Same, Parallel, or Perpendicular?

Students combine the two slope jobs into one decision: classify any pair of lines (from equations, graphs, or points) as the same line, parallel, perpendicular, or neither, and choose the right move to write a parallel or perpendicular line through a point.

TIME	35 minutes (one student with a parent or tutor, or a small group)
WHO	Math 1 (algebra readiness), about age 12. Follows Unit 4, Lessons 1 and 2.
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson, pencil, graph paper
PRIOR KNOWLEDGE	Parallel means same m, different b (Lesson 1). Perpendicular means negative reciprocal slopes, product –1 (Lesson 2). Slope from two points; rewriting into y = mx + b.
STANDARDS	NC Math 1 NC.M1.G-GPE.5 (use slope criteria for parallel and perpendicular lines; write equations of parallel and perpendicular lines through a point).
KEEP OUT	Distance and midpoint (Unit 11). Angle measures other than the right angle.

Learning goals

1. Run the decision in order: get both slopes; equal means parallel (or the same line if b matches); product -1 means perpendicular; otherwise neither.
2. Classify pairs given as equations (rewriting when needed), graphs, and two pairs of points, including testing a point to separate same line from parallel.
3. Write a line through a point that is parallel or perpendicular to a given line, choosing the first move (keep m, or negative reciprocal) without being told which.

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
Same line	same m, same b	One line written twice.
Parallel	same m, different b	Never cross.
Perpendicular	$m1 \times m2 = -1$	Square corner.
Neither	anything else	They cross, not squarely.
The first move	keep m, or flip and change the sign	The only difference between the two writing skills.

> THE ONE SENTENCE TO SAY OUT LOUD
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> Get both slopes. Equal: parallel, or the same line if b matches. Product negative one: perpendicular. Otherwise neither. To write one through a point: choose the first move, then find b.

Lesson timeline (35 minutes)

0:00 to 0:05	**Warm-up: four lines against one.** Show $y = 2x + 1$ with the three others from the figure. Ask the student to name each relationship and the reason, using only slopes and y-intercepts.
0:05 to 0:13	**Mini-lesson: the decision in order.** Write the four steps. Stress the two traps: equal slopes need a b check (same line versus parallel), and opposite slopes are not perpendicular (product must be –1). Do one pair of each kind, including one from two pairs of points with a point test.
0:13 to 0:22	**Sort.** The ten-pair sorting activity. Have the student say the slopes out loud before clicking, and the reason after.
0:22 to 0:32	**Choose the move, then practice.** Through one point, write both the parallel and the perpendicular line to $y = –3x + 4$. Then the practice problems or Worksheet Parts A to C. Same buttons: Hint, Show next step, Reveal answer, Hide help.
0:32 to 0:35	**Exit ticket.** Worksheet Part E or an index card. Success looks like: perpendicular because the product is –1; $y = –1/4\ x + 2$ and $y = 4x – 15$.

Misconceptions to listen for

- **Equal slopes always means parallel.** Check b: it might be one line.
- **Opposite slopes means perpendicular.** 3 and –3 multiply to –9. Flip and change the sign.
- **Same b means something.** Same b alone only says they cross on the y-axis.
- **Classifying before rewriting.** Standard form hides m.
- **From points, stopping at equal slopes.** Test a point to split same line from parallel.
- **Using the wrong first move.** Say parallel or perpendicular out loud, then say keep m or flip and change the sign.

Support and stretch

Support

Give the four-step decision as a card. Have the student draw both lines on graph paper for every pair until the four cases look different at a glance. Keep slopes as simple fractions.

Stretch

Give a pair where one line is vertical. Ask for a line that is perpendicular to one given line and parallel to another (when is that possible?). Ask how many lines through a point are perpendicular to a given line (one) and how many are neither (infinitely many).

Where this goes next

Lesson 4: using slopes to check shapes. The same decision, applied to the sides of a triangle or a rectangle drawn from its corner points.

> THE HABIT TO BUILD
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> Get both slopes first. Then the decision in order: equal, product negative one, otherwise neither.