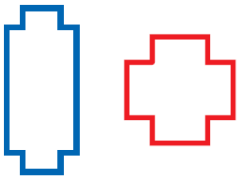
9.7 Dilations/7.2 Similarity Transformations

- Identify and draw translations. (9.7)
- Draw and describe similarity transformations in the coordinate plane. (7.2)

Think-About-It then Write-About-It Where have you see dilations in the real world? Why do we use them?

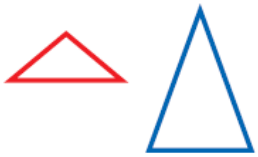
What is a dilation? What do you need to perform a dilation?

Example 1: Identify whether each transformation appears to be a dilation. Explain why you chose yes/no. If you chose yes, where do you think the center of dilation is?

1. 

2. 

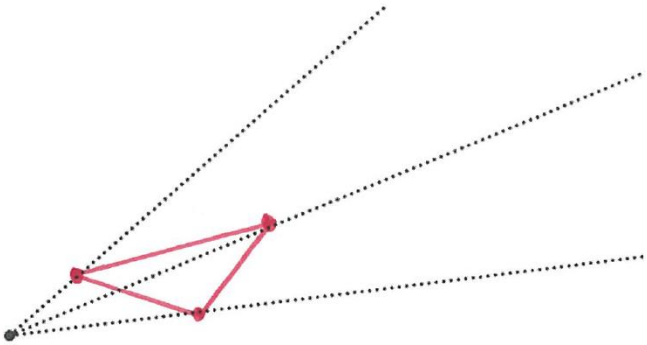
3. 

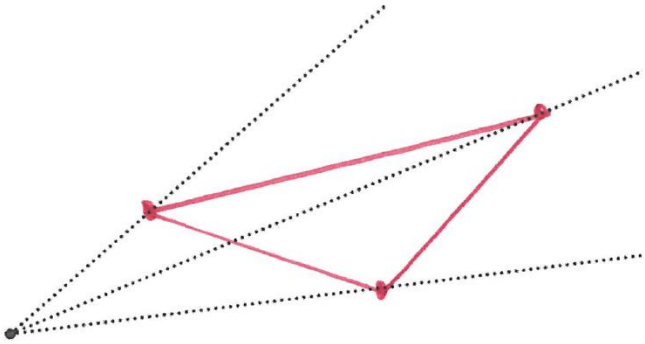
4. 

Make a Prediction: In order to dilate a figure, you must know two things… the point you are dilating from and the scale factor that you are using to dilate the figure. What do you think the following scale factors would do to an image?

4 **¼** **-4** **-¼**

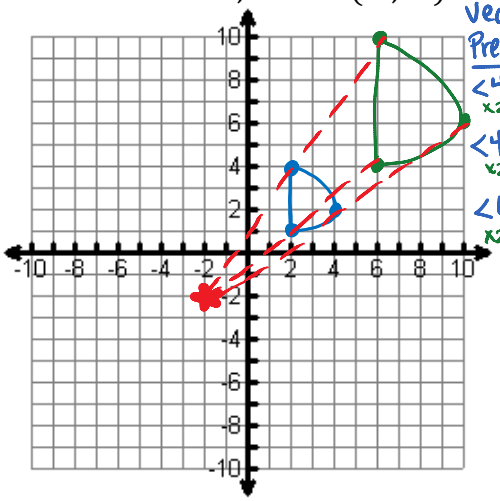
Example 2: Using a ruler, double the size of the first figure and reduce the size of the second figure by ½.





EXAMPLE 3: Dilate each letter in the word "DEVIL!" about the given center with the given scale factor.

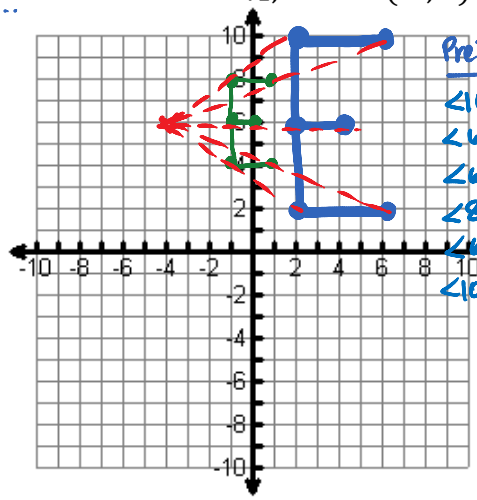
1. Scale Factor of 2; Center (-2, -2)



Translation Vector from center to...

