

SCAVENGER HUNT



REFLECTIONS IN THE COORDINATE PLANE

Reflections in the Coordinate Plane

The two axes · $y = x$ and $y = -x$ · find the mirror from one point · the cards check the answers

FREE

ANSWER

$(-5, 4)$

Reflect $U(-2, 5)$ in the line $y = -x$. Where does U land?

Test your rule on a point of the mirror, such as $(1, -1)$: it must stay where it is.

R

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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: R P H C G L B E.**
2. **Say this once:** *“The mirror changes on every card, and it has more than one name. Write the mirror down first, then the point. 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. There are two cards on each sheet. Cut the whole stack once, between the two cards.
Record sheet	page 11, one per student. It shows the four mirror lines as pictures, with all their names. It does not show their rules.
Answers	pages 12–13, for you only. Do not put them up in the room.

There are three kinds of card, and every card asks for a point. On six cards, students find the image of a point in a named mirror. On five cards, they find the starting point from its image and the mirror. On five cards, they are given one point and its image, and they find the image of another point. The line $y = x$ is on four cards, $y = -x$ on four, the x -axis on four and the y -axis on four. The slanted lines come up as often as the axes, because students find them the hardest. The mirrors are named in seven different ways. No starting point is in the first quadrant. No starting point has a zero or two numbers of the same size, so two different mistakes never give the same point.

Eight of the 16 cards make the ring. The other eight catch wrong answers. They look like every other card. A group may read $y = 0$ as the y -axis, use the rule of the other slanted line, change both signs (a half turn, not a reflection), or slide the point instead of reflecting it. Then it gets the point at the top of one of those eight cards. It does that card, and the answer sends it back to the card it got wrong. If it goes wrong there too, it goes back one more card. It never goes forward, and a wrong answer never lands on a ring card.

Check 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. A group that came by a wrong answer finds there what to check. A group that came by a right answer skips it. If a group keeps going in circles, do not give the answer. Ask: *“Which points does this mirror leave where they are? Is the midpoint of your two points one of them?”*



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

$(-3, -1)$

A reflection in one of the four mirrors carries $S(4, 1)$ to $S'(-1, -4)$. Where does it carry $T(-2, 5)$?

Across the x -axis, x stays and y changes sign.

A

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ANSWER

$(-4, -3)$

Reflect $U(2, -7)$ in the line $x = 0$. Where does U land?

Which of the two numbers measures the distance across this mirror?

B

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ANSWER

(6, -2)

Reflect $U(-5, -3)$ in the y -axis. Where does U land?

One axis, one sign: an axis changes the sign of one coordinate only.

C

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ANSWER

(2, 7)

$V'(-4, 3)$ is the image of V in the line $y = 0$. Find V .

Say the other name of the line aloud before you start.

D

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ANSWER

$(-2, -7)$

A reflection in one of the four mirrors carries $S(3, -1)$ to $S'(1, -3)$. Where does it carry $T(-4, 5)$?

The midpoint of a point and its image lies on the mirror.

E

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ANSWER

$(1, 3)$

Reflect $U(3, -1)$ in the horizontal axis. Where does U land?

First name the mirror from S and S' . Then reflect T in that mirror.

F

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ANSWER

$(5, -3)$

$V'(-1, 6)$ is the image of V in the line $y = x$. Find V .

Test your rule on a point of the mirror, such as $(2, 2)$: it must stay where it is.

G

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ANSWER

$(3, 1)$

A reflection in one of the four mirrors carries $S(1, 4)$ to $S'(4, 1)$. Where does it carry $T(-2, 6)$?

A reflection flips a point over the mirror. It never just slides it.

H

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ANSWER

$(5, -2)$

A reflection in one of the four mirrors carries $S(-1, 3)$ to $S'(-3, 1)$. Where does it carry $T(-4, 5)$?

Is the midpoint of the point and your answer on the mirror? Check it.

