## Lesson 2: Circular Grid

### 2.1: Notice and Wonder: Concentric Circles



What do you notice? What do you wonder?

### 2.2: A Droplet on the Surface

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 c, write the distance between $P$ and the point on the smaller circle in grid units. In the row labeled d, write the distance between $P$ and the corresponding point on the larger circle in grid units.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   $E$   |   $F$   |   $G$   |   $H$   |
| c |   |   |   |   |
| d |   |   |   |   |

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.

### 2.3: 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 $A^{′}$, 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 $EFGH$?

#### 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



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.)

### 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.



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