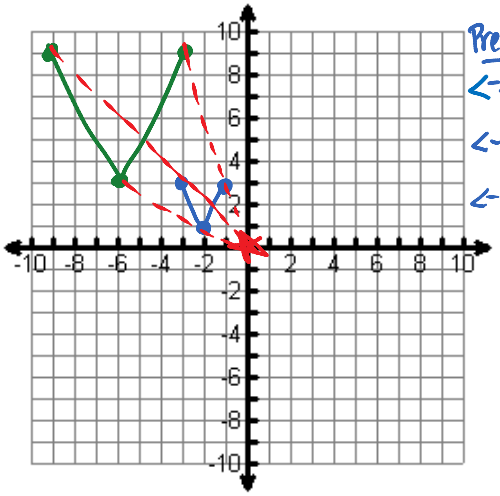
Preimage	Image
<4,3> ×2 ×2	<8,6>
<4,6> ×2 ×2	<8,12>
<6,4> ×2 ×2	<12,8>

2. Scale Factor of ½; Center (-2, 6)



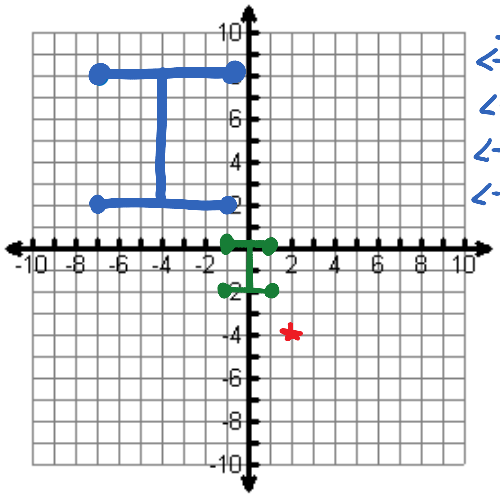
Preimage	Image
<10,4>	<5,2>
<6,4>	<3,2>
<6,0>	<3,0>
<8,0>	<4,0>
<6,-4>	<3,-2>
<10,-4>	<5,-2>

3. Scale Factor of 3; Center (0, 0)



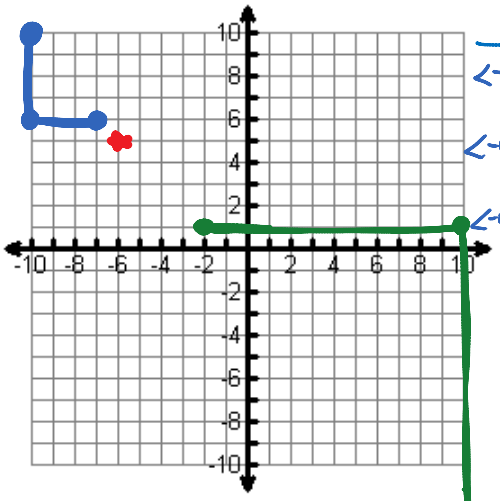
Preimage	Image
<-2,1>	<-6,3>
<-3,3>	<-9,9>
<-1,3>	<-3,9>

4. Scale Factor of 1/3; Center (2, -4)



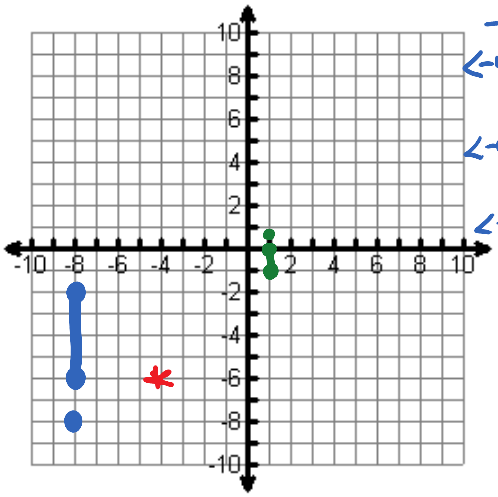
P	I
<-9,12>	<-3,4>
<-3,12>	<-1,4>
<-9,6>	<-3,2>
<-3,6>	<-1,2>

