

SCAVENGER HUNT



TRANSLATIONS IN THE COORDINATE PLANE

Translations in the Coordinate Plane

Run the rule · run it backwards · find it from one point · the cards check the answers

FREE

ANSWER

$(-2, 4)$

The rule is $(x, y) \rightarrow (x + 5, y - 3)$. Find the image of $U(-7, 2)$.

Write the arithmetic for x on one line and for y on the other.

Q

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1. **Tape the 16 cards around the room**, in any order. Send each group to a *different* card. Each card has a large letter in its bottom left corner. **Start each group at one of these eight cards: Q H D N R F M C.**
2. **Say this once:** *“Find the new x on one line and the new y on the next. Do the across number first, then the up number. Keep every minus sign with its number. Eight lines and 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. Two to a sheet — one cut through the stack.
Record sheet	page 11, one per student. The rule and its arrow, with <i>a</i> across and <i>b</i> up, are printed on it as pictures.
Answers	pages 12–13 — yours. They do not go in the room.

Every card asks for a point, in five ways: the image of a point under a rule (four); the original point from a rule and an image (two); where a point lands after a shift given in words (three); a point moved by the shift from another point to its image (six); a point moved by the rule that undoes a rule (one). Every shift has two different parts, and neither part is zero. That way, a student who puts a number on the wrong coordinate always gets a wrong answer. On several cards a negative starting number moves the positive way. That is the hardest case for students.

Eight of the 16 cards make the ring. The other eight are where a wrong answer goes. They look like every other card. Some mistakes give a point that is at the top of one of these cards. The group then does that card, and its answer sends the group back to the card it got wrong. A second mistake there sends the group one card further back, never forward.

The check is the length of their row. A clean run is **eight lines**. Every wrong answer adds two more. Each card has a line under the question that names a good habit. A group that arrived by a wrong answer finds there what to check. If a group keeps going round in circles, do not give the answer. Ask: *“Which number goes with x, and which way does it move it?”*



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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ANSWER

$(-9, 9)$

The rule is $(x, y) \rightarrow (x + 7, y - 1)$. Find the image of $U(-4, -6)$.

The shift is the image point minus the starting point, and never the other way round.

A

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ANSWER

$(10, 4)$

A translation carries $S(3, -1)$ to $S'(-2, 1)$. Where does it carry $T(1, 3)$?

Is the starting coordinate negative? Count on from it, not from its size.

B

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ANSWER

$(-4, 5)$

A translation carries $S(-1, 2)$ to $S'(3, -1)$. Where does it carry $T(-6, 7)$?

The same rule works in every quadrant.

C

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ANSWER

$(7, -8)$

$W(-3, -5)$ moves 6 units right and 2 units down. Where does W land?

Say the shift as two numbers first: across, then up.

D

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ANSWER

$(-7, -3)$

The rule is $(x, y) \rightarrow (x - 3, y + 4)$. $V'(-6, 5)$ is the image of V . Find V .

Across comes first in a pair, then up: (x, y) .

E

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ANSWER

$(-3, -7)$

The rule is $(x, y) \rightarrow (x + 3, y - 6)$. Where does the rule that undoes it carry $Z(2, -3)$?

A shift and then its undoing bring a point home.

F

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ANSWER

(12, -1)

$W(-6, 7)$ moves 4 units right and 3 units down. Where does W land?

A minus sign belongs to its number: count on from the negative number, not from its size.

G

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ANSWER

(-2, -1)

The rule is $(x, y) \rightarrow (x - 4, y + 6)$. $V'(3, -2)$ is the image of V . Find V .

Does the answer fit? Put it through the rule and see.

H

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ANSWER

$(-1, 4)$

A translation carries $S(-1, 3)$ to $S'(4, -4)$. Where does it carry $T(-7, 6)$?

From the image to the original the rule runs the other way: take the shift away.

J

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ANSWER

$(5, -9)$

$W(-9, -4)$ moves 6 units right and 3 units down. Where does W land?

Which way does the undoing rule go? The same distance, the other way.

