

INDEPENDENT VARIABLE

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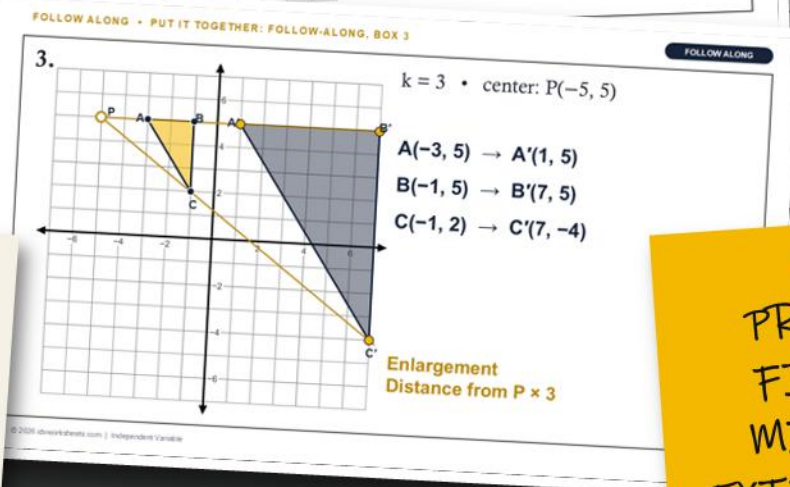
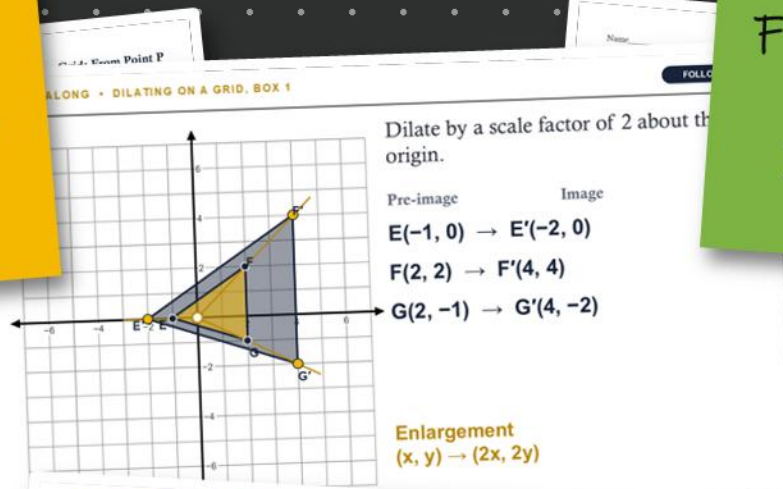


HOW TO DILATE AN IMAGE

SCALE FACTOR | CENTER OF DILATION | GRID & RULER

ANIMATED
POWERPOINT:
DOES THE WORK
FOR YOU!

FULL ANSWER
KEYS
INCLUDED



18 EXAMPLE
PROBLEMS
4 PRACTICE
SHEETS

GRID
PRACTICE,
FIND THE
MISTAKE +
EXIT TICKETS

MORE PRACTICE. LESS PREP. BETTER OUTCOMES.

Inside the Animated Lesson

INDEPENDENT VARIABLE
GRADE 8 • GEOMETRY

HOW TO DILATE AN IMAGE

SCALE FACTOR | CENTER OF DILATION | GRID & RULER

Animated PowerPoint lesson
 18 guided problems • on a grid and with a ruler
 Leveled grid practice, find the mistake • full keys

**18
ANIMATED
PROBLEMS**

**FULL
ANSWER
KEYS
INCLUDED**

MORE PRACTICE. LESS PREP. BETTER OUTCOMES.

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LESSON OVERVIEW
Today's Goals

TODAY WE WILL...

- 1 Dilate a figure on a coordinate grid, using the origin as the center.
- 2 Dilate a figure from any center point, using a ruler.
- 3 Compare the properties of a figure and its image.

KEY VOCABULARY

Dilation enlarges or reduces a figure from a center point	Center of dilation the fixed point every ray starts from
Scale factor (k) the number each distance from the center is multiplied by	Enlargement / reduction $k > 1$ gets bigger; $0 < k < 1$ gets smaller
Pre-image the original figure: A, B, C	Image the new figure: A', B', C' (say "A prime")

MATERIALS
Centimeter ruler and pencil

STANDARDS
CCSS 8.G.A.3
CCSS 8.G.A.4
HSG.SRT.A.1

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THE METHOD
How to Dilate

ON A GRID
Center at the origin

- 1 Multiply BOTH coordinates of each vertex by k: $(x, y) \rightarrow (kx, ky)$.
- 2 Plot each image point. It lands on the ray from the origin through the vertex.
- 3 Connect the image points and label them with primes.

