

# Scale Shift Lab

Track points, lines, and lengths through a dilation.

**HIGH SCHOOL • HSG-SRT.A.1**

**CCSS.Math.Content.HSG-SRT.A.1** "Verify experimentally the properties of dilations given by a center and a scale factor:"

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## DILATION PROPERTIES

For a dilation with center  $C$  and positive scale factor  $k$ , each point stays on the line through  $C$  and its distance from  $C$  is multiplied by  $k$ . A line through  $C$  maps onto itself, a line not through  $C$  maps to a parallel line, and every segment length is multiplied by  $k$ .

## WORKED EXAMPLE

Dilate  $A(15,17)$  and  $B(19,17)$  about  $C(11,13)$  with scale factor  $3/2$ . Compare  $AB$  and  $A'B'$ .

1.  $A - C = (4,4)$  and  $B - C = (8,4)$ .
2. Multiply each vector by  $3/2$ :  $(6,6)$  and  $(12,6)$ .
3. Add  $C$ :  $A'=(17,19)$  and  $B'=(23,19)$ .
4.  $AB=4$  and  $A'B'=6$ , so the length was multiplied by  $3/2$ .

**Answer:  $A'=(17,19)$ ,  $B'=(23,19)$ , and  $A'B'=(3/2)AB$ .**

## PRACTICE 6 problems

- 1** Dilate  $P(-3,5)$  about the origin with scale factor 2. Find  $P'$ .

**ANSWER** \_\_\_\_\_

- 2** Dilate  $Q(2,1)$  about  $C(-2,5)$  with scale factor 3. Find  $Q'$ .

**ANSWER** \_\_\_\_\_

- 3** The line  $y=2x$  is dilated about the origin with scale factor 4. What is the equation of the image line?

**ANSWER** \_\_\_\_\_

- 4** The line  $y=3$  is dilated about the origin with scale factor 4. Find the image line and state its relationship to the original line.

**ANSWER** \_\_\_\_\_

- 5** A segment has length 14. It is dilated with scale factor  $1/2$ . What is the image segment's length?

**ANSWER** \_\_\_\_\_

- 6** Points  $R(2,-4)$  and  $S(6,-4)$  are dilated about the origin with scale factor  $5/2$ . Find  $R'$  and  $S'$ , then compare  $RS$  and  $R'S'$ .

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** For a concert poster, a student scales a horizontal logo segment with endpoints  $U(4,0)$  and  $V(8,0)$  about the origin by a scale factor of  $5/4$ . What are the new endpoints, and how does the segment length change?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** In a video game map, a boundary lies on the line  $y=8$ . The map is dilated about  $C(0,2)$  with scale factor  $4/3$ . What is the equation of the image boundary, and how is it related to the original boundary?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

A dilation centered at  $C(2,-1)$  with scale factor 2 maps  $P(4,2)$  and  $Q(7,2)$  to  $P'$  and  $Q'$ . Find  $P'$  and  $Q'$ . Then use the coordinates to explain why line  $P'Q'$  is parallel to line  $PQ$  and why the segment length property holds.

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## PART 1 • PRACTICE

| # | PROBLEM                                                                                                                                   | ANSWER                                                                                                                                                                 |
|---|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Dilate $P(-3,5)$ about the origin with scale factor 2. Find $P'$ .                                                                        | <b><math>P'=(-6,10)</math></b>                                                                                                                                         |
| 2 | Dilate $Q(2,1)$ about $C(-2,5)$ with scale factor 3. Find $Q'$ .                                                                          | <b><math>Q'=(10,-7)</math></b>                                                                                                                                         |
| 3 | The line $y=2x$ is dilated about the origin with scale factor 4. What is the equation of the image line?                                  | <b><math>y=2x</math></b>                                                                                                                                               |
| 4 | The line $y=3$ is dilated about the origin with scale factor 4. Find the image line and state its relationship to the original line.      | <b>The image line is <math>y=12</math>. It is parallel to <math>y=3</math>.</b>                                                                                        |
| 5 | A segment has length 14. It is dilated with scale factor $1/2$ . What is the image segment's length?                                      | <b>7</b>                                                                                                                                                               |
| 6 | Points $R(2,-4)$ and $S(6,-4)$ are dilated about the origin with scale factor $5/2$ . Find $R'$ and $S'$ , then compare $RS$ and $R'S'$ . | <b><math>R'=(5,-10)</math>, <math>S'=(15,-10)</math>, <math>RS=4</math>, and <math>R'S'=10</math>. The image length is <math>5/2</math> times the original length.</b> |

## PART 2 • APPLY IT

- $U'=(5,0)$  and  $V'=(10,0)$ . The length changes from 4 units to 5 units.** Multiply each coordinate by  $5/4$ . The original horizontal distance is 4, and  $4 \times 5/4 = 5$ .
- The image boundary is  $y=10$ . It is parallel to  $y=8$ .** The boundary is 6 units above the center, and  $6 \times 4/3 = 8$ . Its image is 8 units above  $y=2$ , so its equation is  $y=10$ .

## CHALLENGE

**$P'=(6,5)$  and  $Q'=(12,5)$ . Line  $PQ$  is  $y=2$  and line  $P'Q'$  is  $y=5$ , so the lines are parallel.  $PQ=3$  and  $P'Q'=6$ , so the image length is 2 times the original length.**

Accept ordered pairs written with equivalent coordinate notation. For line equations, accept equivalent equations that describe the same horizontal line, and accept clear statements that the image line is parallel or is the same line when it contains the center.