

SCAVENGER HUNT



EQUATIONS OF PARALLEL AND PERPENDICULAR LINES

Equations of Parallel and Perpendicular Lines

Line through a point · $y = mx + b$ · given lines as graphs, points and equations · the cards check the answers

FREE

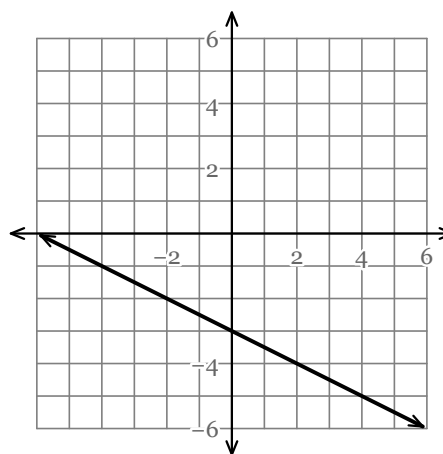
ANSWER $y = -\frac{3}{2}x - 2$

Find the line through the point (2, 4) that is perpendicular to the line on the grid.

Write it as $y = mx + b$.

To find b , take m times x away from y . Watch every sign.

B



chooseyourlesson.com

Scavenger Hunt — how to run it

a full class period

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: *M F Q C A D R P*.
2. **Say this once:** “Find the slope of the given line. Write down the new slope first. Then find b with the new slope. Write the answer as $y = mx + b$, like $y = -\frac{2}{3}x + 5$. Then walk to the card with that equation at the top.”
3. **Each group writes one line per card.** Eight right answers bring the group back to its first card.

16 cards	pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.
Record sheet	page 11, one per student. It shows the three steps.
Answers	pages 12–13, for you only. Do not put them up in the room.

Every card asks for the line through a point, parallel or perpendicular to a given line. The given line comes in different ways: 3 cards give it as $y = mx + b$, 4 as an equation not solved for y , 2 in point-slope form, 4 through two points, and 3 as a line drawn on a grid with no equation. Every answer is written as $y = mx + b$, with fractions in lowest terms. A line has only one equation in this form, so two different card tops are always two different lines. On two of the eight ring cards the new line is parallel. On the rest it is perpendicular.

Eight of the sixteen cards make the ring. A group reaches the other eight only by a wrong answer, but all the cards look the same. Each ring card has one common mistake. Some are slope mistakes: finding b with the old slope after writing the new one, keeping the old slope for a perpendicular, or changing the sign without turning the fraction over. The others are mistakes in finding b : a sign slip, or the point's x and y swapped. Each mistake lands on a card off the ring that asks the same question again, with the line shown another way. That card sends the group back to the card it got wrong.

The check is the length of the group's list. A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in italics under its question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. Guessing does not work: no simple rule, such as walking to the only top with the right slope, gets more than four of the cards. If a group keeps coming back to the same cards, ask: “Which slope did you use to find b ? Put the point into your equation. Do both sides match?”



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.
chooseyourlesson.com — 135 free geometry lessons.

ANSWER

$$y = \frac{1}{2}x - 6$$

Find the line through the point $(-4, 1)$ that is perpendicular to $2x - y = -2$.

Write it as $y = mx + b$.

What does the word parallel or perpendicular say about the slope?

A

chooseyourlesson.com

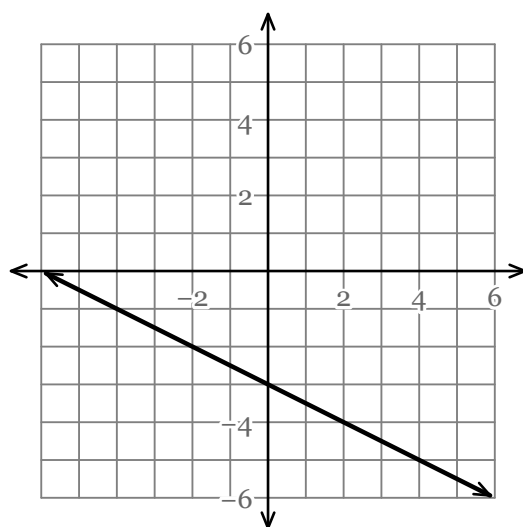
ANSWER

$$y = -\frac{3}{2}x - 2$$

Find the line through the point $(2, 4)$ that is perpendicular to the line on the grid.

Write it as $y = mx + b$.

To find b , take m times x away from y . Watch every sign.



chooseyourlesson.com

B

ANSWER

$$y = -2x - 3$$

Find the line through the point $(4, -4)$ that is perpendicular to $y = -2x$.

