

SCAVENGER HUNT



DILATIONS IN THE COORDINATE PLANE

Dilations in the Coordinate Plane

Any center, not only the origin · three steps · the cards check the answers

FREE

ANSWER

$(-2, 12)$

Dilate $P(-6, -4)$ using center $C(-2, 2)$ and scale factor $1/2$. Where does P land?

Where is the center? Measure every step from the center, not from the origin.

F

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1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. **Start each group at a *different* one of these eight cards:** *F H L E K M R J*.
2. **Say this once:** *“Find the center first. It is not always the origin. Use the three steps on your sheet. After eight cards you are back where you started.”*
3. **Find the point, then find the card with that point at the top.**

16 cards	pages 3–10, one copy. There are two cards on each page, so cut the stack once.
Record sheet	page 11, one per student. The three steps are printed on it with a picture.
Answers	pages 12–13. Keep them. They do not go on the walls.

Every card asks for a point. Eight cards give a point, a center and a scale factor, and ask for the image. Five cards give the scale factor as a distance, such as twice as far from C. Two cards give a rule in letters, with center the origin, to use on a point. One card gives an image, a center and a scale factor, and asks for the starting point. Twelve cards have a center that is not the origin. On those cards, multiplying both numbers by the scale factor gives the wrong point. The scale factors are 2, $\frac{1}{2}$, 3 and 4. No printed point has a zero in it.

Eight of the 16 cards make the ring. The other eight are where a wrong answer goes. Both kinds of card look the same. A group lands on one of these cards after a common mistake. It multiplied by the scale factor when the center is not the origin, forgot to add the center back, added the scale factor instead of multiplying, or used the scale factor upside down. That card asks the same question in other words. Its answer sends the group back to the card it got wrong. A second wrong answer sends the group to another of these cards, never onto the ring.

The length of the record sheet is your check. A clean run is **eight lines**. Every wrong answer adds two more. The line under the question on each card says what to check. A group that came by a wrong answer needs it, and a group that came by a right answer can skip it. If a group keeps going in circles, do not give the answer. Ask: *“Where is the center? Is your point on the line from the center through the start?”*



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ANSWER

$(12, -3)$

A dilation has center $C(2, 4)$. It moves each point so it is twice as far from C . Where does $P(-4, -2)$ go?

Step 3 adds the center to the result. Check that step.

A

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ANSWER

$(-8, -4)$

Dilate $P(4, -6)$ using center $C(2, -4)$ and scale factor $1/2$. Where does P land?

The center is not always the origin. Find the center before any multiplying.

B

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ANSWER

(2, 5)

A dilation has center $C(-2, 2)$. It moves each point so it is half as far from C . Where does $P(-6, -4)$ go?

A dilation multiplies the distance from the center. Does your point do that?

C

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ANSWER

(3, 1)

A dilation has center $C(-2, 2)$. It moves each point so it is 3 times as far from C . Where does $P(2, 1)$ go?

Multiply each number of the step. Adding the scale factor is a different move.

D

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ANSWER

(6, 7)

A dilation with center $C(2, -4)$ and scale factor 2 sends V to $V'(4, -6)$. Find V .

Which point is the start and which is the image? Read the card twice.

E

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ANSWER

(-2, 12)

Dilate $P(-6, -4)$ using center $C(-2, 2)$ and scale factor $1/2$. Where does P land?

Where is the center? Measure every step from the center, not from the origin.

F

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ANSWER

$(-3, -2)$

A dilation has center $C(-4, -4)$. It moves each point so it is twice as far from C . Where does $P(-3, 4)$ go?

Every step starts at the center. Which point is the center here?

G

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ANSWER

$(-4, -1)$

Dilate $P(-1, 2)$ using center the origin and scale factor 3. Where does P land?

A translation adds the same numbers to every point. A dilation multiplies.

H

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ANSWER

$(-4, -12)$

Dilate $P(-3, 4)$ using center $C(-4, -4)$ and scale factor 2. Where does P land?

Lay a ruler through the center and the point. Does the image sit on that line?

J

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ANSWER

$(3, -5)$

Dilate $P(-4, -2)$ using center $C(2, 4)$ and scale factor 2. Where does P land?

Is the center the origin on this card? If not, take the center away first.

K

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ANSWER

$(-3, 6)$

Dilate $P(2, 4)$ using center $C(-2, 1)$ and scale factor 2. Where does P land?

The image stays near the center, not near the origin. Step 3 adds the center.

L

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ANSWER

$(-10, -8)$

Dilate $P(2, 1)$ using center $C(-2, 2)$ and scale factor 3. Where does P land?