J

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ANSWER

$(5, 3)$

A reflection in one of the four mirrors carries $S(-2, 1)$ to $S'(1, -2)$. Where does it carry $T(-2, 6)$?

Both signs change? That is a half-turn about the origin, not a reflection.

K

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ANSWER

$(6, -1)$

Reflect $U(-4, 3)$ in the x -axis. Where does U land?

Which coordinate stays the same across this mirror? Keep it as it is.

L

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ANSWER

$(-6, 1)$

$V'(-5, -3)$ is the image of V in the line $x = 0$. Find V .

A point on $y = x$ has two equal coordinates. Does the midpoint?

M

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ANSWER

$(-6, 3)$

$V'(2, -7)$ is the image of V in the y -axis. Find V .

Reflect, do not slide: the image is on the other side of the mirror.

N

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ANSWER

$(-5, 2)$

$V'(3, -1)$ is the image of V in the line $y = 0$. Find V .

The line $y = 0$ and the x -axis are one line. Which coordinate is 0 on it?

P

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ANSWER

$(4, -3)$

Reflect $U(-1, 6)$ in the line $y = x$. Where does U land?

Across an axis, the coordinate along the mirror stays as it is.

Q

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ANSWER

$(-5, 4)$

Reflect $U(-2, 5)$ in the line $y = -x$. Where does U land?

Test your rule on a point of the mirror, such as $(1, -1)$: it must stay where it is.

R

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Scavenger Hunt — where I went

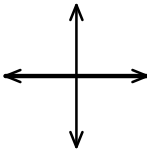
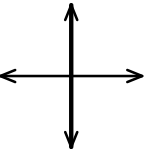
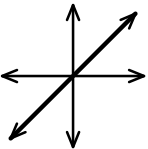
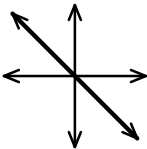
Reflections in the coordinate plane

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 mirror first:** it changes from card to card. A clean run is eight lines. **Wrong answer? Read the line under the question. It says what to check on the card before this one. Right answer? Skip that line.**

 the x-axis · $y = 0$ the horizontal axis · $(x, 0)$ stays put	 the y-axis · $x = 0$ the vertical axis · $(0, y)$ stays put	 $y = x$ (a, a) stays put	 $y = -x$ $(a, -a)$ stays put
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Card letter	The mirror	My point
1		
2		
3		
4		
5		
6		
7		
8		
9		

Where does a point go when it meets a mirror?

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.**

$(-6, 1) = S$ $(-6, 3) = L$ $(-5, 2) = F$ $(-5, 4) = L$ $(-4, -3) = I$ $(-3, -1) = I$ $(-2, -7) = P$ $(1, 3) = D$ $(2, 7) = E$ $(3, 1) = S$
 $(4, -3) = F$ $(5, -3) = I$ $(5, -2) = I$ $(5, 3) = P$ $(6, -2) = D$ $(6, -1) = E$

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



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Scavenger Hunt — answers

For the teacher

The ring in order. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card.

R → P → H → C → G → L → B → E → R

Where does a point go when it meets a mirror? *FLIP SIDE*. Students read it across the boxes of the record sheet. The boxes are in order of the first number of each point, then the second.

The answers on the ring in that order: $(-5, 2) = F$, $(-5, 4) = L$, $(-4, -3) = I$, $(-2, -7) = P$, $(3, 1) = S$, $(5, -3) = I$, $(6, -2) = D$, $(6, -1) = E$. The letters spell FLIP SIDE.