Write it as $y = mx + b$.

A whole number such as 2 is the fraction 2 over 1. Keep its sign.

C

chooseyourlesson.com

ANSWER

$$y = -\frac{1}{2}x - 1$$

Find the line through the point $(1, -3)$ that is parallel to $y = 4x + 3$.

Write it as $y = mx + b$.

Rise over run gives a slope. Count from one grid point to the next.

D

chooseyourlesson.com

ANSWER

$$y = 2x + 5$$

Find the line through the point $(2, -2)$ that is perpendicular to the line through $(-3, -4)$ and $(3, -2)$.

Write it as $y = mx + b$.

Find b with the slope from step 2. Leave the slope of the given line out.

E

chooseyourlesson.com

ANSWER

$$y = 2x$$

Find the line through the point $(-2, -5)$ that is parallel to $3x + 2y = -2$.

Write it as $y = mx + b$.

Solve for y first. Then the number in front of x is the slope.

F

chooseyourlesson.com

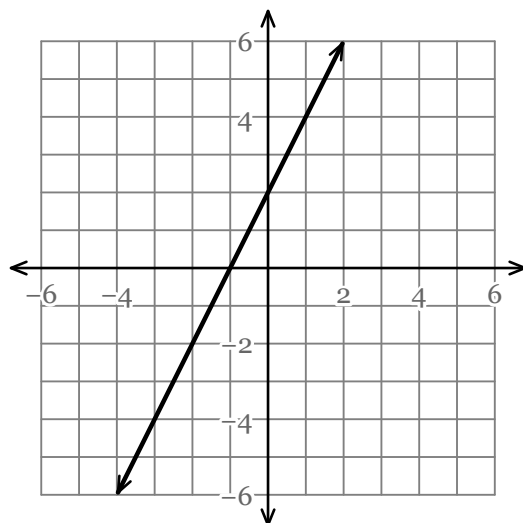
ANSWER

$$y = 4x + 1$$

Find the line through the point $(-4, 1)$ that is perpendicular to the line on the grid.

Write it as $y = mx + b$.

Put the point the new line goes through into your equation. Do both sides come out the same?



G

chooseyourlesson.com

ANSWER

$$y = \frac{1}{2}x + 7$$

Find the line through the point $(-2, -5)$ that is parallel to the line through $(-4, 5)$ and $(2, -4)$.

Write it as $y = mx + b$.

A perpendicular line never keeps the old slope. Turn the fraction over and change its sign.

H

chooseyourlesson.com

ANSWER

$$y = \frac{1}{2}x + 6$$

Find the line through the point $(-4, 5)$ that is perpendicular to $x - 2y = -4$.

Write it as $y = mx + b$.

In a point (x, y) , x comes first. Put each number in its own place.

J

chooseyourlesson.com

ANSWER

$$y = -3x - 5$$

Find the line through the point $(1, -3)$ that is parallel to the line through $(-2, -5)$ and $(-1, -1)$.

Write it as $y = mx + b$.

Change the sign and turn the fraction over. The opposite reciprocal is both.

K

chooseyourlesson.com

ANSWER

$$y = -\frac{1}{2}x + 9$$

Find the line through the point $(4, -4)$ that is perpendicular to the line through $(2, -4)$ and $(3, -6)$.

Write it as $y = mx + b$.

Which slope goes into $y = mx + b$ to find b ? Take the slope from step 2.

L

chooseyourlesson.com

ANSWER

$$y = -3x + 4$$

Find the line through the point $(2, 4)$ that is perpendicular to $y = -\frac{1}{2}x - 3$.

Write it as $y = mx + b$.

Write the new slope on its own line before you find b .

M

chooseyourlesson.com

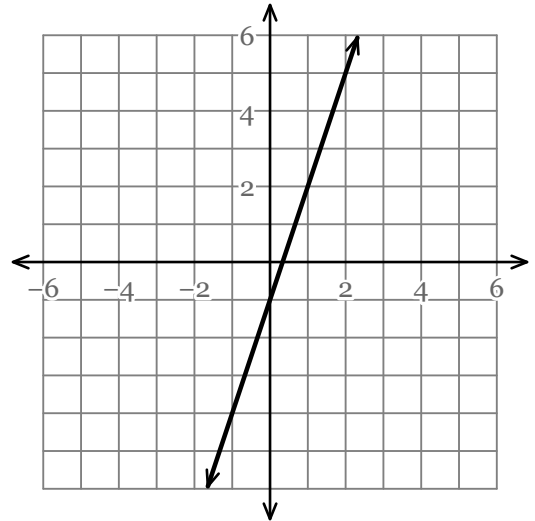
ANSWER

$$y = -3x - 4$$

Find the line through the point $(-3, 4)$ that is perpendicular to the line on the grid.

