Similarity and Dilations

Investigate mistakes and missing measures

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

A dilation centered at the origin uses $(x, y) \mapsto (kx, ky)$ with $k > 0$. Corresponding lengths have ratio k, perimeters scale by k, and areas by k^2. Similar figures have equal corresponding angles and proportional corresponding sides; they are congruent only when $k = 1$. A reduction has $0 < k < 1$. Compute image length divided by original length, using the same correspondence throughout.

Worked example

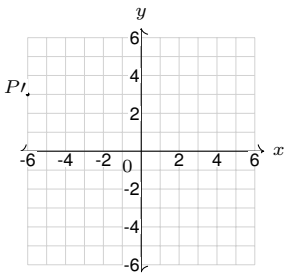
Dilate $E(-2, 1)$ by $k = 2$ about the origin. Find the image and its inverse scale factor.

1. Multiply both coordinates by 2: $(2(-2), 2(1)) = (-4, 2)$.
2. The inverse dilation uses $1/2$, since $(\frac{1}{2}(-4), \frac{1}{2}(2)) = (-2, 1)$.
3. Plot $E\prime = (-4, 2)$ on the same ray from the origin. Its distance from the center is twice the original.
Answer: $E\prime = (-4, 2)$; inverse factor $\frac{1}{2}$.

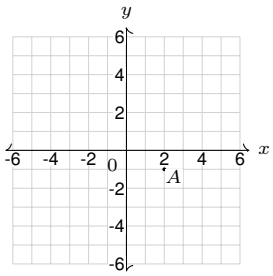
Practice Problems

Show your thinking.

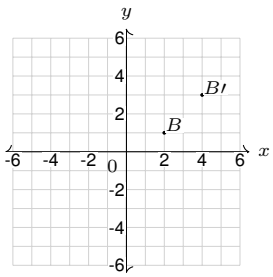
1. A dilation sends P to $P\prime(-6, 3)$ with $k = 3$. Recover and plot P.



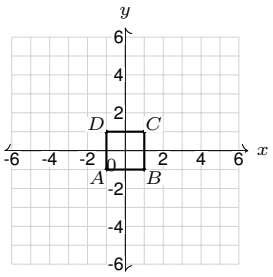
2. A student dilates $A(2, -1)$ by 2 and writes $(4, -1)$. Correct the error.



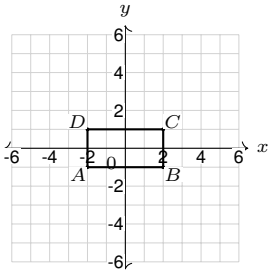
3. Could an origin-centered dilation send $B(2, 1)$ to $B\prime(4, 3)$? Check both coordinates.



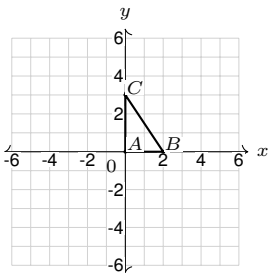
4. A square based on the shown square has area 36 square units. Find the positive dilation factor from the shown square.



5. The shown rectangle measures 4 by 2. A student calls a 6 by 4 rectangle similar. Test the correspondence of long and short sides.



6. A triangle similar to the shown triangle has corresponding vertical leg 5. Recover its horizontal leg b.



Answer Key

1. $(-2, 1)$
2. $(4, -2)$
3. No common scale factor.
4. $k = 3$
5. Not similar: $\frac{6}{4} \neq \frac{4}{2}$.
6. $b = \frac{10}{3}$ units.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Undo multiplication by 3: $x = -6/3 = -2$ and $y = 3/3 = 1$.

2. The recovered point is $P = (-2, 1)$. A forward check gives $(3(-2), 3(1)) = (-6, 3)$.

3. Plot $(-2, 1)$ at factor $1/3$ along the ray to $(-6, 3)$, not 3 times farther away.

Problem 2

1. The student multiplied only x: $2(2) = 4$, but left the vertical coordinate unchanged.

2. A dilation multiplies both, so $2(-1) = -2$ and $A\prime = (4, -2)$.

3. The correct point remains on the ray through $(2, -1)$ because $-2/4 = -1/2$; the proposed point does not.

Problem 3

1. The first coordinate would require $k = 4/2 = 2$.

2. The second would require $k = 3/1 = 3$. Since $2 \neq 3$, there is no single multiplier for both coordinates.

3. An origin-centered dilation cannot make this mapping. With $k = 2$ the correct image would be $(4, 2)$, not $(4, 3)$.

Problem 4

1. The shown square side is $1 - (-1) = 2$, so its area is $2^2 = 4$.

2. The area ratio is $36/4 = 9 = k^2$. Since the factor is positive, $k = \sqrt{9} = 3$.

3. The image side is $3(2) = 6$, and $6^2 = 36$ checks the area. The factor is not 9.

Problem 5

1. The long-side ratio is $6/4 = 1.5$ while the short-side ratio is $4/2 = 2$.

2. These unequal ratios cannot come from one dilation. With $k = 1.5$, the short side would be $1.5(2) = 3$.

3. Thus 6 by 3, not 6 by 4, would be a similar enlargement under this correspondence.

Problem 6

1. The shown horizontal and vertical legs are 2 and 3, so the enlargement factor is $5/3$.

2. The matching horizontal leg is $b = 2(5/3) = 10/3$ units.

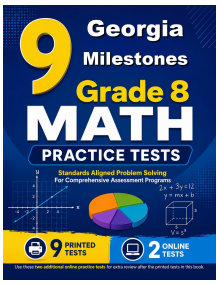
3. Check the ratios: $(10/3)/2 = 5/3$. Adding 2 to both original legs would not preserve their ratio.

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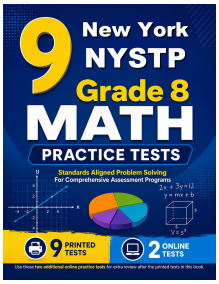
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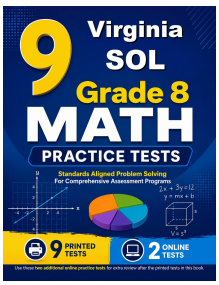
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