

Writing and Graphing Linear Functions in Three Forms

Grade 9 – Algebra 1 math · Lesson · Standards: F-IF.C.7a, F-LE.A.1a, F-LE.A.2, A-CED.A.2

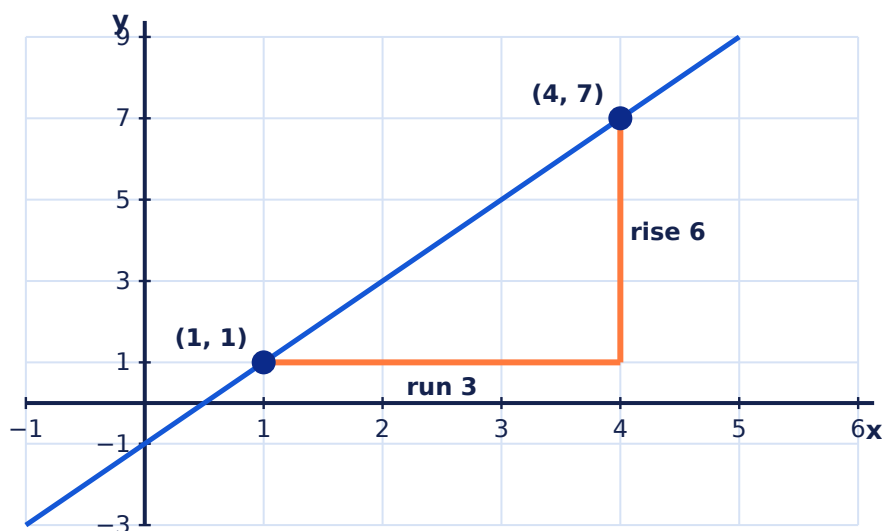
Quick answer: A linear function has a constant rate of change called slope: the change in y divided by the change in x . It can be written as $y = mx + b$, $y - y_1 = m(x - x_1)$ or $Ax + By = C$. Parallel lines share a slope, and perpendicular slopes are negative reciprocals.

Standards: F-IF.C.7a, F-LE.A.1a, F-LE.A.2, A-CED.A.2 · **Level:** Grade 9 Algebra 1

How do you find the slope of a line?

Slope measures steepness: the change in y divided by the change in x between two points.

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$



Run = 3, rise = 6, so slope = $6 \div 3 = 2$.

What are the three forms of a linear equation?

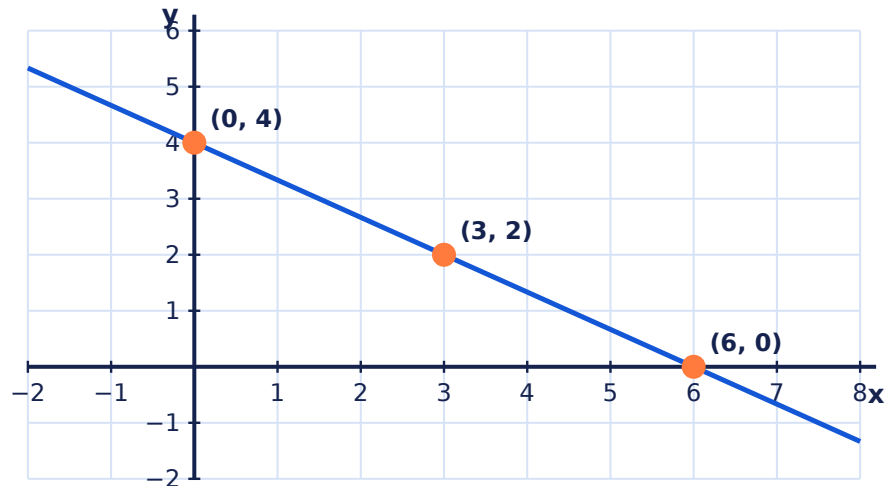
Form	Equation	Best used when
Slope-intercept	$y = mx + b$	you know the slope and the y-intercept
Point-slope	$y - y_1 = m(x - x_1)$	you know the slope and any point
Standard	$Ax + By = C$	you want both intercepts quickly

Method: write the line through (1, 1) and (4, 7)

1. Slope: $(7 - 1) \div (4 - 1) = 2$.
2. Point-slope with $(1, 1)$: $y - 1 = 2(x - 1)$.
3. Distribute and solve for y : $y = 2x - 1$ (slope-intercept form).
4. Standard form: $2x - y = 1$.