Three steps: take the center away, multiply, then add the center.

M

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ANSWER

$(6, -8)$

A dilation has center $C(-2, 1)$. It moves each point so it is twice as far from C . Where does $P(2, 4)$ go?

To undo a scale factor of 2, use a scale factor of $1/2$.

N

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ANSWER

$(8, 6)$

Use the rule $(x, y) \rightarrow (3x, 3y)$ on $P(-1, 2)$. Where does P go?

Is the image near the center, or near the origin? Step 3 decides.

P

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ANSWER

$(-6, 8)$

Use the rule $(x, y) \rightarrow (4x, 4y)$ on $P(-1, -3)$. Where does P go?

Find the center on the card first. The rules with only a multiply belong to the origin.

Q

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ANSWER

$(10, -1)$

Dilate $P(-1, -3)$ using center the origin and scale factor 4. Where does P land?

Scale factor 4 means 4 times as far. Is your point 4 times as far from the center?

R

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Scavenger Hunt — where I went

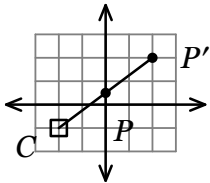
Dilations in the coordinate plane

Name _____

Period _____

Date _____

Do the card you are at. Fill in one line. Then find the card with your answer at the top. **Write the center and the scale factor first.** They change from card to card. A clean run is eight lines. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**



A dilation with center C and scale factor k , in three steps:

1. **Take the center away.** Subtract the coordinates of C from the coordinates of P . This gives the step from C to P .
2. **Multiply by the scale factor.** Multiply both numbers of that step by k .
3. **Add the center back.** Add the coordinates of C . This gives P' .

P' is on the line from C through P , k times as far from C . When the center is the origin, steps 1 and 3 change nothing.

Card letter	Center and scale factor	My point
1		
2		
3		
4		
5		
6		
7		
8		
9		

What does a fish look like after a dilation with scale factor 3?

Every point stands for a letter. Write the letter for each of your answers in the box above that point. Leave the other boxes empty. Then read the boxes you filled from left to right. **If they do not spell two words, one answer is wrong.**

$(-10, -8) = S$ $(-8, -4) = D$ $(-6, 8) = U$ $(-4, -12) = C$ $(-4, -1) = A$ $(-3, -2) = P$ $(-3, 6) = L$ $(-2, 12) = E$ $(2, 5) = L$
 $(3, -5) = D$ $(3, 1) = A$ $(6, -8) = C$ $(6, 7) = U$ $(8, 6) = E$ $(10, -1) = P$ $(12, -3) = S$

$(-10, -8)$	$(-8, -4)$	$(-6, 8)$	$(-4, -12)$	$(-4, -1)$	$(-3, -2)$	$(-3, 6)$	$(-2, 12)$
$(2, 5)$	$(3, -5)$	$(3, 1)$	$(6, -8)$	$(6, 7)$	$(8, 6)$	$(10, -1)$	$(12, -3)$



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Scavenger Hunt — answers

For the teacher

The ring, in order. A group can start at any card on it. After eight right answers, it is back at the card where it started.

F → H → L → E → K → M → R → J → F

What does a fish look like after a dilation with scale factor 3? *SCALED UP*. Students read the letters along the boxes of the record sheet. The boxes are in order of the first coordinate, then the second. The right answers in the order of the boxes: $(-10, -8) = S$, $(-4, -12) = C$, $(-4, -1) = A$, $(-3, 6) = L$, $(-2, 12) = E$, $(3, -5) = D$, $(6, 7) = U$, $(10, -1) = P$. That spells SCALED UP.