5. Scale Factor of -4; Center (-6, 5)



P	I
<-1,1>	<4,-4>
<-4,1>	<16,-4>
<-4,5>	<16,-20>

6. Scale Factor of -¼; Center (-4, -6)



P	I
<-4,0>	<1,0>
<-4,4>	<1,-1>
<-4,2>	<1,½>

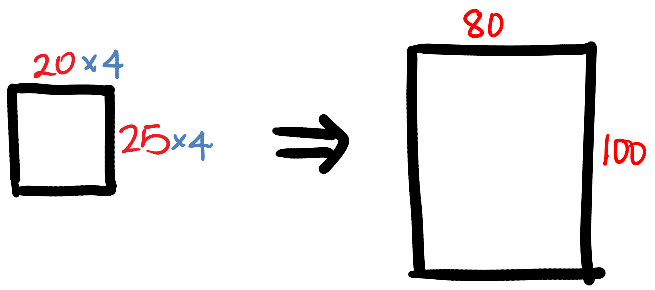
Look at Problems #1 and #3, what did those scale factors do to the letter? How about #2 and #4? How about #5 and #6? Go back and modify your predictions on the front page.

So let's summarize…

Scale Factor	Results
$k > 1$	Enlargement
$0 < k < 1$	Reduction (shrink)
$-1 < k < 0$	Reduction and Rotation 180° about origin
$k < -1$	Enlargement and Rotation 180° about origin

Example 4: Applications

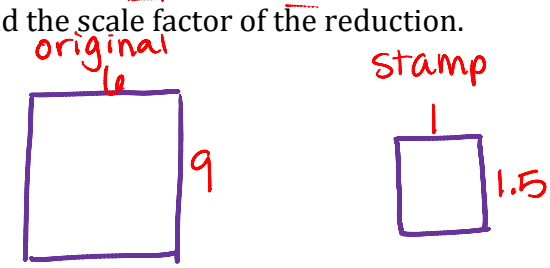
13. An artist is creating a large painting from a photograph by dividing the photo into squares and dilating each square by a scale factor of 4. If the photograph is 20 cm by 25 cm, what is the perimeter of the paining?



$P = 80 + 80 + 100 + 100$

$P = 360$ cm

14. An engraver is designing a stamp to celebrate Asian American history. Her original version of the stamp is a rectangle 6 inches by 9 inches. When the stamp is produced, it will be a rectangle 1 inch by 1.5 inches. Find the scale factor of the reduction.

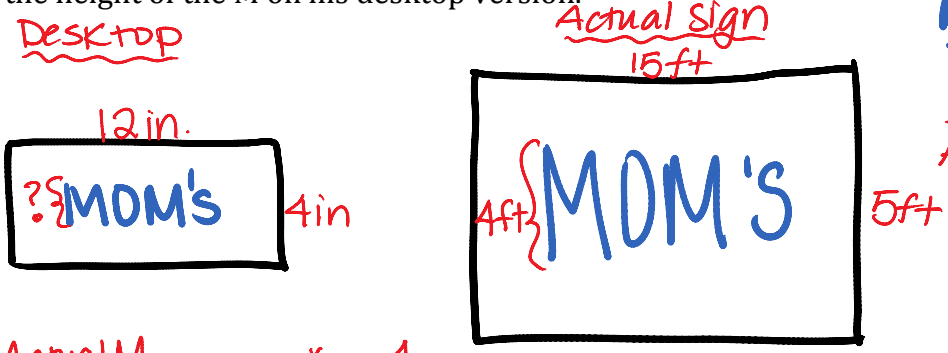


$\frac{1}{6} = \frac{1.5}{9}$

scale factor must be between $0 < k < 1$

so… $\boxed{1/6}$ is the scale factor

15. A sign painter creates a rectangular sign for Mom's Diner on his computer desktop. The desktop version is 12 inches by 4 inches. The actual sign will be 15 feet by 5 feet. If the capital M in "Mom's" will be 4 feet tall, find the height of the M on his desktop version.



