

5-6 SIMILARITY TRANSFORMATIONS

REVIEW:

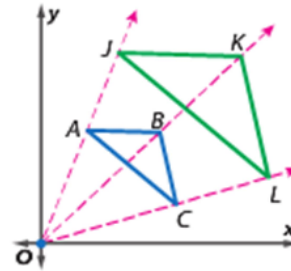
1 Identify Similarity Transformations Recall from Lesson 4-7 that a *transformation* is an operation that maps an original figure, the *preimage*, onto a new figure called the *image*.

A **dilation** is a transformation that enlarges or reduces the original figure proportionally. Since a dilation produces a similar figure, a dilation is a type of **similarity transformation**.

Dilations are performed with respect to a fixed point called the **center of dilation**.

The **scale factor of a dilation** describes the extent of the dilation. The scale factor is the ratio of a length on the image to a corresponding length on the preimage.

The letter k usually represents the scale factor of a dilation. The value of k determines whether the dilation is an enlargement or a reduction.



$\triangle JKL$ is a dilation of $\triangle ABC$.
Center of dilation: $(0, 0)$
Scale factor: $\frac{JK}{AB}$

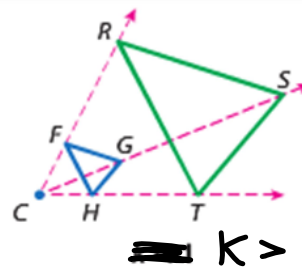
Image
preimage

Concept Summary Types of Dilations

A dilation with a scale factor greater than 1 produces an **enlargement**, or an image that is larger than the original figure.

Symbols If $k > 1$, the dilation is an enlargement.

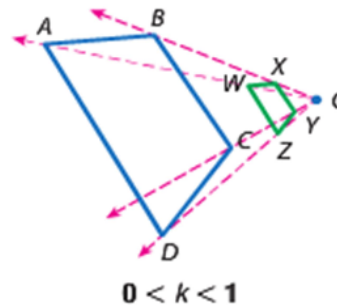
Example $\triangle FGH$ is dilated by a scale factor of 3 to produce $\triangle RST$. Since $3 > 1$, $\triangle RST$ is an enlargement of $\triangle FGH$.



A dilation with a scale factor between 0 and 1 produces a **reduction**, an image that is smaller than the original figure.

Symbols If $0 < k < 1$, the dilation is a reduction.

Example $ABCD$ is dilated by a scale factor of $\frac{1}{4}$ to produce $WXYZ$. Since $0 < \frac{1}{4} < 1$, $WXYZ$ is a reduction of $ABCD$.



$$\frac{\text{image}}{\text{preimage}} = \frac{B}{A} = \frac{\text{length from B}}{\text{corresponding length from A}}$$

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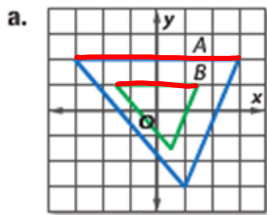
The scale factor of dilation can be represented as a fraction, decimal, or a percent.

For example, a scale factor of $\frac{2}{5}$ may also be represented by .4 or 40%.

EXAMPLE 1:

$$\begin{aligned} \text{decimal} \times 100 &= \% \\ .4 \times 100 &= 40\% \end{aligned}$$

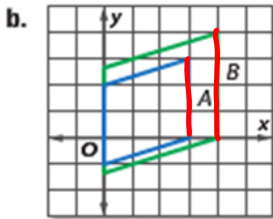
Determine whether the dilation from A to B is an enlargement or a reduction. Then find the scale factor of the dilation.



A = preimage
 B = image
 A → B = smaller
 = reduction
 $0 < k < 1$

$$\frac{B}{A} = \frac{3}{6} = \frac{1}{2}$$

$$K = \frac{1}{2}, 0.5, 50\%$$



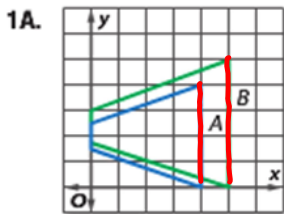
A → B = bigger
 = enlargement
 $k > 1$

$$\frac{B}{A} = \frac{4}{3}$$

$$K = \frac{4}{3}, 1.\bar{3}, 133.\bar{3}\%$$

$$133\frac{1}{3}\%$$

TRY THESE:

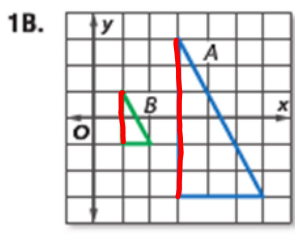


A → B = bigger
 = enlargement
 $k > 1$

$$\frac{B}{A} = \frac{5}{4}$$

$$K = \frac{5}{4}, 1.25, 125\%$$

$\frac{\text{image}}{\text{preimage}}$ or $\frac{\text{preimage}}{\text{image}}$?



A = preimage
B = image

A → B
bigger to smaller
reduction
 $0 < k < 1$

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 $\frac{B}{A} = \frac{2}{6} = \frac{1}{3}$

$k = \frac{1}{3}, 0.\overline{3}, 33.\overline{3}\%$
or $33\frac{1}{3}\%$

EXAMPLE 2:

Adriana uses a copier to enlarge a movie ticket to use as the background for a page in her movie ticket scrapbook. She places the ticket on the glass of the copier. Then she must decide what percentage to input in order to create an image that is three times as big as her original ticket.

$k > 1$
enlargement
image = 3(preimage)



$\frac{\text{image}}{\text{preimage}}$

By what percent should Adriana enlarge the ticket stub so that the dimensions of its image are 3 times that of her original? What will be the dimensions of the enlarged image?

image length = $3(6.4) = 19.2$
image width = $3(5) = 15$

$l: \frac{19.2}{6.4} = 3 = 300\%$

$w: \frac{15}{5} = 3 = 300\%$

If the resulting ticket stub image was 1.5 centimeters wide by about 1.9 centimeters long, instead, what percent did Adriana mistakenly use to dilate the original image? Explain your reasoning.

} new images

$l: \frac{1.9}{6.4} \approx .296875 \approx .3 \approx 30\%$

$w: \frac{1.5}{5} = .3 = 30\%$

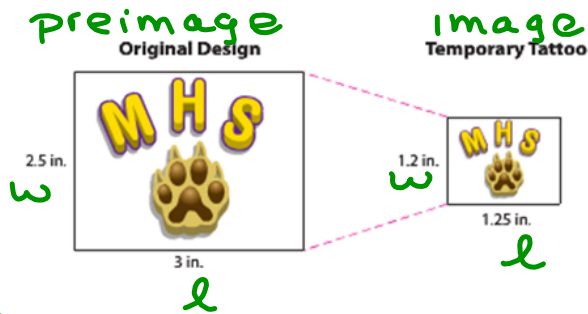
reduction because
 $0 < .3 < 1$

EXAMPLE 3:

CCSS MODELING Candace created a design to be made into temporary tattoos for a homecoming game as shown. Is the temporary tattoo a dilation of the original design? If so, what is the scale factor? Explain.

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$\frac{\text{Image}}{\text{preimage}}$



We are looking at a reduction $0 < k < 1$

length: $\frac{1.25}{3} \approx .41\bar{6}$

width: $\frac{1.2}{2.5} = .48$

} scale factors not the same; therefore, not a dilation.

$.41\bar{6} \neq .48$