## Lesson 3: Dilations with no Grid

Let’s dilate figures not on grids.

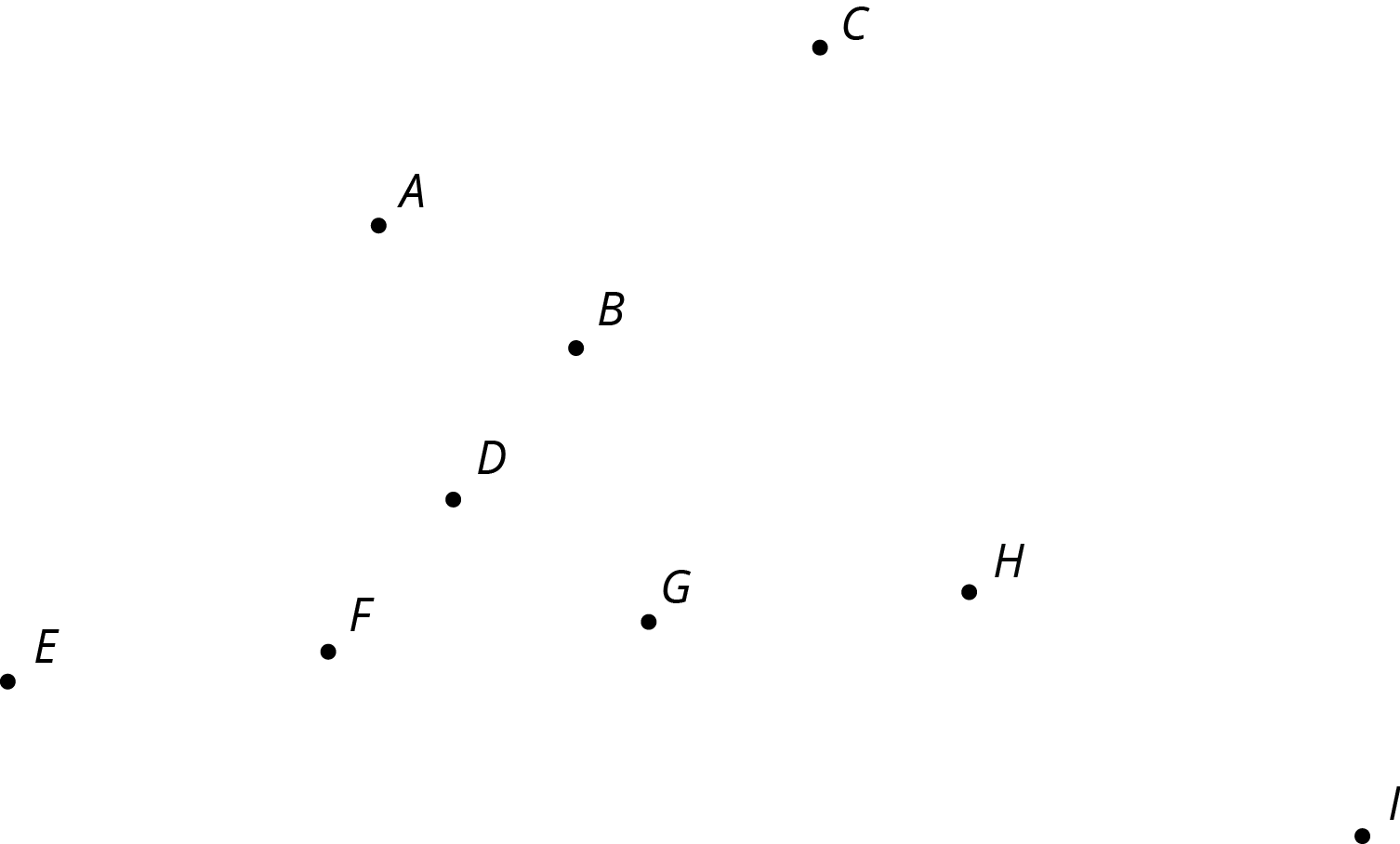
### 3.1: Points on a Ray

1. Find and label a point on the ray whose distance from is twice the distance from to .
2. Find and label a point on the ray whose distance from is half the distance from to .



### 3.2: Dilation Obstacle Course

Here is a diagram that shows nine points.