EXAMPLE $k = 2$
 $G(2, -1) \rightarrow G'(2 \cdot 2, 2 \cdot (-1)) = G'(4, -2)$

WITH A RULER
Center at any point

- 1 Draw a ray from the center through each vertex.
- 2 Measure the distance from the center to the vertex, then multiply by k.
- 3 Mark the image point on the ray at the new distance. Connect the image points.

EXAMPLE $k = \frac{1}{2}$
 Center to B is 4.8 cm, so center to B' is $\frac{1}{2} \times 4.8 = 2.4$ cm.

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FOLLOW ALONG • DILATING ON A GRID, BOX 1

FOLLOW ALONG

1.

Dilate by a scale factor of 2 about the origin.

Pre-image	Image
$E(\underline{\quad}, \underline{\quad})$	$E'(\underline{\quad}, \underline{\quad})$
$F(\underline{\quad}, \underline{\quad})$	$F'(\underline{\quad}, \underline{\quad})$
$G(\underline{\quad}, \underline{\quad})$	$G'(\underline{\quad}, \underline{\quad})$

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FOLLOW ALONG • DILATING ON A GRID, BOX 1

FOLLOW ALONG

1.

Dilate by a scale factor of 2 about the origin.

Pre-image	Image
$E(-1, 0) \rightarrow E'(-2, 0)$	
$F(2, 2) \rightarrow F'(4, 4)$	
$G(2, -1) \rightarrow G'(4, -2)$	

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FOLLOW ALONG • DILATING ON A GRID, BOX 1

FOLLOW ALONG

1.

Dilate by a scale factor of 2 about the origin.

Pre-image	Image
$E(-1, 0) \rightarrow E'(-2, 0)$	
$F(2, 2) \rightarrow F'(4, 4)$	
$G(2, -1) \rightarrow G'(4, -2)$	

Enlargement
 $(x, y) \rightarrow (2x, 2y)$

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FOLLOW ALONG • DILATING WITH A RULER, BOX 9

FOLLOW ALONG

9.

Use a scale factor of $\frac{3}{2}$ and a center of dilation at point P.

PA 1.2 $\rightarrow$ 1.8 cm
 PB 1.8 $\rightarrow$ 2.7 cm
 PC 1.8 $\rightarrow$ 2.7 cm
 PD 1.2 $\rightarrow$ 1.8 cm

(distance from P: pre-image $\rightarrow$ image)

Enlargement
Every length $\times 1.5$

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KEY IDEA
Compare the Properties

Look back at any problem. What changed from the pre-image to the image, and what stayed the same?

STAYS THE SAME

- ✓ Angle measures
- ✓ The shape (the figures are similar)
- ✓ Each side is parallel to its image side (or on the same line)
- ✓ The center of dilation does not move

CHANGES

- $\rightarrow$ Every side length is multiplied by k
- $\rightarrow$ Every distance from the center is multiplied by k
- $\rightarrow$ The size: $k > 1$ enlarges, $0 < k < 1$ reduces

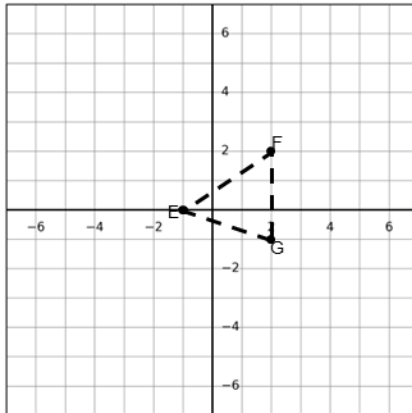
Problem 10: $k = 2$

A dilation makes a **SIMILAR** figure (~): same shape and angles; lengths in the ratio image : pre-image = k.

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Directions: Dilate each figure about the origin by the scale factor given. Draw a ray from the origin through each vertex, plot the image points, and label the image with primes (E', F', G').