Write it as $y = mx + b$.

*Read the point the new line goes through once more.
Which number is x , and which number is y ?*



N

chooseyourlesson.com

ANSWER

$$y = -\frac{1}{3}x + 3$$

Find the line through the point $(2, -2)$ that is perpendicular to $x - 3y = 9$.

Write it as $y = mx + b$.

Check every answer: put the point the new line goes through into it. Compare both sides.

P

chooseyourlesson.com

ANSWER

$$y = -\frac{3}{2}x - 8$$

Find the line through the point $(-4, 5)$ that is perpendicular to $y - 4 = \frac{1}{2}(x - 4)$.

Write it as $y = mx + b$.

Check the slope of your answer. Is it the slope from step 2?

Q

chooseyourlesson.com

ANSWER

$$y = 4x - 7$$

Find the line through the point $(-3, 4)$ that is perpendicular to $y - 2 = 3(x - 1)$.

Write it as $y = mx + b$.

Step 1, step 2, step 3. Keep the three steps in this order.

R

chooseyourlesson.com

Scavenger Hunt — where I went

Parallel and perpendicular lines

Name _____

Period _____

Date _____

For each card, write the slope of the given line, then the slope of the new line, then the equation. Write every equation as $y = mx + b$. Write the slope and b as whole numbers or as fractions in lowest terms. Then find the card with your equation at the top. A clean run is eight lines. Each card has a line in *italics* under its question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**

Step 1. Find the slope of the given line. If its equation is not solved for y , solve it for y first.

Step 2. Write the slope of the new line on its own. **Parallel:** the same slope. **Perpendicular:** the opposite reciprocal. Turn the fraction over *and* change its sign.

Step 3. Put the NEW slope, and the x and y of the point the NEW line goes through, into $y = mx + b$. Solve for b .

Check. Put that point into your finished equation. Both sides must come out the same.

Card letter	Slope of the given line	Slope of the new line	The new line: $y = mx + b$
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Where does a line go skiing?

Every b stands for a letter. For each of your equations, write the letter for its b in the box above that number. Read the boxes you filled, left to right. **If they do not spell the answer, one of your answers is wrong.**

-8 = O -7 = N -6 = A -5 = L -4 = O -3 = S -2 = N -1 = L 0 = O 1 = E 3 = P 4 = E 5 = A 6 = P 7 = S 9 = O

-8	-7	-6	-5	-4	-3	-2	-1	0	1	3	4	5	6	7	9



135 free geometry lessons — worksheets, worked answers and lesson plans.
chooseyourlesson.com

Scavenger Hunt — answers

For the teacher

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

$$\mathbf{M} (y = 2x) \rightarrow \mathbf{F} (y = -\frac{3}{2}x - 8) \rightarrow \mathbf{Q} (y = -2x - 3) \rightarrow \mathbf{C} (y = \frac{1}{2}x - 6) \rightarrow \mathbf{A} (y = -\frac{1}{2}x - 1) \rightarrow \mathbf{D} (y = 4x - 7) \rightarrow \mathbf{R} (y = -\frac{1}{3}x + 3) \rightarrow \mathbf{P} (y = -3x + 4) \rightarrow \mathbf{M}$$

Where does a line go skiing? The answer is *ON A SLOPE!* It is read along the boxes of the record sheet, which run from the smallest b to the largest. Every answer is in the form $y = mx + b$. A student whose equation is right but written in another form should rewrite it as $y = mx + b$ to find the card.

