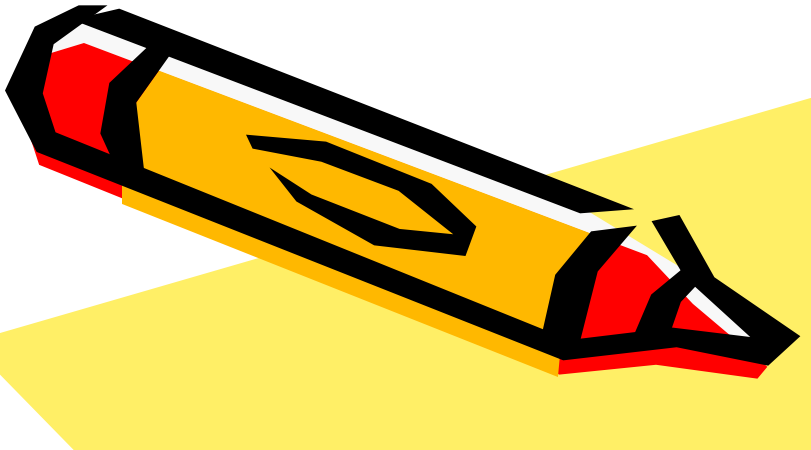
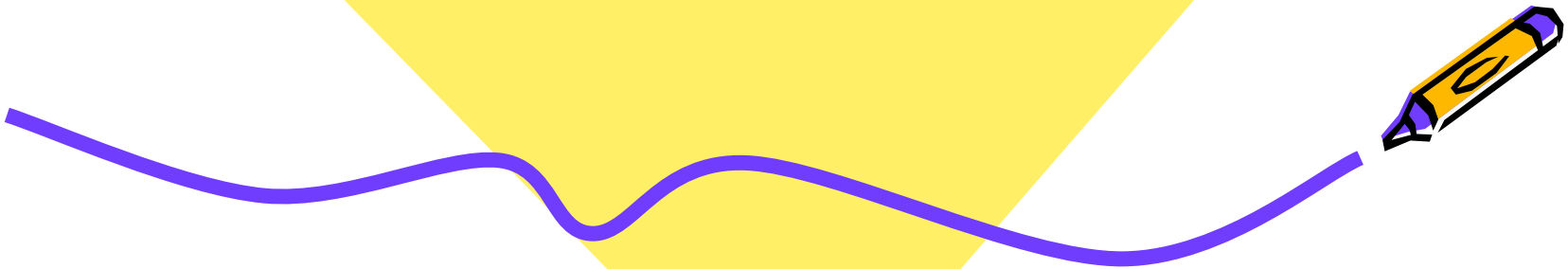
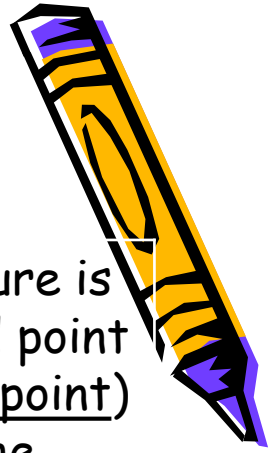


Geometry

Dilations



Vocabulary



Dilation

A dilation is a transformation in which a figure is enlarged or reduced with respect to a fixed point *C* called the center of dilation (or vanishing point) and a scale factor *k*, which is the ratio of the lengths of the corresponding sides of the image and the preimage.

A dilation with center of dilation *C* and scale factor *k* maps every point *P* in a figure to a point so that the following are true.

- If *P* is the center point *C*, then P = P′
- If *P* is not the center point *C*, then the image point P′ lies on $\overline{CP}$
  The scale factor *k* is a positive number such that $k = \frac{CP'}{CP}$
- Angle measures are preserved.

Vocabulary

Reduction	A dilation that alters an image, creating a proportionally smaller image.
Enlargement	A dilation that alters an image, creating a proportionally larger image.
Scale Factor	The ratio of the lengths of corresponding sides, before and after the dilation. Direction matters: reduction vs. enlargement They are reciprocals of each other.

Corresponding sides of the images before and after a dilation are proportional.

All sides are dilated using the same scale factor.

Dilations

On the coordinate plane, the rule for a dilation relative to the origin is:

$(x, y) \rightarrow (kx, ky)$

Where k is the scale factor.

Note that since the dilation is relative to the origin, this will cause a dilation of the figure as well as its distance from the origin.

Dilation

https://www.youtube.com/watch?v=BCllaARDOWI

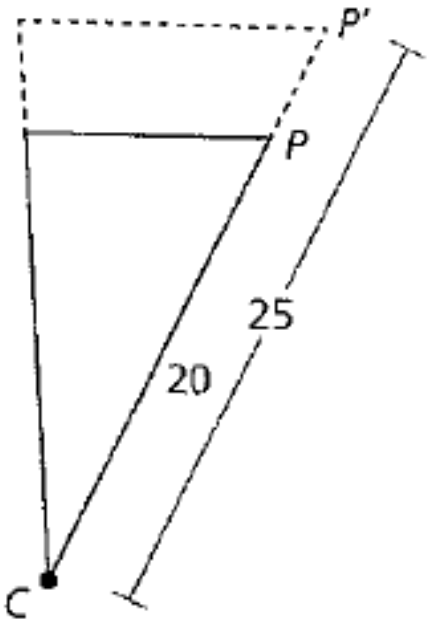
Animated video about Dilations

Dilations

Determine the scale factor for the given dilation.