1. Dilate by a scale factor of **2** about the origin.



Pre-image

E(____, ____)

F(____, ____)

G(____, ____)

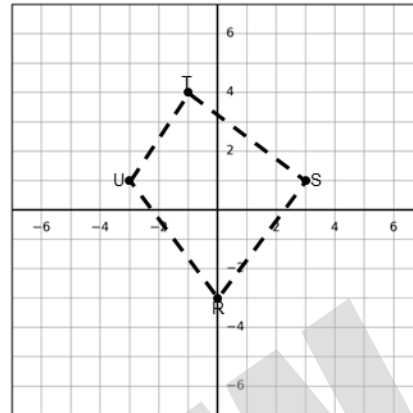
Image

E'(____, ____)

F'(____, ____)

G'(____, ____)

2. Dilate by a scale factor of **1/2** about the origin.



Pre-image

T(____, ____)

S(____, ____)

R(____, ____)

U(____, ____)

Image

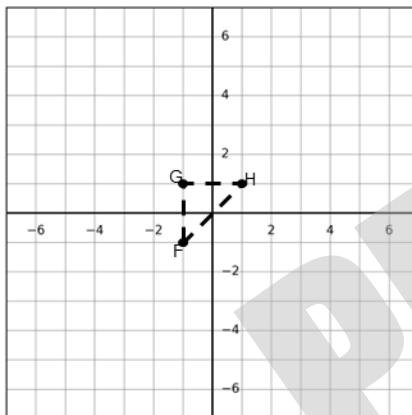
T'(____, ____)

S'(____, ____)

R'(____, ____)

U'(____, ____)

3. Dilate by a scale factor of **4.5** about the origin.



Pre-image

G(____, ____)

H(____, ____)

F(____, ____)

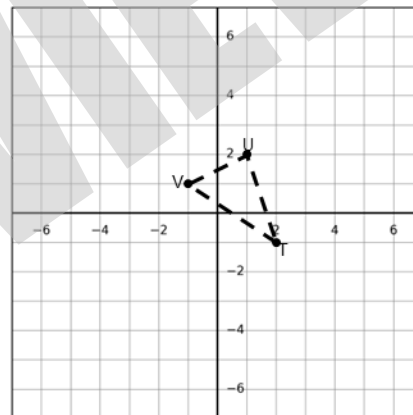
Image

G'(____, ____)

H'(____, ____)

F'(____, ____)

4. Dilate by a scale factor of **2** about the origin.



Pre-image

V(____, ____)

U(____, ____)

T(____, ____)

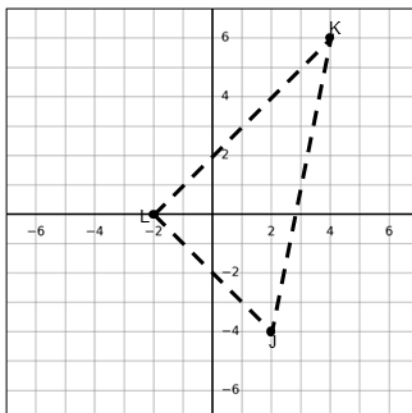
Image

V'(____, ____)

U'(____, ____)

T'(____, ____)

5. Dilate by a scale factor of **1/4** about the origin.



Pre-image

K(____, ____)

J(____, ____)

L(____, ____)

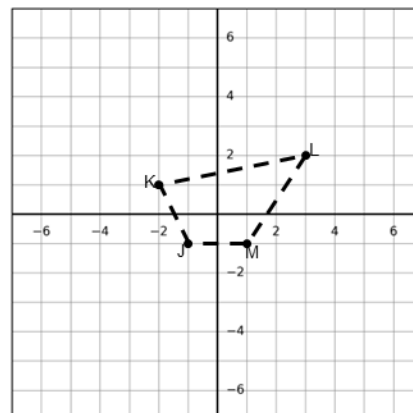
Image

K'(____, ____)

J'(____, ____)

L'(____, ____)

6. Dilate by a scale factor of **3/2** about the origin.



Pre-image

K(____, ____)

L(____, ____)

M(____, ____)

J(____, ____)

Image

K'(____, ____)

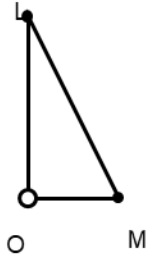
L'(____, ____)

M'(____, ____)

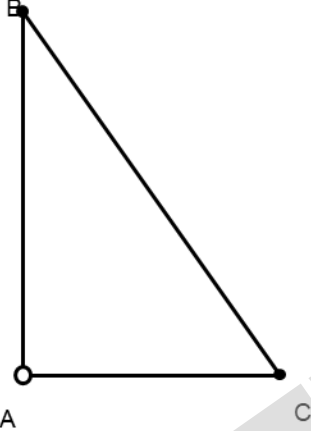
J'(____, ____)

Directions: Use a centimeter ruler. Draw a ray from the center through each vertex, measure, multiply by the scale factor, and mark each image point. Connect and label the image with primes. Print at 100%.