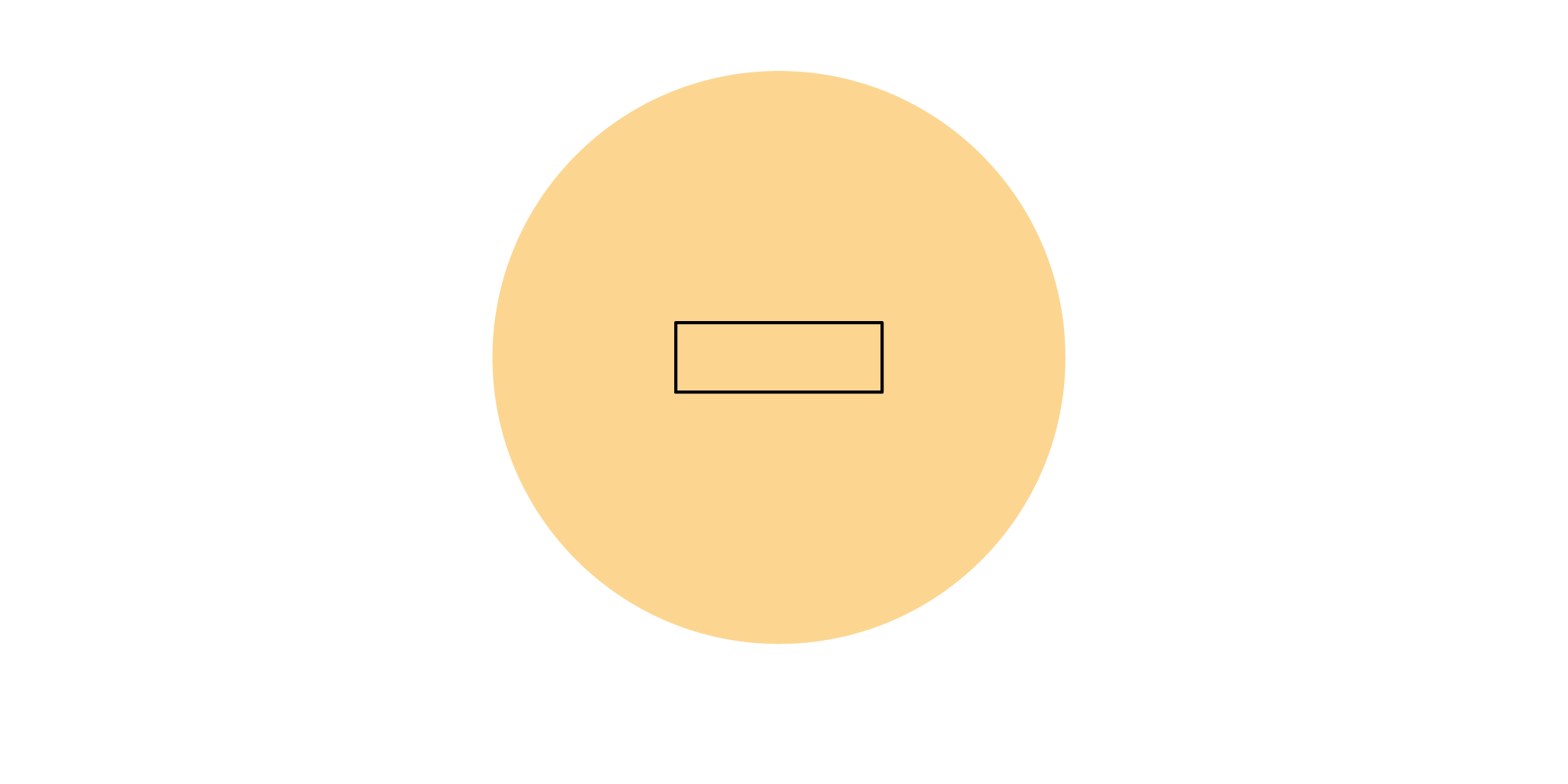
1. Dilate using a scale factor of 5 and as the center of dilation. Which point is its image?
2. Using as the center of dilation, dilate so that its image is . What scale factor did you use?
3. Using as the center of dilation, dilate so that its image is . What scale factor did you use?
4. To dilate so that its image is , what point on the diagram can you use as a center?
5. Dilate using as the center and a scale factor of . Which point is its image?
6. Describe a dilation that uses a labeled point as its center and that would take to .
7. Using as the center of dilation, dilate so that its image is itself. What scale factor did you use?

### 3.3: Getting Perspective

1. Using one colored pencil, draw the images of points and using as the center of dilation and a scale factor of 4. Label the new points and .
2. Using a different color, draw the images of points and  using as the center of dilation and a scale factor of . Label the new points and .