	Card	What it asks	How to find the answer	Answer	Wrong point, and the mistake behind it	Joke letter of its top point
1	F	Dilate a point.	From C to P is $(-4, -6)$. Times $1/2$, that is $(-2, -3)$. Add C : $(-2, 2) + (-2, -3) = (-4, -1)$.	$(-4, -1)$	$(-3, -2)$: P multiplied by the scale factor, as if the center were the origin.	E
2	H	Dilate a point.	The center is the origin, so multiply both numbers of P by 3: $(-1, 2)$ becomes $(-3, 6)$.	$(-3, 6)$	$(2, 5)$: the scale factor added instead of multiplied.	A
3	L	Dilate a point.	From C to P is $(4, 3)$. Times 2, that is $(8, 6)$. Add C : $(-2, 1) + (8, 6) = (6, 7)$.	$(6, 7)$	$(8, 6)$: the center taken away and never added back.	L
4	E	Undo a dilation.	V' is the image after a dilation with scale factor 2. To undo that dilation, use scale factor $1/2$ instead. From C to V' is $(2, -2)$. Times $1/2$, that is $(1, -1)$. Add C : $(2, -4) + (1, -1) = (3, -5)$.	$(3, -5)$	$(6, -8)$: the scale factor used upside down.	U
5	K	Dilate a point.	From C to P is $(-6, -6)$. Times 2, that is $(-12, -12)$. Add C : $(2, 4) + (-12, -12) = (-10, -8)$.	$(-10, -8)$	$(-8, -4)$: P multiplied by the scale factor, as if the center were the origin.	D
6	M	Dilate a point.	From C to P is $(4, -1)$. Times 3, that is $(12, -3)$. Add C : $(-2, 2) + (12, -3) = (10, -1)$.	$(10, -1)$	$(12, -3)$: the center taken away and never added back.	S
7	R	Dilate a point.	The center is the origin, so multiply both numbers of P by 4: $(-1, -3)$ becomes $(-4, -12)$.	$(-4, -12)$	$(3, 1)$: the scale factor added instead of multiplied.	P
8	J	Dilate a point.	From C to P is $(1, 8)$. Times 2, that is $(2, 16)$. Add C : $(-4, -4) + (2, 16) = (-2, 12)$.	$(-2, 12)$	$(-6, 8)$: P multiplied by the scale factor, as if the center were the origin.	C

Each wrong point in the table is at the top of a card off the ring. Those cards are on the next page. Each wrong point comes from a common mistake about dilations, not from a slip in arithmetic.

Scavenger Hunt — the cards off the ring

For the teacher

These eight cards are where a wrong answer goes. **A group cannot reach one by being right.** The top of each card is the wrong point from one ring card. Each card asks the same question as the ring card just before that one, in other words: the scale factor as a distance, a rule in letters, or $1/2$ for “undo a scale factor of 2.” So its answer is the top of the card the group got wrong, and the group goes back there. A group that goes wrong twice is never sent forward.

Card	What it asks	How to find the answer	Answer	Wrong point, and the mistake behind it	Joke letter of its top point
G	Dilate a point. The scale factor is given as a distance.	From C to P is $(1, 8)$. Times 2, that is $(2, 16)$. Add C : $(-4, -4) + (2, 16) = (-2, 12)$.	$(-2, 12)$	$(-6, 8)$: P multiplied by the scale factor, as if the center were the origin.	P
C	Dilate a point. The scale factor is given as a distance.	From C to P is $(-4, -6)$. Times $1/2$, that is $(-2, -3)$. Add C : $(-2, 2) + (-2, -3) = (-4, -1)$.	$(-4, -1)$	$(-3, -2)$: P multiplied by the scale factor, as if the center were the origin.	L
P	Use a rule on a point.	The rule multiplies both numbers of P by 3: $(-1, 2)$ becomes $(-3, 6)$.	$(-3, 6)$	$(2, 5)$: the scale factor added instead of multiplied.	E
N	Dilate a point. The scale factor is given as a distance.	From C to P is $(4, 3)$. Times 2, that is $(8, 6)$. Add C : $(-2, 1) + (8, 6) = (6, 7)$.	$(6, 7)$	$(8, 6)$: the center taken away and never added back.	C
B	Dilate a point.	From C to P is $(2, -2)$. Times $1/2$, that is $(1, -1)$. Add C : $(2, -4) + (1, -1) = (3, -5)$.	$(3, -5)$	$(6, -8)$: the scale factor used upside down.	D
A	Dilate a point. The scale factor is given as a distance.	From C to P is $(-6, -6)$. Times 2, that is $(-12, -12)$. Add C : $(2, 4) + (-12, -12) = (-10, -8)$.	$(-10, -8)$	$(-8, -4)$: P multiplied by the scale factor, as if the center were the origin.	S
D	Dilate a point. The scale factor is given as a distance.	From C to P is $(4, -1)$. Times 3, that is $(12, -3)$. Add C : $(-2, 2) + (12, -3) = (10, -1)$.	$(10, -1)$	$(12, -3)$: the center taken away and never added back.	A
Q	Use a rule on a point.	The rule multiplies both numbers of P by 4: $(-1, -3)$ becomes $(-4, -12)$.	$(-4, -12)$	$(3, 1)$: the scale factor added instead of multiplied.	U

Other mistakes lead to no card on the ring. 96 other wrong points were tried, such as turning the center's signs the wrong way, multiplying only one number, or writing the right point with its two numbers swapped. None of them is at the top of a card on the ring.

Guessing does not work. Every simple rule that only uses the printed numbers, such as multiplying the point by the scale factor, gets at most four of the sixteen cards right.