How do you graph from standard form?

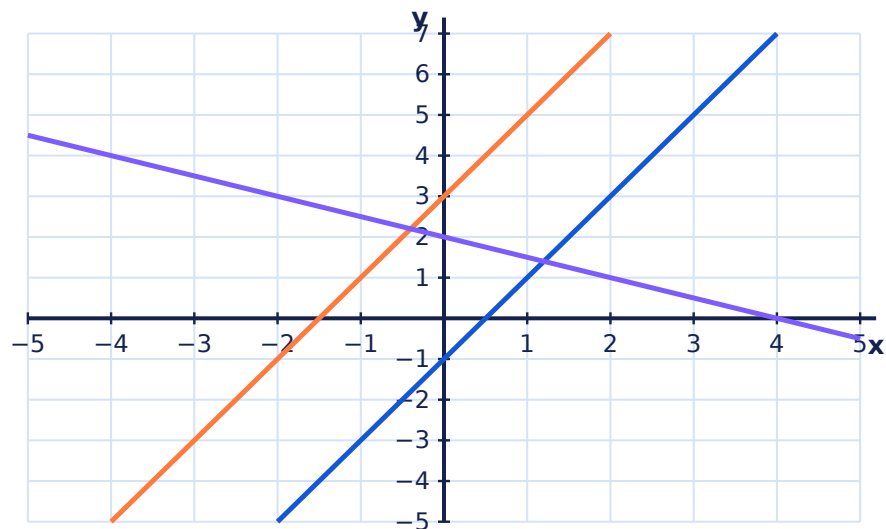
Set $x = 0$ to find the y -intercept and $y = 0$ to find the x -intercept, then draw the line through both points. For $2x + 3y = 12$ the intercepts are $(6, 0)$ and $(0, 4)$.



The line $2x + 3y = 12$, drawn from its intercepts.

What are parallel and perpendicular lines?

Parallel lines have equal slopes. Perpendicular lines have slopes that are **negative reciprocals**, so their product is -1 : slopes 2 and $-1/2$ are perpendicular.



Blue and orange are parallel (slope 2); violet is perpendicular (slope $-1/2$).

Common mistake

Forgetting the sign when taking a negative reciprocal. The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$, and the negative reciprocal is $-\frac{4}{3}$.

To write a model from a story, the rate of change becomes the slope and the starting value becomes the y-intercept.

Mathbot's tip

Check any equation by substituting the original points. If both points work, the equation is right.

Key points to remember

- Slope = $(y_2 - y_1) \div (x_2 - x_1)$ for any two points on the line.
- In $y = mx + b$, m is the slope and b is the y-intercept.
- Point-slope form needs one point and the slope.
- Parallel lines have equal slopes; perpendicular slopes multiply to -1 .
- In a model, the rate of change is the slope and the starting value is the y-intercept.

Writing and Graphing Linear Functions in Three Forms: frequently asked questions

How do you convert standard form to slope-intercept form?

Solve for y . For $4x + 2y = 10$, subtract $4x$ to get $2y = -4x + 10$, then divide by 2 to get $y = -2x + 5$. The slope is -2 and the y-intercept is 5.

When should you use point-slope form?

Use it when you know a point and the slope, or can find the slope from two points. Substitute the numbers directly and then simplify if another form is needed.

What is a negative reciprocal?

Flip the fraction and change the sign. The negative reciprocal of $\frac{2}{5}$ is $-\frac{5}{2}$. Two lines with these slopes are perpendicular because the slopes multiply to -1 .

How can you tell from a table that a function is linear?

Equal steps in x must give equal steps in y . For $x = 0, 2, 4, 6$ and $y = 5, 11, 17, 23$, y increases by 6 each time, so the rate of change is 3 and the table is linear.

What do slope and intercept mean in a real situation?

The slope is the amount the output changes for each unit of input, such as dollars per month. The y-intercept is the starting value when the input is zero, such as a joining fee.