateral on a Circular Grid

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 E, the image of B as F, the image of C as G, and the image of D as H. Draw segments between the dilated points to create polygon $EFGH$.
2. What are some things you notice about the new polygon?

3. Choose a few more points on the sides of the original polygon and transform them using the same dilation. What do you notice?

4. 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 I, the image of B as J, the image of C as K, and the image of D as L. Draw segments between the dilated points to create polygon $IJKL$.
5. What do you notice about polygon $IJKL$?

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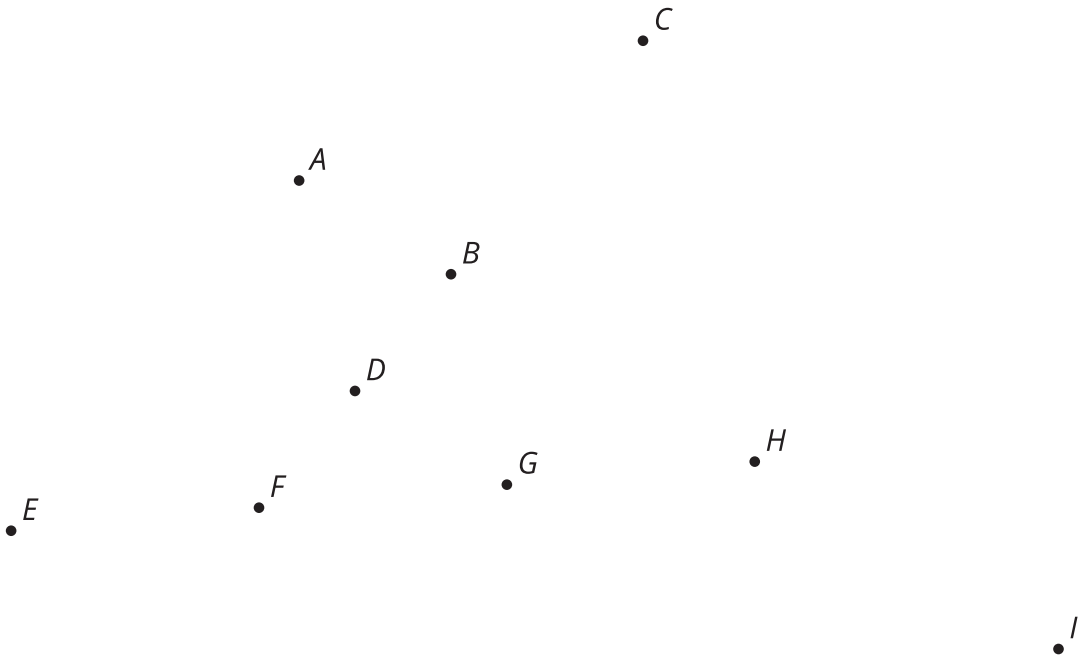
Are you ready for more?

Suppose P is a point that is not on line segment WX. Let line segment YZ be the dilation of line segment WX using P as the center with a scale factor of 2. Experiment using a circular grid to make predictions about whether each of the following statements is always true, sometimes true, or never true.

1. Line segment YZ is twice as long as line segment WX.
2. Line segment YZ is 5 units longer than line segment WX.
3. The point P is on line segment YZ.
4. Line segments YZ and WX intersect.

9.3 Dilation Obstacle Course

Here is a diagram that shows 9 points.

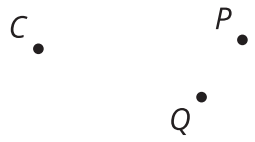


1. Dilate B using a scale factor of 5 and A as the center of dilation. Which point is its image?
2. Using H as the center of dilation, dilate G so that its image is E. What scale factor did you use?
3. Using H as the center of dilation, dilate E so that its image is G. What scale factor did you use?
4. To dilate F so that its image is B, what point on the diagram can you use as the center of dilation?
5. Dilate H using A as the center of dilation and a scale factor of $\frac{1}{3}$. Which point is its image?
6. Describe a dilation that uses a labeled point as its center of dilation and that would take F to H.

