Slope-Intercept Form: y = mx + b

Students meet y = mx + b and the two jobs of its numbers: b is the y-intercept (where the line crosses the y-axis, because that is where x = 0) and m is the slope. They read m and b from equations, graph a line by plotting b and stepping by m, and read m and b off simple graphs.

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 1 (slope).
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson, pencil, graph paper, ruler
PRIOR KNOWLEDGE	Slope as rise over run (Lesson 1). Evaluating a rule at x = 0 (Unit 2). The invisible 1 and adding the opposite (Unit 1).
STANDARDS	NC Math 1 NC.M1.F-IF.7 (graph linear functions and show intercepts), NC.M1.F-LE.5 (interpret the parameters of a linear function), NC.M1.A-CED.2.
KEEP OUT	Writing equations from tables and two points is Lesson 4. Families and parallel lines are Lesson 3 and Unit 4.

Learning goals

1. State the two jobs: b is the y-intercept and starting value, m is the slope, the steepness and direction, and explain why b is on the y-axis (x = 0 makes mx vanish).
2. Read m and b from an equation, including the invisible 1, a missing b, a missing x term, negative b, fraction m, and terms in the other order.
3. Graph a line from its equation by plotting b and stepping by m as rise over run.
4. Match an equation to its graph by elimination (sign of m, then b, then size of m), naming the rule that ruled out each wrong choice, with plugging in a point only as a final check.
5. Read b and m off a simple graph and write y = mx + b.

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
Slope-intercept form	y = mx + b	The form that shows the slope and the y-intercept.
y-intercept, b	(0, b)	Where the line crosses the y-axis; the value when x = 0; the starting value.
Slope, m	rise over run	Steepness and direction: how much y changes per step of x.
Invisible 1	y = x + 3	m = 1.
Flat line	y = 5	m = 0, no x term.

> THE ONE SENTENCE TO SAY OUT LOUD
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> b is the starting point on the y-axis, the value when x is 0. m is the steepness and direction, rise over run. Plot b, step by m, draw the line.

Lesson timeline (45 minutes)

0:00 to 0:05	Warm-up: x = 0. Give y = 2x + 3 and ask for y when x = 0 (3), then x = 1 (5), x = 2 (7). Ask: "Where does x = 0 live on the grid?" On the y-axis. So (0, 3) is where the line crosses it. And each step right added 2. Name them: b and m.
0:05 to 0:15	Mini-lesson: two jobs. Write y = mx + b. Put x = 0 in and watch mx disappear: y = b. Say both jobs out loud and have the student repeat. Then the careful-cases table: y = x + 3, y = –2x, y = 5, y = 4x – 7, y = 3 + 2x. Ask the two questions each time: which number is on x, which stands alone?
0:15 to 0:27	Graph from the equation. Three moves on the board: plot b, step by m, draw. Do y = 2x – 1 and y = –x + 4 together, then the student does the four interactive grids (including the flat one). Then the table view: fill the table for y = 2x – 1 and notice the x = 0 row is b and each row adds m.
0:27 to 0:40	Match by elimination, reverse it, then practice. One equation, four graphs: cross out by the sign of m, then b, then the size of m; say the rule for each cross-out; plug in a point only as a final double-check. Then read b and m off the three simple graphs, then the practice problems or Worksheet Parts A to E. Same buttons: Hint, Show next step, Reveal answer, Hide help.
0:40 to 0:45	Exit ticket. Worksheet Part F or an index card: y = –2x + 5, m and b and their jobs; three dots for y = 1/3 x + 2. Success looks like: m –2 falling, b 5 on the y-axis; (0, 2), (3, 3), (6, 4).

Misconceptions to listen for

- **b is the x-intercept.** b is on the y-axis, because x = 0 there. The x-intercept comes in Lesson 4.
- **m is the first number I see.** m is the number on x, wherever it sits: y = 3 + 2x has m = 2.
- **Losing the sign of b.** y = 4x – 7 is 4x + (–7), so b = –7.
- **y = x has no slope.** It has slope 1, the invisible 1.
- **Stepping the wrong way.** Rise is up or down; run is to the right. A negative m goes down as you go right.
- **Starting the graph at any point.** Start at (0, b). It is the one point you always know.

Support and stretch

Support

Keep m as a fraction with a run of 1 at first (m = 2 is 2/1). Use a ruler and color the y-intercept dot before stepping. Read equations aloud in the pattern: "m is the number on x, that is ...; b stands alone, that is ...".

Stretch

Give an equation with a fraction slope and ask for a dot to the left of the y-axis (step the other way). Ask what y = mx + b looks like when b = 0 and when m = 0 at the same time. Ask for two different lines that share the same b, previewing Lesson 3.

Where this goes next

Lesson 3: the family of lines. All lines share the form y = mx + b, so they are one family, and each line is a member picked out by its m and b. Change b and the line slides; change m and it tilts.

> THE HABIT TO BUILD
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> Read every line the same way: which number is on x (m, the steepness), which stands alone (b, the start on the y-axis). Graph every line the same way: plot b, step by m, draw.