Writing the Equation of a Line

Students write y = mx + b from each kind of starting information (a graph, a table, two points, a slope and a point), always by finding m and then b, and they meet the x-intercept as the crossing where y = 0.

TIME	45 minutes (one student with a parent or tutor, or a small group)
WHO	Math 1 (algebra readiness), about age 12. Follows Unit 3, Lesson 3 (the family of lines).
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson, pencil, graph paper
PRIOR KNOWLEDGE	Slope as rise over run (Lesson 1). y = mx + b and the jobs of m and b (Lesson 2). Solving a one-step equation by adding the opposite (Unit 1).
STANDARDS	NC Math 1 NC.M1.A-CED.2 (create linear equations in two variables), NC.M1.F-LE.2 (construct linear functions from a graph, a table, or two points), NC.M1.F-IF.7 (intercepts).
KEEP OUT	Point-slope and standard form are the optional Lesson 6. Parallel and perpendicular are Unit 4.

Learning goals

1. Write y = mx + b from a graph (read b, count m) and from a table (constant change, x = 0 row, walking back when needed).
2. Write y = mx + b from two points and from a slope and a point by finding m and then putting a point in to solve for b, and check with another point.
3. Find both intercepts from an equation, writing each as a point, and say what each means in a story.
4. Explain why a single known point is enough to find b once m is known.

Vocabulary: say both, every time

The rule for the whole lesson: whenever the adult or the student says a math word, they follow it with the plain-English version. Proper term first, plain English second, until the student does it without being asked.

TERM	LOOKS LIKE	PLAIN ENGLISH
m, the slope	rise over run	Count it, read the constant change, or subtract two points.
b, the y-intercept	value when x = 0	Read it, take the x = 0 row, or put a point in and solve.
x-intercept	value of x when y = 0	Solve 0 = mx + b. When the story hits zero.
Put the point in	y = mx + b with x and y filled	One unknown left: b.
Walk the table back	step by the constant change	Reach x = 0 to read b.

> THE ONE SENTENCE TO SAY OUT LOUD
>
> Find m, find b, write y = mx + b, check with a point. y-intercept: x is 0. x-intercept: y is 0.

Lesson timeline (45 minutes)

0:00 to 0:05	Warm-up: reverse Lesson 2. Show a graph with b = –2 and a rise of 3 over a run of 2. Ask for m and b and the equation. Then hand over a table with x = 0 and ask the same. Point out the job never changes: find m, find b.
0:05 to 0:17	Mini-lesson: the two hard starts. Two points: find m by subtracting, then say out loud that a point on the line makes the equation true, put it in, and solve the one-step equation for b (add the opposite, both sides). Check with the other point. Then a slope and a point: m is given, same finish. Then a table without x = 0: walk back, and show that putting a row in gives the same b.
0:17 to 0:27	The x-intercept. Both crossings of y = 2x – 6 on the grid: (0, –6) with x = 0, (3, 0) with y = 0. Solve 0 = 2x – 6 together. Then the draining tank: b is the start, the x-intercept is when it is empty. Have the student write both as points.
0:27 to 0:40	Practice. The practice problems or Worksheet Parts A to E. Same buttons: Hint, Show next step, Reveal answer, Hide help. Use the Check your line grids to plot the given points and see the drawn line pass through them.
0:40 to 0:45	Exit ticket. Worksheet Part F or an index card: the line through (1, 4) and (3, 10); slope 4 through (2, 3); intercepts of y = –5x + 20. Success looks like: y = 3x + 1, y = 4x – 5, (0, 20) and (4, 0).

Misconceptions to listen for

- **The first row of a table is b.** Only the x = 0 row is. Walk back or put a row in.
- **Stopping at m.** The equation needs b too. Every time.
- **Swapping the intercepts.** y-intercept: x = 0. x-intercept: y = 0. Say the zero out loud.
- **An intercept is a number.** It is a point. Write (0, b) and (x, 0).
- **Putting the point in the wrong slots.** x goes where x is, y goes where y is. Say the point as (x, y) first.
- **Skipping the check.** The second point catches sign slips instantly.

Support and stretch

Support

Give the finish as a three-line template: m = ..., then y = m x + b with the point filled in, then b = ... Use points with small whole numbers. Plot the two points and the y-intercept on paper to see the line agree.

Stretch

Give two points with a fraction slope and a fraction b. Ask for the x-intercept of a line given only by two points. Ask which lines through (3, 5) have an x-intercept at 4 (exactly one) and why.

Where this goes next

Lesson 5: linear functions in the real world. m becomes a rate (per hour, per mile), b becomes a starting amount or flat fee, and the x-intercept becomes when the story hits zero. Then comparing two linear functions given in different ways.

> THE HABIT TO BUILD
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> Whatever you are given: find m, find b, write y = mx + b, check with a point. For the x-intercept, put y = 0.