Ratio #1

$\frac{\text{Desktop M}}{\text{Desktop Length}} = \frac{\text{Actual M}}{\text{Actual Length}} \Rightarrow \frac{x}{12} = \frac{4}{15}$

$15x = 48$ $\boxed{x = 3.2 \text{ in}}$

Ratio #2

$\frac{\text{Desktop M}}{\text{Actual M}} = \frac{\text{Desktop W}}{\text{Actual W}}$

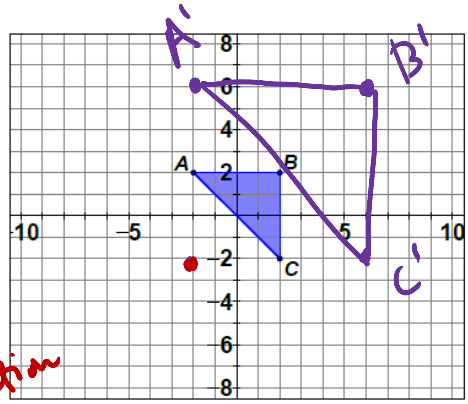
$\frac{x}{4} = \frac{4}{5}$

$5x = 16$

$\boxed{x = 3.2 \text{ in}}$

For #1-4, dilate Δ ABC around the given center with the given scale factor.

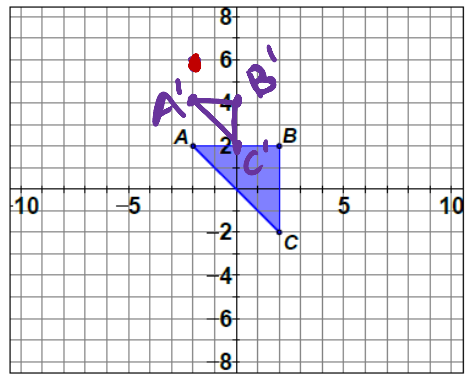
1. Scale Factor: 2
   Center: (-2, -2)



Translation vector from center!

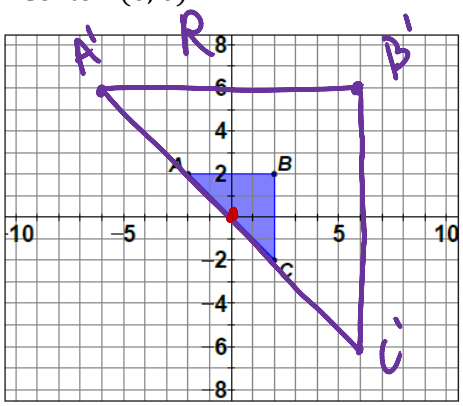
A <0,4> A' <0,8>
B <4,4> B' <8,8>
C <4,0> C' <8,0>

2. Scale Factor: ½
   Center: (-2, 6)



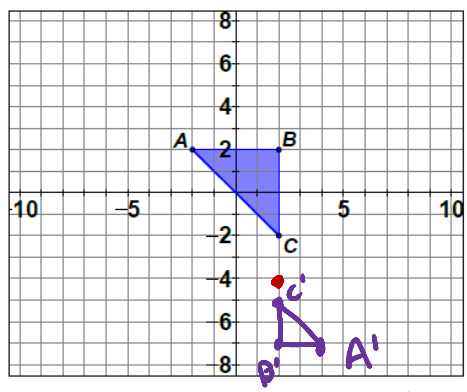
A <0,-4> A' <0,-2>
B <4,-4> B' <2,-2>
C <4,-8> C' <2,-4>

3. Scale Factor: 3
   Center: (0, 0)



A <-2,2> A' <-6,6>
B <2,2> B' <6,6>
C <2,-2> C' <6,-6>

4. Scale Factor: -½
   Center: (2,-4)



A <-4,6> A' <2,-3>
B <0,6> B' <0,-3>
C <0,2> C' <0,-1>

5. A blueprint shows a reduction of a room using a scale factor of $\frac{1}{50}$. In the blueprint, the room's length is 8 in., and its width is 6 in. Find the perimeter of the room.

8in ×50 400 x

B.P. 6in ×50 → Actual

y 300

$\frac{50}{1} \cdot x \cdot \frac{1}{50} = 8 \cdot \frac{50}{1}$ x=400

$y \frac{50}{1} \cdot y \cdot \frac{1}{50} = 6 \cdot \frac{50}{1}$ y=300

P = 400+400+300+300

P=1,400 inches