K

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ANSWER

$(3, -2)$

A translation carries $S(4, -5)$ to $S'(1, 1)$. Where does it carry $T(2, -3)$?

The first number of the rule goes with x , the second with y .

L

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ANSWER

$(-1, 3)$

The rule is $(x, y) \rightarrow (x - 6, y + 1)$. Find the image of $U(2, 4)$.

Right and up are plus. Left and down are minus.

M

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ANSWER

$(3, -7)$

A translation carries $S(-2, 3)$ to $S'(1, -1)$. Where does it carry $T(-6, 5)$?

A translation's rule, found from one point, works for every point of the plane.

N

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ANSWER

$(-5, 1)$

A translation carries $S(-3, 5)$ to $S'(1, -1)$. Where does it carry $T(3, -2)$?

Right and left change x . Up and down change y .

P

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ANSWER

$(-2, 4)$

The rule is $(x, y) \rightarrow (x + 5, y - 3)$. Find the image of $U(-7, 2)$.

Write the arithmetic for x on one line and for y on the other.

Q

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ANSWER

$(-3, 1)$

The rule is $(x, y) \rightarrow (x - 7, y + 2)$. Find the image of $U(4, -9)$.

Say the new point aloud before writing it: across, then up.

R

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Scavenger Hunt — where I went

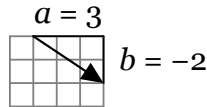
Translations in the coordinate plane

Name _____

Period _____

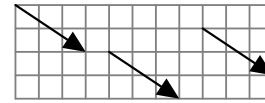
Date _____

Work out the card you are at, fill in one line, then find the card with your answer at the top. **Work out x in one column and y in the other**, and keep every minus sign with its number. A clean run is eight lines. A longer row means one answer was wrong. **Wrong answer? Read the line under the question. It says what to check on the card before this one. Right answer? Skip that line.**



$$(x, y) \rightarrow (x + 3, y - 2)$$

a is across: right +, left - b is up: up +, down -



the same rule, draw anywhere
every point of the plane moves by the same arrow

Card letter	x : across (right +, left -)	y : up (up +, down -)	My point
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

What does a translation say to every single point of the plane?

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 across. **If it does not spell two words, one answer was wrong.**

$(-9, 9) = V$ $(-7, -3) = O$ $(-5, 1) = R$ $(-4, 5) = M$ $(-3, -7) = O$ $(-3, 1) = V$ $(-2, -1) = E$ $(-2, 4) = O$ $(-1, 3) = V$
 $(-1, 4) = E$ $(3, -7) = E$ $(3, -2) = M$ $(5, -9) = O$ $(7, -8) = R$ $(10, 4) = V$ $(12, -1) = E$

$(-9, 9)$	$(-7, -3)$	$(-5, 1)$	$(-4, 5)$	$(-3, -7)$	$(-3, 1)$	$(-2, -1)$	$(-2, 4)$
$(-1, 3)$	$(-1, 4)$	$(3, -7)$	$(3, -2)$	$(5, -9)$	$(7, -8)$	$(10, 4)$	$(12, -1)$



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Scavenger Hunt — answers

For the teacher

The ring, in order, is below. A group may start anywhere on it. From any card, eight right answers bring the group back to that card.

Q → H → D → N → R → F → M → C → Q

What does a translation say to every single point of the plane? *MOVE OVER*. Students read the answer along the boxes of the record sheet. The boxes are in order of the first coordinate, then the second.

The answers on the ring in that order: $(-4, 5) = M$, $(-3, -7) = O$, $(-3, 1) = V$, $(-2, -1) = E$, $(-2, 4) = O$, $(-1, 3) = V$, $(3, -7) = E$, $(7, -8) = R$. The letters spell *MOVE OVER*.