Card	What the card asks	Answer, and why	The common wrong answer on this card, and why	Letter of its top
1 M	Through (2, 4), perpendicular to $y = -\frac{1}{2}x - 3$.	$y = 2x$. The given line $y = -\frac{1}{2}x - 3$ has slope $-\frac{1}{2}$. Perpendicular, so the new slope is the opposite reciprocal, 2. Put the point in: $4 = 2(2) + b$, so $b = 0$.	$y = 2x + 5$. The new slope is written, but b is found with the given slope: $4 = -\frac{1}{2}(2) + b$ gives $b = 5$. The point does not fit: $2(2) + 5 = 9$, not 4.	E
2 F	Through (-2, -5), parallel to $3x + 2y = -2$.	$y = -\frac{3}{2}x - 8$. Solve $3x + 2y = -2$ for y : $y = -\frac{3}{2}x - 1$. The slope is $-\frac{3}{2}$. Parallel, so the new slope is the same, $-\frac{3}{2}$. Put the point in: $-5 = -\frac{3}{2}(-2) + b$, so $b = -8$.	$y = -\frac{3}{2}x - 2$. A sign slip: $b = -5 + 3$ in place of $-5 - 3$, so $b = -2$. The point does not fit: $-\frac{3}{2}(-2) - 2 = 1$, not -5.	O
3 Q	Through (-4, 5), perpendicular to $y - 4 = \frac{1}{2}(x - 4)$.	$y = -2x - 3$. The given line $y - 4 = \frac{1}{2}(x - 4)$ has slope $\frac{1}{2}$. Perpendicular, so the new slope is the opposite reciprocal, -2. Put the point in: $5 = -2(-4) + b$, so $b = -3$.	$y = \frac{1}{2}x + 7$. The given slope $\frac{1}{2}$ is kept. That line goes through the point, but it is parallel to the given line, not perpendicular.	O
4 C	Through (4, -4), perpendicular to $y = -2x$.	$y = \frac{1}{2}x - 6$. The given line $y = -2x$ has slope -2. Perpendicular, so the new slope is the opposite reciprocal, $\frac{1}{2}$. Put the point in: $-4 = \frac{1}{2}(4) + b$, so $b = -6$.	$y = \frac{1}{2}x + 6$. The point's x and y are swapped: $4 = \frac{1}{2}(-4) + b$ gives $b = 6$. The point does not fit: $\frac{1}{2}(4) + 6 = 8$, not -4.	S
5 A	Through (-4, 1), perpendicular to $2x - y = -2$.	$y = -\frac{1}{2}x - 1$. Solve $2x - y = -2$ for y : $y = 2x + 2$. The slope is 2. Perpendicular, so the new slope is the opposite reciprocal, $-\frac{1}{2}$. Put the point in: $1 = -\frac{1}{2}(-4) + b$, so $b = -1$.	$y = -\frac{1}{2}x + 9$. The new slope is written, but b is found with the given slope: $1 = 2(-4) + b$ gives $b = 9$. The point does not fit: $-\frac{1}{2}(-4) + 9 = 11$, not 1.	A
6 D	Through (1, -3), parallel to $y = 4x + 3$.	$y = 4x - 7$. The given line $y = 4x + 3$ has slope 4. Parallel, so the new slope is the same, 4. Put the point in: $-3 = 4(1) + b$, so $b = -7$.	$y = 4x + 1$. A sign slip: $b = -3 + 4$ in place of $-3 - 4$, so $b = 1$. The point does not fit: $4(1) + 1 = 5$, not -3.	L
7 R	Through (-3, 4), perpendicular to $y - 2 = 3(x - 1)$.	$y = -\frac{1}{3}x + 3$. The given line $y - 2 = 3(x - 1)$ has slope 3. Perpendicular, so the new slope is the opposite reciprocal, $-\frac{1}{3}$. Put the point in: $4 = -\frac{1}{3}(-3) + b$, so $b = 3$.	$y = -3x - 5$. Only the sign is changed, giving slope -3. The opposite reciprocal also turns the fraction over: $-\frac{1}{3}$.	N
8 P	Through (2, -2), perpendicular to $x - 3y = 9$.	$y = -3x + 4$. Solve $x - 3y = 9$ for y : $y = \frac{1}{3}x - 3$. The slope is $\frac{1}{3}$. Perpendicular, so the new slope is the opposite reciprocal, -3. Put the point in: $-2 = -3(2) + b$, so $b = 4$.	$y = -3x - 4$. The point's x and y are swapped: $2 = -3(-2) + b$ gives $b = -4$. The point does not fit: $-3(2) - 4 = -10$, not -2.	P

Scavenger Hunt — the cards off the ring

For the teacher

A group reaches these eight cards only by a wrong answer. The equation at the top of each one is the wrong answer from one ring card. The card asks the question of the ring card before it again, with the given line shown another way, so its right answer is the equation at the top of the card the group got wrong. If the group makes the same mistake here, it goes to another card off the ring. So a second wrong answer never moves a group forward.