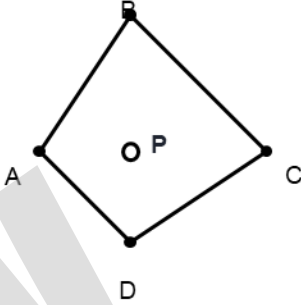
7. Use a scale factor of 2 and a center of dilation at point O.



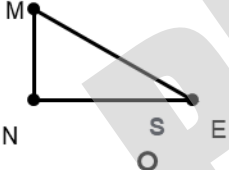
8. Use a scale factor of 1/2 and a center of dilation at point A.



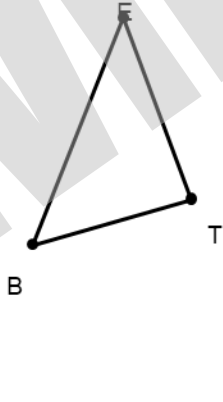
9. Use a scale factor of 3/2 and a center of dilation at point P.



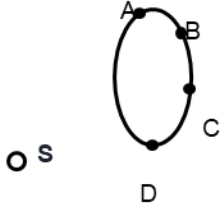
10. Use a scale factor of 2 and a center of dilation at point S.



11. Use a scale factor of 1/3 and a center of dilation at point S.



12. Use a scale factor of 2 and center S. Dilate points A–D, then sketch the image of the oval.



Compare the Properties (use your Problem 10)

Measure each side of $\triangle MNE$ and of its image $\triangle M'N'E'$ to the nearest 0.1 cm. Then divide.

Measure	Pre-image $\triangle MNE$	Image $\triangle M'N'E'$	Image $\div$ Pre-image
Side MN			
Side NE			
Side ME			

Angle at N

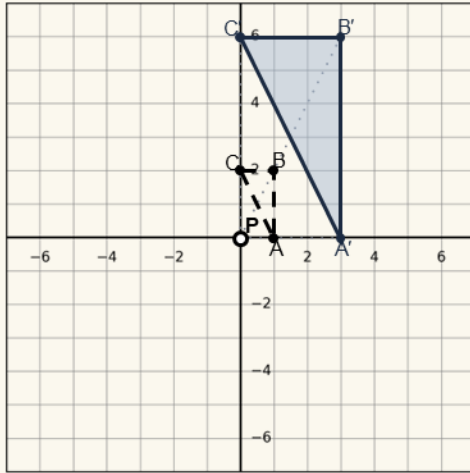
1. What happened to every side length?

2. What happened to the angle at N?

3. Is $M'N'$ parallel to MN ? Is $N'E'$ parallel to NE ?

4. Congruent or similar? Explain.

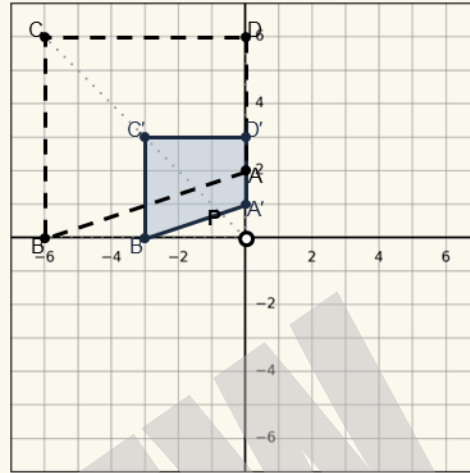
Directions: Study the two examples. Then dilate each figure by the scale factor, centered at the origin. Write the coordinates of the image.