	Card	What it asks for	Working	Answer	Wrong answer, and the mistake	Letter for the point at its top
1	Q	the image of a point under a rule	$(-7) + 5, 2 - 3$	$(-2, -1)$	$(12, -1)$. The minus sign of a negative starting number is dropped.	O
2	H	the original point from a rule and an image	$3 + 4, (-2) - 6$	$(7, -8)$	$(-1, 4)$. The shift is used the wrong way.	E
3	D	where a point lands after a shift given in words	$(-3) + 6, (-5) - 2$	$(3, -7)$	$(-5, 1)$. The two amounts go on the wrong coordinates.	R
4	N	a point moved by the shift from another point to its image	shift $(3, -4)$; $(-6) + 3, 5 - 4$	$(-3, 1)$	$(-9, 9)$. The shift is used the wrong way.	E
5	R	the image of a point under a rule	$4 - 7, (-9) + 2$	$(-3, -7)$	$(-7, -3)$. The coordinates are written the wrong way round.	V
6	F	a point moved by the rule that undoes a rule	$2 - 3, (-3) + 6$	$(-1, 3)$	$(5, -9)$. The shift is used the wrong way.	O
7	M	the image of a point under a rule	$2 - 6, 4 + 1$	$(-4, 5)$	$(3, -2)$. The two amounts go on the wrong coordinates.	V
8	C	a point moved by the shift from another point to its image	shift $(4, -3)$; $(-6) + 4, 7 - 3$	$(-2, 4)$	$(10, 4)$. The minus sign of a negative starting number is dropped.	M

Each wrong answer in the table is at the top of a card. Those cards are on the next page. None of these wrong answers is a simple arithmetic slip. Each comes from a common mistake, and a student can make one of these mistakes without the others.

Scavenger Hunt — the cards off the ring

For the teacher

These eight cards are where a wrong answer goes. At its top, each shows the point a group gets by making the named mistake at one card of the ring. Its own answer is the top of that ring card. So a group that lands here goes back to the card it got wrong, and its row is two lines longer. **A group cannot reach one of these cards by being right.** The mistake on one of these cards gives the top of the card before it in this list. So a second mistake sends a group one card further back, never forward.

Card	What it asks for	Working	Answer	Wrong answer, and the mistake	Letter for the point at its top
G	where a point lands after a shift given in words	$(-6) + 4, 7 - 3$	$(-2, 4)$	$(10, 4)$. The minus sign of a negative starting number is dropped.	E
J	a point moved by the shift from another point to its image	shift $(5, -7)$; $(-7) + 5, 6 - 7$	$(-2, -1)$	$(12, -1)$. The minus sign of a negative starting number is dropped.	E
P	a point moved by the shift from another point to its image	shift $(4, -6)$; $3 + 4, (-2) - 6$	$(7, -8)$	$(-1, 4)$. The shift is used the wrong way.	R
A	the image of a point under a rule	$(-4) + 7, (-6) - 1$	$(3, -7)$	$(-5, 1)$. The two amounts go on the wrong coordinates.	V
E	the original point from a rule and an image	$(-6) + 3, 5 - 4$	$(-3, 1)$	$(-9, 9)$. The shift is used the wrong way.	O
K	where a point lands after a shift given in words	$(-9) + 6, (-4) - 3$	$(-3, -7)$	$(-7, -3)$. The coordinates are written the wrong way round.	O
L	a point moved by the shift from another point to its image	shift $(-3, 6)$; $2 - 3, (-3) + 6$	$(-1, 3)$	$(5, -9)$. The shift is used the wrong way.	M
B	a point moved by the shift from another point to its image	shift $(-5, 2)$; $1 - 5, 3 + 2$	$(-4, 5)$	$(3, -2)$. The two amounts go on the wrong coordinates.	V

Other mistakes lead to no card. There are 66 more wrong answers like this. They include copying the rule's two numbers as the point. On a card that gives one point and its image, they include adding the shift to the image instead of to the new point. A group with one of these answers finds no card with it, and knows to check again.

The line under the question on every card names a good habit. It does not give the answer. On a card off the ring, it names the habit that the mistake leading there broke.

Guessing does not work. The best shortcut, to add the two printed amounts to the point, answers only seven of the sixteen cards.