Remember:

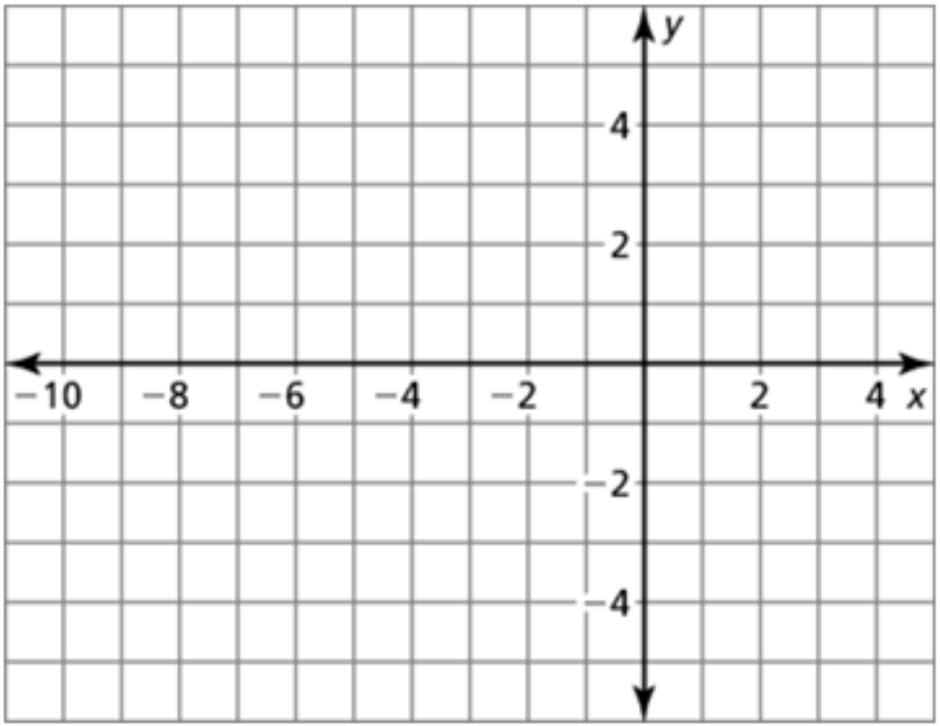
A scale factor less than 1 causes a reduction.
A scale factor greater than 1 causes an enlargement.
A scale factor equal to 1 is congruent.



Dilations

Graph the polygon and its image after a dilation with the indicated scale factor.

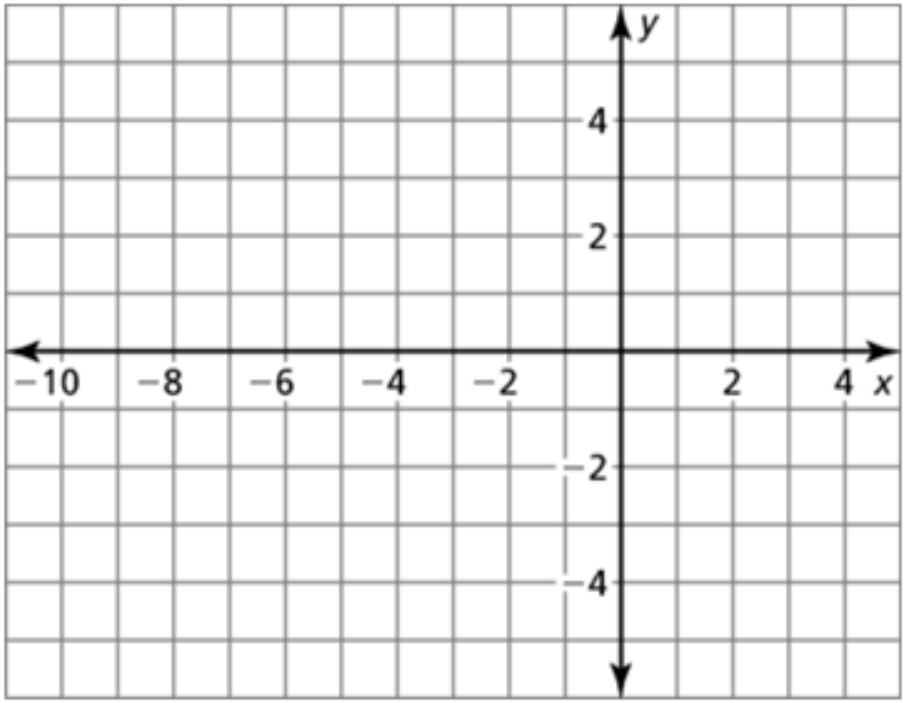
$A(-3, 1), B(-4, -1), C(-2, -1); k = 2$



Dilations

Graph the polygon and its image after a dilation with the indicated scale factor.

$P(-10, 0), Q(-5, 0), R(0, 5), S(-5, 5); k = \frac{1}{5}$



Dilations

Dilation relative to any given point (vanishing point):

1. Perform a translation so that the given point (vanishing point) lands at the origin (translate all points of the figure accordingly).
2. Perform the given dilation for all points of the figure.
3. Perform the opposite translation from step 1 returning to the original point of dilation (vanishing point). Translate all points of the figure accordingly.

Dilations

Using the coordinate plane:

1. Graph ΔABC with vertices A(13, -5), B(10, -9), C(5, -5)

2. Graph the dilation using a scale factor of $\frac{1}{2}$ and dilation (vanishing) point (10, 12)