

CUT & GLUE SORT



EQUATIONS OF PARALLEL AND PERPENDICULAR LINES

Which Line Is It? Parallel and Perpendicular Lines

Twelve lines in words · $y = mx + b$ · correct, wrong, or many lines fit · three rows

FREE

1

A line through (4, 1) that is perpendicular to $y = 2x + 3$.

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

2

A line through (2, 1).

$$y = 2x - 3$$

3

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

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

Row 1. Correct: only one line fits the words, and this equation is that line.

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Row 2. Wrong: this equation does not fit the words.

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Row 3. Cannot tell: this equation fits the words, but other lines fit them too.

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1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. No calculator is needed.
2. **Say this once:** *“Put the point into the equation. Check the slope. Then ask: could another line fit these words too? A line needs a point and a slope. On this sheet, a line counts as parallel to itself.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheets	pages 3 and 4, one of each per student. Page 3 has the three rows and the checks. Page 4 has the pieces.
Answers	page 5.

Each piece describes a line in words and gives one equation in the form $y = mx + b$. A point and a slope fix exactly one line. The slope can come from a line the new line is parallel or perpendicular to. The student checks the equation two ways: the point must fit it, and its slope must be right.

Row 2 holds the common mistakes. One equation has the right slope, but b was found with the given line's slope. One is the given line itself, through a point that is not on it. One has x and y of the point swapped. One is the horizontal line through the point when the line had to be perpendicular to a horizontal line. That line looks reasonable, but it is parallel to the given line. The right answer there is a vertical line, $x = \text{a number}$.

Row 3 holds words that do not fix one line. Every equation there fits its words, so a student who only checks the equation puts these pieces in row 1. Two of the four pieces give two facts that say the same thing: a point that is the y -intercept, and two given lines that are parallel. Row 1 has a point that is already on the given line. The answer there is the given line itself, because on this sheet a line counts as parallel to itself. Some textbooks use other definitions, so tell the class which ones this sheet uses. Guessing does not work: a simple rule, such as “two facts mean correct,” places at most six pieces correctly.



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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Cut & Glue Sort — which line is it?

Parallel and perpendicular lines

Name _____

Period _____

Date _____

Each piece on the next page describes a line in words and gives one equation. **Does the equation fit the words? Could other lines fit them too? Glue the piece in its row.**

Does the equation fit the words? Put the point the line goes through (the point after “through”) into the equation. Both sides must come out the same. Then read the slope. **Parallel:** the same slope as the given line. **Perpendicular:** the opposite reciprocal. A line perpendicular to a horizontal line is vertical, and a line perpendicular to a vertical line is horizontal.

Do the words fix one line? One line needs a point it goes through *and* a slope (or a line to be parallel or perpendicular to). On this sheet, a line counts as parallel to itself.

Row 1. Correct: only one line fits the words, and this equation is that line.

Row 2. Wrong: this equation does not fit the words.

Row 3. Cannot tell: this equation fits the words, but other lines fit them too.

Cut & Glue Sort — the pieces

Cut along the dashed lines

Cut out the twelve pieces. Glue each one in its row on the other sheet. Every equation is written as $y = mx + b$.

1 A line through (4, 1) that is perpendicular to $y = 2x + 3$. $y = -\frac{1}{2}x - 7$	2 A line through (2, 1). $y = 2x - 3$	3 A line through (3, 1) that is perpendicular to $3x - 2y = 4$. $y = -\frac{2}{3}x + 3$	4 A line through (1, 5) that is parallel to $y = 2x + 3$. $y = 2x + 3$
5 A line through (2, 4) that is parallel to $y = -3x + 1$. $y = -3x + 1$	6 A line perpendicular to $y = \frac{1}{2}x + 1$ and also perpendicular to $y = \frac{1}{2}x - 3$. $y = -2x + 6$	7 A line parallel to $y = 3x - 2$. $y = 3x + 5$	8 A line through (2, 5) that is perpendicular to $x = 1$. $y = 5$
9 A line through (3, -2) that is perpendicular to $y = 4$. $y = -2$	10 A line through (1, -1) that is perpendicular to $y = \frac{1}{3}x - 2$. $y = -3x - 2$	11 A line through (2, 1) that is parallel to the line through (0, 1) and (2, 7). $y = 3x - 5$	12 A line through (0, 4) whose y -intercept is 4. $y = -2x + 4$



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Each row holds four pieces. Every piece is written out again here, with the reason.

