

LESSON 10 | MEET THE IDEA

Parallel, perpendicular, horizontal and vertical lines

Thursday, November 12, 2026 . 6:00–7:00 PM Central

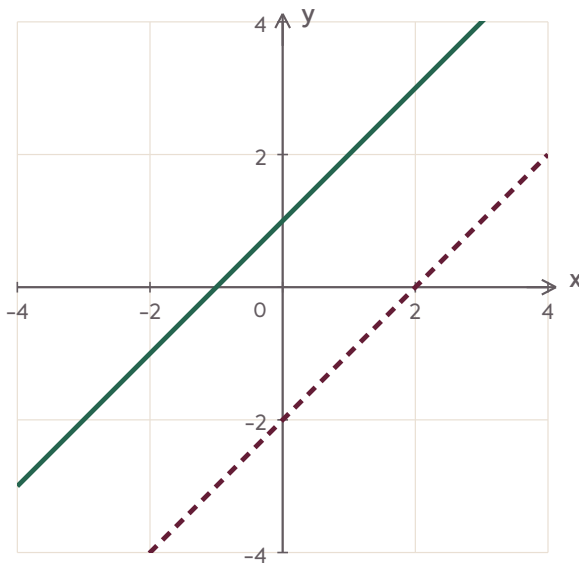
By the end, I can...

Write parallel and perpendicular lines through a point, including horizontal and vertical cases.

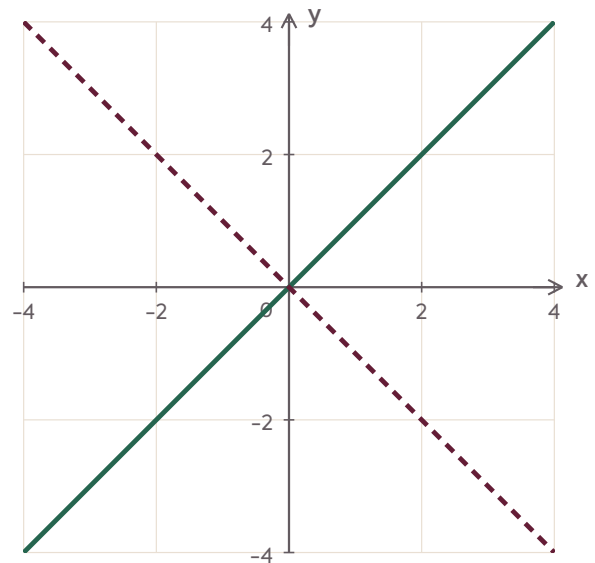
Parallel lines are distinct lines that never meet. Nonvertical parallel lines have the same slope.

Perpendicular lines meet at a right angle (90°).

Parallel lines



Perpendicular lines



Left: solid $y = x + 1$ and dashed $y = x - 2$ both have slope 1.

Right: solid $y = x$ and dashed $y = -x$ have slopes 1 and -1.

The nonzero-slope rule

For perpendicular lines with finite, nonzero slopes: $m_2 = -1/m_1$. Their slopes multiply to -1. Horizontal and vertical lines form their own special perpendicular pair.

LESSON 10 | WORKED EXAMPLES

Keep or change the slope first

Example 1 | Parallel to $y = 2x + 1$ through $(3, 4)$

$$m = 2$$

Parallel means keep the slope.

$$y - 4 = 2(x - 3)$$

Use the new point, not the old y-intercept.

$$y = 2x - 2$$

Distribute and simplify.

Check: $2(3) - 2 = 4$. The new intercept differs, so these are distinct parallel lines.

Example 2 | Perpendicular to $y = 2x + 1$ through $(2, 3)$

$$m = -1/2$$

Take the negative reciprocal of 2.

$$y - 3 = -(1/2)(x - 2)$$

Use the perpendicular slope with the new point.

$$y = -(1/2)x + 4$$

Distribute, then add 3.