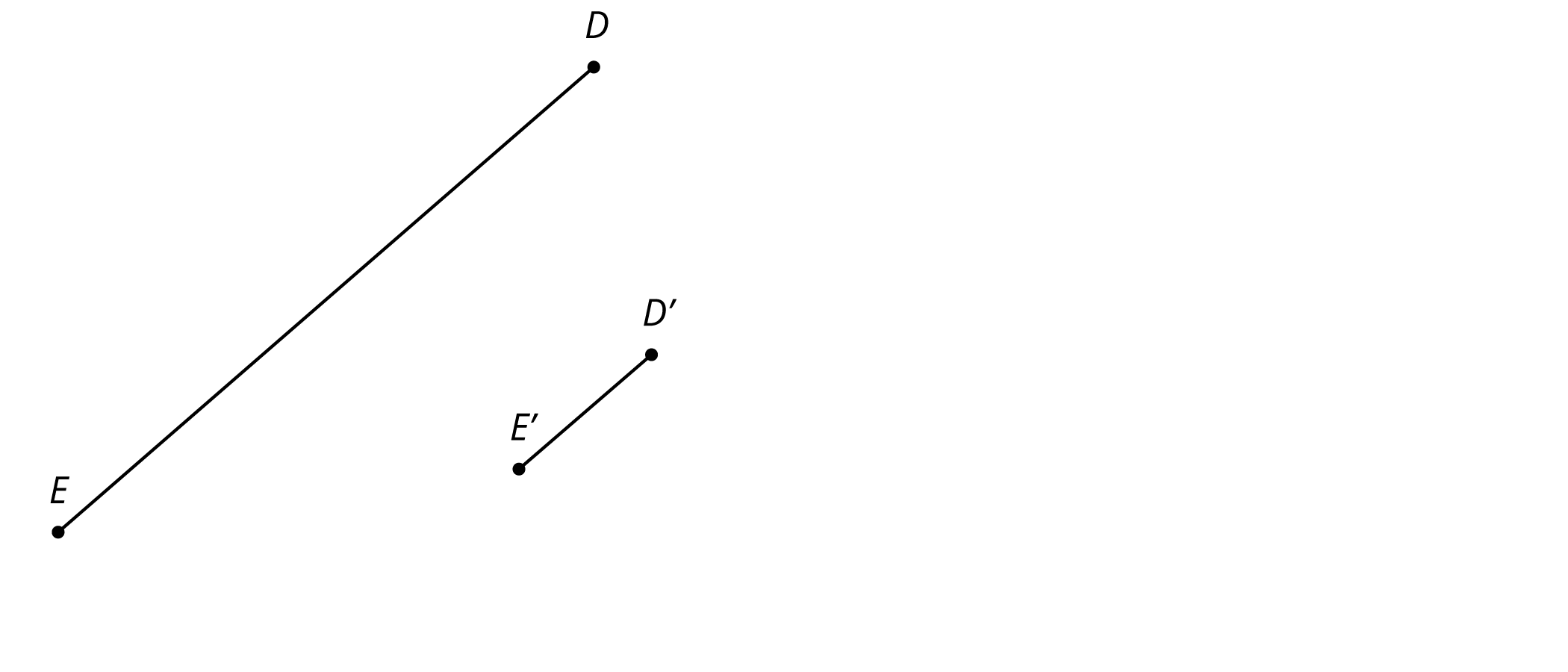
* 
* Pause here so your teacher can review your diagram. Your teacher will then give you a scale factor to use in the next part.

1. Now you’ll make a perspective drawing. Here is a rectangle.

* 
  1. Choose a point *inside the shaded circular region* but *outside the rectangle* to use as the center of dilation. Label it .
  2. Using your center and the scale factor you were given, 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.
  3. Draw a segment 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 there’s time, you can shade the sides of the box to make it look more realistic.
  4. 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 than to the original rectangle, or farther away? How is that decided?

#### Are you ready for more?

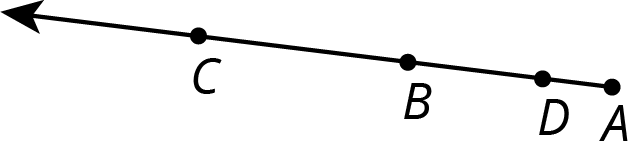
Here is line segment and its image  under a dilation.



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

### Lesson 3 Summary

If is the center of dilation, how can we find which point is the dilation of with scale factor 2?



Since the scale factor is larger than 1, the point must be farther away from than is, which makes the point we are looking for. If we measure the distance between and , we would find that it is exactly twice the distance between and .

A dilation with scale factor less than 1 brings points closer. The point is the dilation of with center and scale factor .



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