1 **Correct: only one line fits the words, and this equation is that line.**

3. A line through (3, 1) that is perpendicular to $3x - 2y = 4$. Equation: $y = -\frac{2}{3}x + 3$. *Why:* The point fits, $-\frac{2}{3}(3) + 3 = 1$, and the slope $-\frac{2}{3}$ is the opposite reciprocal of the given line's. A point and a slope fix one line.

4. A line through (1, 5) that is parallel to $y = 2x + 3$. Equation: $y = 2x + 3$. *Why:* (1, 5) is on $y = 2x + 3$, so the only line through it parallel to that line is the line itself. (On this sheet a line counts as parallel to itself.)

8. A line through (2, 5) that is perpendicular to $x = 1$. Equation: $y = 5$. *Why:* A line perpendicular to the vertical line $x = 1$ is horizontal. Through (2, 5) it is $y = 5$.

11. A line through (2, 1) that is parallel to the line through (0, 1) and (2, 7). Equation: $y = 3x - 5$. *Why:* The point fits, $3(2) - 5 = 1$, and the slope 3 is the same as the given line's. A point and a slope fix one line.

2 **Wrong: this equation does not fit the words.**

1. A line through (4, 1) that is perpendicular to $y = 2x + 3$. Equation: $y = -\frac{1}{2}x - 7$. *Why:* The slope $-\frac{1}{2}$ is right, but b was found with the given slope. The point does not fit: $-\frac{1}{2}(4) - 7 \neq 1$. The line is $y = -\frac{1}{2}x + 3$.

5. A line through (2, 4) that is parallel to $y = -3x + 1$. Equation: $y = -3x + 1$. *Why:* This is the given line itself, and (2, 4) is not on it: $-3(2) + 1 \neq 4$. The line is $y = -3x + 10$.

9. A line through (3, -2) that is perpendicular to $y = 4$. Equation: $y = -2$. *Why:* $y = -2$ goes through the point, but it is horizontal, like $y = 4$: parallel, not perpendicular. A line perpendicular to a horizontal line is vertical, so the line is $x = 3$.

10. A line through (1, -1) that is perpendicular to $y = \frac{1}{3}x - 2$. Equation: $y = -3x - 2$. *Why:* The slope is right, but b was found with x and y swapped. The point does not fit: $-3(1) - 2 \neq -1$. The line is $y = -3x + 2$.

3 **Cannot tell: this equation fits the words, but other lines fit them too.**

2. A line through (2, 1). Equation: $y = 2x - 3$. *Why:* The words give a point but no slope. Every line through the point fits, and this one passes through it.

6. A line perpendicular to $y = \frac{1}{2}x + 1$ and also perpendicular to $y = \frac{1}{2}x - 3$. Equation: $y = -2x + 6$. *Why:* The two given lines are parallel, so the words give only a slope, -2 . Every line with that slope fits, such as this one.

7. A line parallel to $y = 3x - 2$. Equation: $y = 3x + 5$. *Why:* The words give a slope but no point. Every line with that slope fits, and this is one of them.

12. A line through (0, 4) whose y -intercept is 4. Equation: $y = -2x + 4$. *Why:* The point (0, 4) IS the y -intercept 4, so the words give one point and no slope. Every line through (0, 4) except the vertical one fits.

To check a piece with a student, ask: “Does the point fit the equation? Is the slope right? Could a different line fit the same words?”