7. Using B as the center of dilation, dilate H so that its image is itself. What scale factor did you use?

9.4 Getting Perspective

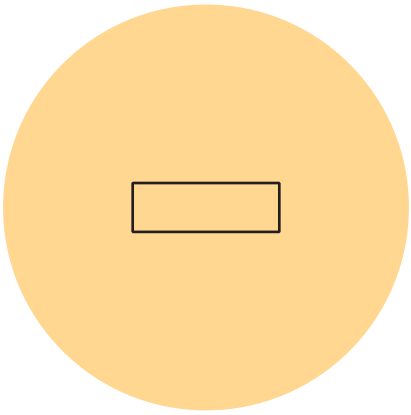
1. Draw the images of points P and Q using C as the center of dilation and a scale factor of 4. Label the new points P' and Q'.



2. Draw the images of points P and Q using C as the center of dilation and a scale factor of $\frac{1}{2}$. Label the new points P'' and Q''.

   Pause here so your teacher can review your diagram. Your teacher will then give you a scale factor to use in the next part.

3. Let's make a perspective drawing. Here is a rectangle.



a. Choose a point *inside the shaded circular region* but *outside the rectangle* to use as the center of dilation. Label it C.

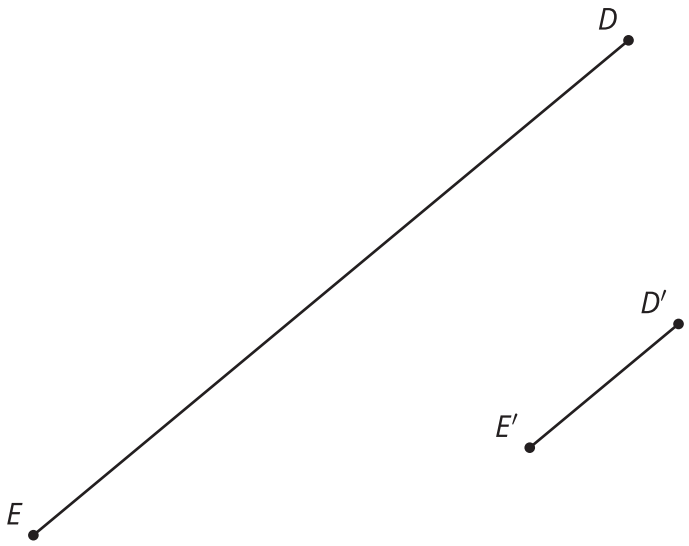
b. Use your center C and the scale factor you were given to draw the image under the dilation of each vertex of the rectangle, one at a time. Connect the dilated vertices to create the dilated rectangle.

c. Draw segments that connects each of the original vertices with its image. This will make your diagram look like a cool three-dimensional drawing of a box! If time allows, you can shade the sides of the box to make it look more realistic.

d. Compare your drawing to other people's drawings. What is the same and what is different? How do the choices you made affect the final drawing? Was your dilated rectangle closer to C than to the original rectangle, or farther away? How is that decided?

Are you ready for more?

Here is line segment DE and its image $D'E'$ under a dilation.



1. Use a ruler or straightedge to find and draw the center of dilation. Label it F.
2. What is the scale factor of the dilation?

Lesson 9 Summary

A **dilation** is a transformation in which each point on a figure moves along a line and changes its distance from a fixed point, called the center of dilation. All of the original distances are multiplied by the same scale factor.

In the figure, point B is dilated with the center of dilation at A.

Since point C is farther away from A than B, the scale factor is larger than 1. If we measure the distance between A and C, we would find that it is exactly twice the distance between A and B, meaning the scale factor of the dilation is 2.

Since point D is closer to A than B, the scale factor is smaller than 1. If we measure the distance between A and D, we would find that it is one third the distance between A and B, meaning the scale factor of the dilation is $\frac{1}{3}$.