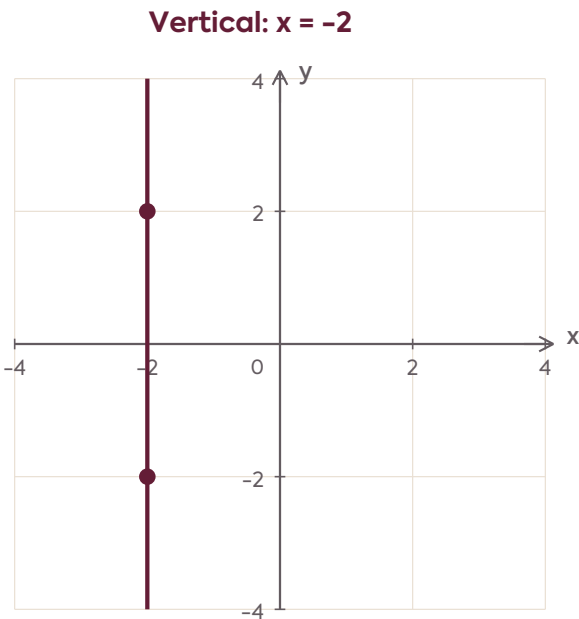
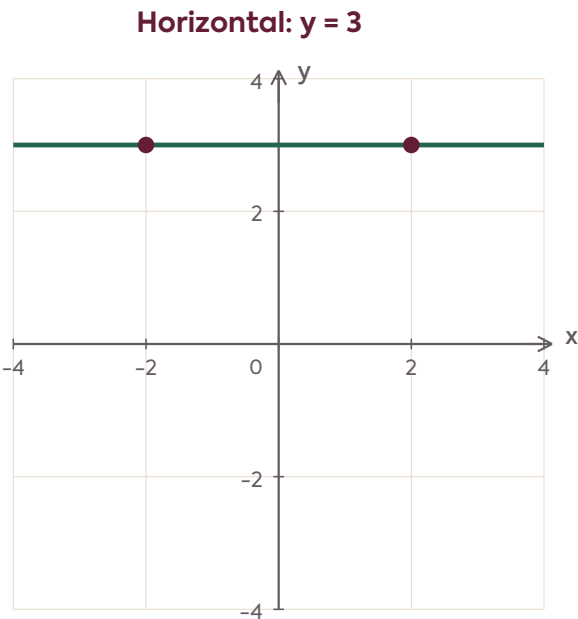
Check the slope product: $2(-1/2) = -1$. Check the point: $-(1/2)(2) + 4 = 3$.

Do not copy the whole equation

A parallel line keeps the **slope**, but its intercept usually changes. If the supplied point is already on the given line, keeping that slope reproduces the same line, not a distinct parallel line.

LESSON 10 | THE SPECIAL CASES

Flat is different from vertical



Line type	What stays fixed	Slope
Horizontal: $y = b$	Every point has the same y -coordinate.	0: rise is 0.
Vertical: $x = a$	Every point has the same x -coordinate.	Undefined: run is 0.

Through $(4, -1)$, the horizontal line is $y = -1$; the vertical line is $x = 4$. They are perpendicular to each other. The first is parallel to the x -axis; the second is parallel to the y -axis.

Zero is a number; undefined is not

For a horizontal line, $0/4 = 0$. For a vertical line, $4/0$ is undefined. A vertical line also fails the function test for y as a function of x .

LESSON 10 | SHORT CHECKS

Your turn

1. Write a line parallel to $y = 3x - 2$ through $(1, 5)$.

2. Write a line perpendicular to $y = 2x + 7$ through $(4, 1)$.

3. Write the horizontal and vertical lines through $(-3, 2)$. State each slope.

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

5. Are $2x + y = 6$ and $y = (1/2)x - 1$ perpendicular? Explain using slopes.

6. A student says the slope through $(2, 1)$ and $(2, 5)$ is 0. Explain the error.

A reliable order

Identify the given slope. Decide the new slope or special line type. Use the point. Finally, check that point in your equation.

LESSON 10 | WORKED ANSWERS AND RECAP

Check your thinking

1. Keep $m = 3$. Then $y - 5 = 3(x - 1)$, giving $y = 3x + 2$.
2. Use $m = -1/2$. Then $y - 1 = -(1/2)(x - 4)$, giving $y = -(1/2)x + 3$. At $x = 4$, $y = 1$.
3. Horizontal: $y = 2$, slope **0**. Vertical: $x = -3$, slope **undefined**.
4. $y = 4$ is horizontal, so its perpendicular line is vertical. Through the given point, that line is $x = 5$.
5. Yes. Rewrite the first as $y = -2x + 6$. The slopes are -2 and $1/2$, and $(-2)(1/2) = -1$.
6. $m = (5 - 1)/(2 - 2) = 4/0$, which is **undefined**. Both points have $x = 2$, so the line is vertical.

Remember the pair

Horizontal lines have equations $y = a$ constant. Vertical lines have equations $x = a$ constant. They meet at 90° , even though the negative-reciprocal formula cannot be applied to slope 0.

I can...

- ☐ Write parallel and perpendicular equations.
- ☐ Handle axis-parallel lines correctly.
- ☐ Check the new line with the given point.

Next class: decide which inputs and outputs make sense. Curriculum focus: A.2E, A.2F, A.2G.