Example 1: $k = 3$, center: the origin

Answer

 $A(1, 0) \rightarrow$
 $A'(3, 0)$ $B(1, 2) \rightarrow$
 $B'(3, 6)$ $C(0, 2) \rightarrow$
 $C'(0, 6)$

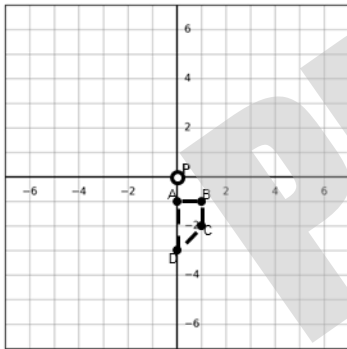
Centered at the origin: multiply both coordinates by k . Enlargement: every length $\times 3$.

Example 2: $k = 1/2$, center: the origin

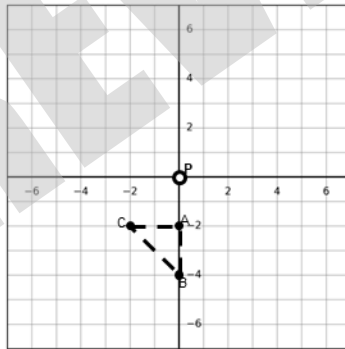
Answer

 $A(0, 2) \rightarrow$
 $A'(0, 1)$ $B(-6, 0) \rightarrow$
 $B'(-3, 0)$ $C(-6, 6) \rightarrow$
 $C'(-3, 3)$ $D(0, 6) \rightarrow$
 $D'(0, 3)$

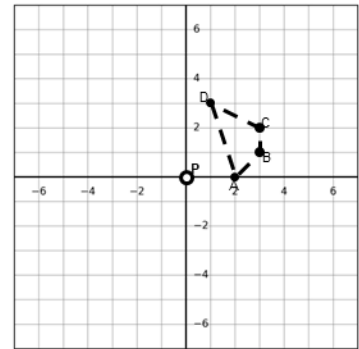
Centered at the origin: multiply both coordinates by k . Reduction: every length $\times 1/2$.

Your turn**1.** $k = 2$ • center: the origin

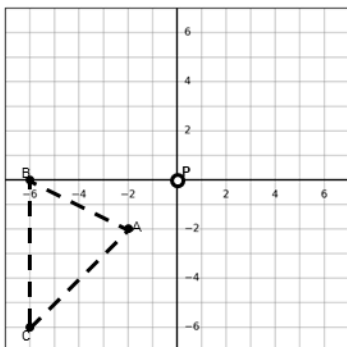
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

2. $k = 1.5$ • center: the origin

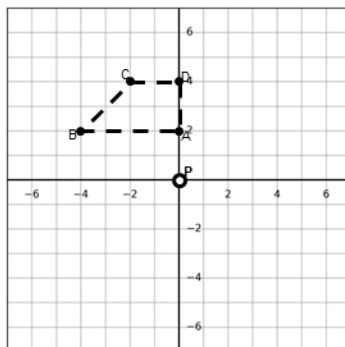
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

3. $k = 2$ • center: the origin

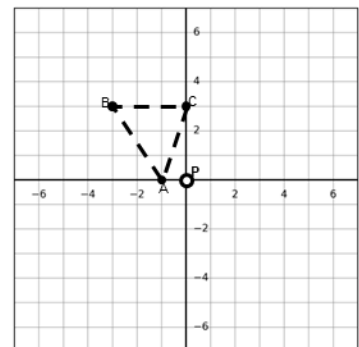
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

4. $k = 1/2$ • center: the origin

$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

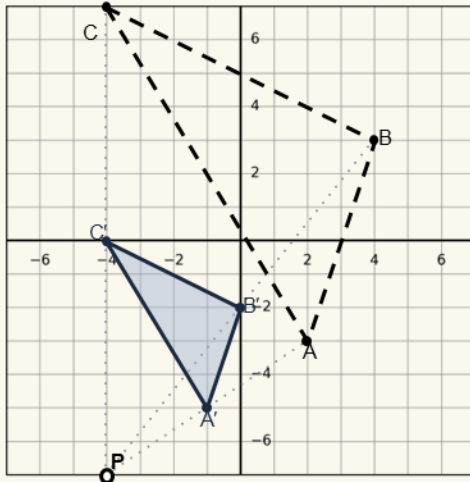
5. $k = 1.5$ • center: the origin

$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

6. $k = 2$ • center: the origin

$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

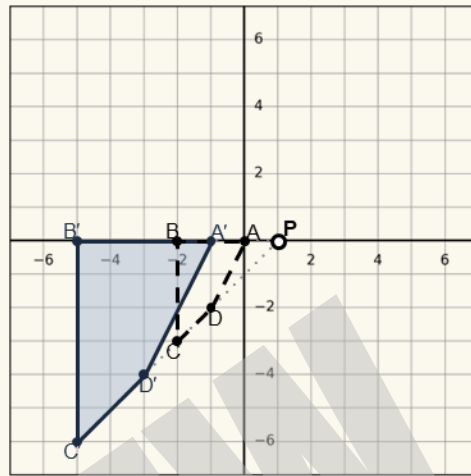
Directions: Study the two examples. Then dilate each figure by the scale factor, centered at P. Write the coordinates of the image.