Card	What the card asks	Answer, and why	The common wrong answer on this card, and why	Letter of its top
E	Through (2, -2), perpendicular to the line through (-3, -4) and (3, -2).	$y = -3x + 4$. From (-3, -4) to (3, -2): rise 2 over run 6, so the slope is $\frac{1}{3}$. Perpendicular, so the new slope is the opposite reciprocal, -3. Put the point in: $-2 = -3(2) + b$, so $b = 4$.	$y = -3x - 4$. The point's x and y are swapped: $2 = -3(-2) + b$ gives $b = -4$. The point does not fit: $-3(2) - 4 = -10$, not -2.	A
B	Through (2, 4), perpendicular to the line drawn on the grid.	$y = 2x$. The drawn line passes through the grid points (-6, 0) and (6, -6): rise -6 over run 12, so the slope is $-\frac{1}{2}$. Perpendicular, so the new slope is the opposite reciprocal, 2. Put the point in: $4 = 2(2) + b$, so $b = 0$.	$y = 2x + 5$. The new slope is written, but b is found with the given slope: $4 = -\frac{1}{2}(2) + b$ gives $b = 5$. The point does not fit: $2(2) + 5 = 9$, not 4.	N
H	Through (-2, -5), parallel to the line through (-4, 5) and (2, -4).	$y = -\frac{3}{2}x - 8$. From (-4, 5) to (2, -4): rise -9 over run 6, so the slope is $-\frac{3}{2}$. Parallel, so the new slope is the same, $-\frac{3}{2}$. Put the point in: $-5 = -\frac{3}{2}(-2) + b$, so $b = -8$.	$y = -\frac{3}{2}x - 2$. A sign slip: $b = -5 + 3$ in place of $-5 - 3$, so $b = -2$. The point does not fit: $-\frac{3}{2}(-2) - 2 = 1$, not -5.	S
J	Through (-4, 5), perpendicular to $x - 2y = -4$.	$y = -2x - 3$. Solve $x - 2y = -4$ for y : $y = \frac{1}{2}x + 2$. The slope is $\frac{1}{2}$. Perpendicular, so the new slope is the opposite reciprocal, -2. Put the point in: $5 = -2(-4) + b$, so $b = -3$.	$y = \frac{1}{2}x + 7$. The given slope $\frac{1}{2}$ is kept. That line goes through the point, but it is parallel to the given line, not perpendicular.	P
L	Through (4, -4), perpendicular to the line through (2, -4) and (3, -6).	$y = \frac{1}{2}x - 6$. From (2, -4) to (3, -6): rise -2 over run 1, so the slope is -2. Perpendicular, so the new slope is the opposite reciprocal, $\frac{1}{2}$. Put the point in: $-4 = \frac{1}{2}(4) + b$, so $b = -6$.	$y = \frac{1}{2}x + 6$. The point's x and y are swapped: $4 = \frac{1}{2}(-4) + b$ gives $b = 6$. The point does not fit: $\frac{1}{2}(4) + 6 = 8$, not -4.	O
G	Through (-4, 1), perpendicular to the line drawn on the grid.	$y = -\frac{1}{2}x - 1$. The drawn line passes through the grid points (-4, -6) and (2, 6): rise 12 over run 6, so the slope is 2. Perpendicular, so the new slope is the opposite reciprocal, $-\frac{1}{2}$. Put the point in: $1 = -\frac{1}{2}(-4) + b$, so $b = -1$.	$y = -\frac{1}{2}x + 9$. The new slope is written, but b is found with the given slope: $1 = 2(-4) + b$ gives $b = 9$. The point does not fit: $-\frac{1}{2}(-4) + 9 = 11$, not 1.	E
K	Through (1, -3), parallel to the line through (-2, -5) and (-1, -1).	$y = 4x - 7$. From (-2, -5) to (-1, -1): rise 4 over run 1, so the slope is 4. Parallel, so the new slope is the same, 4. Put the point in: $-3 = 4(1) + b$, so $b = -7$.	$y = 4x + 1$. A sign slip: $b = -3 + 4$ in place of $-3 - 4$, so $b = 1$. The point does not fit: $4(1) + 1 = 5$, not -3.	L
N	Through (-3, 4), perpendicular to the line drawn on the grid.	$y = -\frac{1}{3}x + 3$. The drawn line passes through the grid points (-1, -4) and (2, 5): rise 9 over run 3, so the slope is 3. Perpendicular, so the new slope is the opposite reciprocal, $-\frac{1}{3}$. Put the point in: $4 = -\frac{1}{3}(-3) + b$, so $b = 3$.	$y = -3x - 5$. Only the sign is changed, giving slope -3. The opposite reciprocal also turns the fraction over: $-\frac{1}{3}$.	O

Other mistakes lead to no card. A group might turn the fraction over without changing its sign, copy the given line's b , read the slope from an equation not solved for y , take the opposite reciprocal for a parallel line, or put the new slope through a point of the given line. Its equation is then not at the top of any card.