	Card	What the card asks	Mirror and rule	Answer	Wrong answer and its mistake	Letter for the point at its top
1	R	find the image of a point in a named mirror	the line $y = -x$: $(x, y) \rightarrow (-y, -x)$	$(-5, 2)$	$(5, -2)$: mixed up $y = x$ and $y = -x$	L
2	P	find the point, given its image and the mirror	the horizontal axis: $(x, y) \rightarrow (x, -y)$	$(3, 1)$	$(-3, -1)$: used the rule of the other axis	F
3	H	given one point and its image, find the image of another	S to S' is the line $y = x$: $(x, y) \rightarrow (y, x)$	$(6, -2)$	$(1, 3)$: slid the point instead of reflecting it	S
4	C	find the image of a point in a named mirror	the vertical axis: $(x, y) \rightarrow (-x, y)$	$(5, -3)$	$(5, 3)$: changed both signs (a half turn, not a reflection)	D
5	G	find the point, given its image and the mirror	the line $y = x$: $(x, y) \rightarrow (y, x)$	$(6, -1)$	$(-6, 1)$: mixed up $y = x$ and $y = -x$	I
6	L	find the image of a point in a named mirror	the horizontal axis: $(x, y) \rightarrow (x, -y)$	$(-4, -3)$	$(4, -3)$: changed both signs (a half turn, not a reflection)	E
7	B	find the image of a point in a named mirror	the vertical axis: $(x, y) \rightarrow (-x, y)$	$(-2, -7)$	$(2, 7)$: used the rule of the other axis	I
8	E	given one point and its image, find the image of another	S to S' is the line $y = -x$: $(x, y) \rightarrow (-y, -x)$	$(-5, 4)$	$(-6, 3)$: slid the point instead of reflecting it	P

Each wrong answer in this table is the point at the top of a card off the ring. Those cards are on the next page. None of these wrong points is an arithmetic slip. Each one comes from a common way of mixing up the four rules.

Scavenger Hunt — the cards off the ring

For the teacher

These eight cards catch wrong answers. At its top, each shows the point a group gets by making the named mistake on one ring card. 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 a right answer.** A mistake on one of these cards gives the top of the card before it in this list. So going wrong twice sends a group one card further back, never forward.

Card	What the card asks	Mirror and rule	Answer	Wrong answer and its mistake	Letter for the point at its top
J	given one point and its image, find the image of another	S to S' is the line $y = -x$: $(x, y) \rightarrow (-y, -x)$	(-5, 4)	(-6, 3): slid the point instead of reflecting it	I
A	given one point and its image, find the image of another	S to S' is the line $y = -x$: $(x, y) \rightarrow (-y, -x)$	(-5, 2)	(5, -2): mixed up $y = x$ and $y = -x$	I
F	find the image of a point in a named mirror	the horizontal axis: $(x, y) \rightarrow (x, -y)$	(3, 1)	(-3, -1): used the rule of the other axis	D
K	given one point and its image, find the image of another	S to S' is the line $y = x$: $(x, y) \rightarrow (y, x)$	(6, -2)	(1, 3): slid the point instead of reflecting it	P
M	find the point, given its image and the mirror	the vertical axis: $(x, y) \rightarrow (-x, y)$	(5, -3)	(5, 3): changed both signs (a half turn, not a reflection)	S
Q	find the image of a point in a named mirror	the line $y = x$: $(x, y) \rightarrow (y, x)$	(6, -1)	(-6, 1): mixed up $y = x$ and $y = -x$	F
D	find the point, given its image and the mirror	the horizontal axis: $(x, y) \rightarrow (x, -y)$	(-4, -3)	(4, -3): changed both signs (a half turn, not a reflection)	E
N	find the point, given its image and the mirror	the vertical axis: $(x, y) \rightarrow (-x, y)$	(-2, -7)	(2, 7): used the rule of the other axis	L

Other mistakes lead to no card. Every other common mistake, 37 wrong points in all, gives a point that is at the top of no card. This includes using either axis rule on a slanted line. A group holding one of these points finds no card, and so it knows to check its work.

The line under the question gives a habit to check, not an answer. It is written the same way on every card. On a card off the ring, it names the check that the group skipped on the card before.

Guessing from the numbers alone does not work. No simple rule, such as swapping the two numbers, gets more than four of the 16 cards right.