Example 1: $k = 1/2$, center: $P(-4, -7)$ 

Answer

 $A(2, -3) \rightarrow$
 $A'(-1, -5)$ $B(4, 3) \rightarrow$
 $B'(0, -2)$ $C(-4, 7) \rightarrow$
 $C'(-4, 0)$

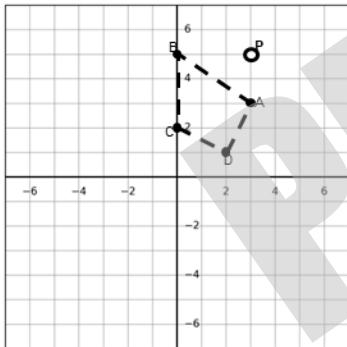
Centered at P: multiply each distance FROM P by k , then count from P.
Reduction: every length $\times 1/2$.

Example 2: $k = 2$, center: $P(1, 0)$ 

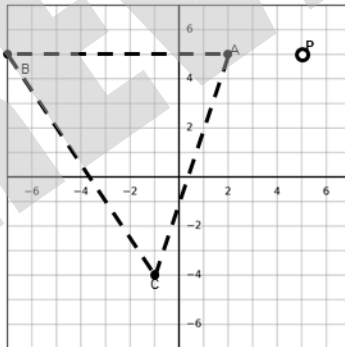
Answer

 $A(0, 0) \rightarrow$
 $A'(-1, 0)$ $B(-2, 0) \rightarrow$
 $B'(-5, 0)$ $C(-2, -3) \rightarrow$
 $C'(-5, -6)$ $D(-1, -2) \rightarrow$
 $D'(-3, -4)$

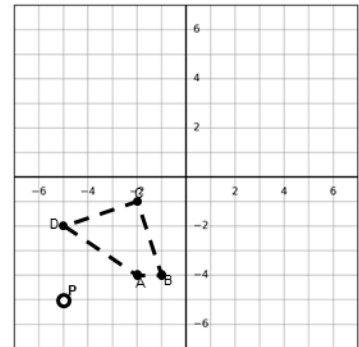
Centered at P: multiply each distance FROM P by k , then count from P.
Enlargement: every length $\times 2$.

Your turn1. $k = 3$ • center: $P(3, 5)$ 

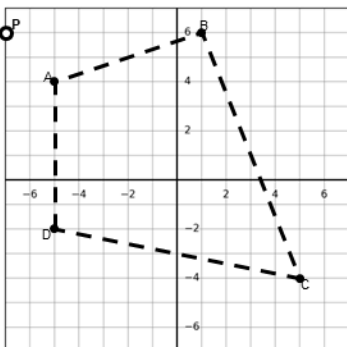
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

2. $k = 1/3$ • center: $P(5, 5)$ 

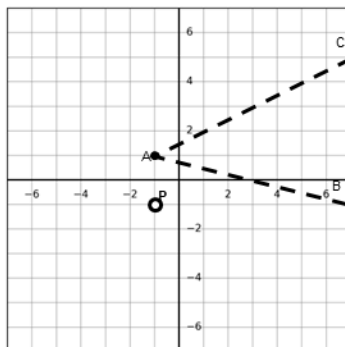
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

3. $k = 3$ • center: $P(-5, -5)$ 

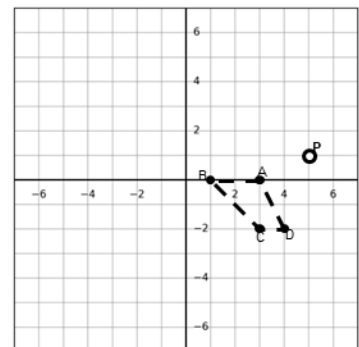
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

4. $k = 1/2$ • center: $P(-7, 6)$ 

$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

5. $k = 1/2$ • center: $P(-1, -1)$ 

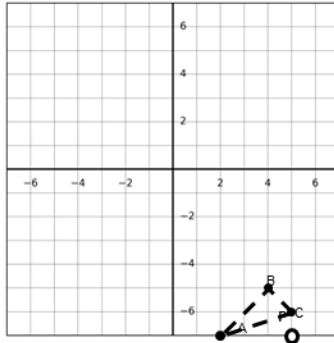
$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

6. $k = 2$ • center: $P(5, 1)$ 

$A'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $B'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$
 $C'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$ $D'(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

Directions: Each student made ONE mistake. Circle the first wrong line, explain the mistake, and fix it.

1. Nadia dilated triangle ABC by a scale factor of 4, centered at P(5, -7).



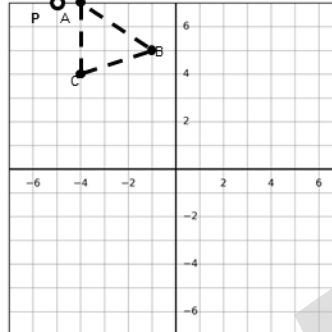
1) $A(2, -7) \rightarrow A'(6, -3)$

2) $B(4, -5) \rightarrow B'(8, -1)$

3) $C(5, -6) \rightarrow C'(9, -2)$

Explain and fix:

2. Theo dilated triangle ABC by a scale factor of 3, centered at P(-5, 7).



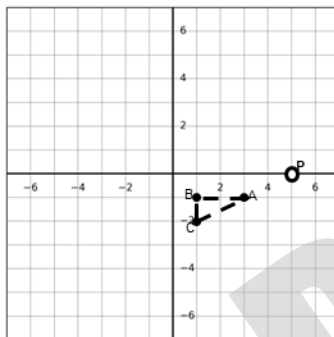
1) $A(-4, 7) \rightarrow A'(-12, 21)$

2) $B(-1, 5) \rightarrow B'(-3, 15)$

3) $C(-4, 4) \rightarrow C'(-12, 12)$

Explain and fix:

3. Isabel dilated triangle ABC by a scale factor of 2, centered at P(5, 0).



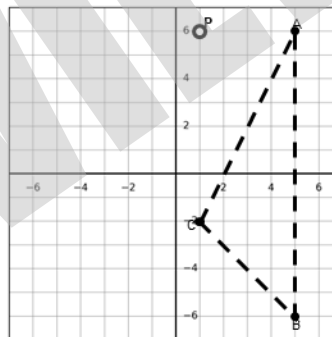
1) $A(3, -1) \rightarrow A'(1, -1)$

2) $B(1, -1) \rightarrow B'(-3, -1)$

3) $C(1, -2) \rightarrow C'(-3, -2)$

Explain and fix:

4. Marcus dilated triangle ABC by a scale factor of $\frac{1}{4}$, centered at P(1, 6).



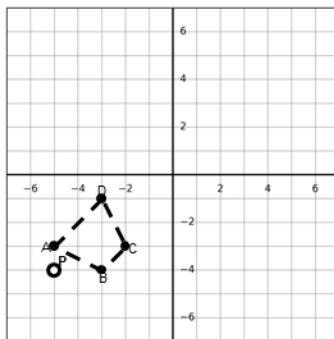
1) $A(5, 6) \rightarrow A'(17, 6)$

2) $B(5, -6) \rightarrow B'(17, -42)$

3) $C(1, -2) \rightarrow C'(1, -26)$

Explain and fix:

5. Wren dilated quadrilateral ABCD by a scale factor of 3, centered at P(-5, -4).



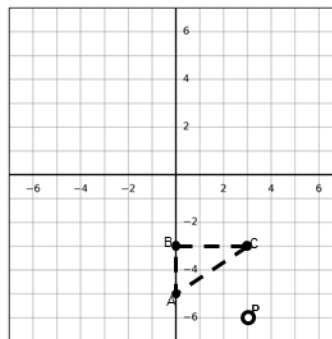
1) From P(-5, -4) to C(-2, -3): 3 across, 1 up/down

2) Times 3: 9 across, 3 up/down

3) $C'(9, 3)$

Explain and fix:

6. Diego dilated triangle ABC by a scale factor of 3, centered at P(3, -6).



1) $k = 3$

2) $AB = 2$ units

3) $A'B' = 2$ units, because a dilation keeps the side lengths

Explain and fix:
