# Proportional Graphs

Students plot a proportional table, learn the graph test (a straight line through the origin), see the two ways a graph fails, connect steepness to the unit rate (steeper, nothing more), and decide when to connect the dots.

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|---|---|
| TIME | 25 minutes (one student with a parent or tutor) |
| WHO | 7th grade, about age 12. Follows Lesson 3, The Unit Rate. |
| MATERIALS | Student worksheet (PDF), the Deep Dive 5 page for this lesson (plotting grid, slider, graph match), pencil. |
| PRIOR KNOWLEDGE | Plotting points in the first quadrant (6th grade); the table test and the unit rate (Lessons 2 and 3). |
| STANDARDS | NC.7.RP.2. |
| KEEP OUT | The 8th grade name for steepness and its formula. Say steeper, and say unit rate. One sentence that 8th grade names the steepness is fine. |

## Learning goals

1. Plot a table and apply the graph test: straight, and through the origin.
2. Explain how a graph fails: misses the origin, or bends.
3. Say that a bigger unit rate makes a steeper line.
4. Decide whether to connect the dots.

## 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 |
|---|---|---|
| Origin | (0, 0) | Where both amounts are zero. |
| Straight line through the origin | the lemonade line | The picture of a proportional relationship. |
| Steeper | Mia's line | Rises faster: a bigger unit rate. |

> THE ONE SENTENCE TO SAY OUT LOUD
>
> Straight, and through the origin. Steeper means a bigger unit rate.

## Lesson timeline (25 minutes)

| | |
|---|---|
| 0:00 to 0:06 | **Plot.** The lemonade table on the grid, one click per row. Draw the line. Say both tests. |
| 0:06 to 0:12 | **Two ways to fail.** Bowling misses the origin; the square's area bends. The three-graph match. |
| 0:12 to 0:18 | **Slider.** Move the unit rate and watch the line tip. Mia and Jordan on one grid. Steeper, nothing else. |
| 0:18 to 0:22 | **Dots or a line.** The sort. Can both amounts be split? |
| 0:22 to 0:25 | **Exit ticket.** Worksheet Part D. Success looks like the line crossing at 5 ruled out because it misses the origin. |

## Misconceptions to listen for

- **Straight means proportional.** It must also go through (0, 0).
- **Through the origin means proportional.** It must also be straight.
- **A bigger total means a steeper line.** Steepness is the unit rate, the rise for every 1 across.
- **Always connect the dots.** Only when both amounts can be split.

## Support and stretch

### Support

Have the student put a finger on (0, 0) before deciding anything. Then trace the line with a ruler: does it bend? For steepness, count the rise for one step across on both lines.

### Stretch

Ask for a story whose graph is straight but misses the origin, and one that goes through the origin but bends. Ask what the slider would show at r = 0.

## Where this goes next

Lesson 5: the equation y = rx. The unit rate from the table, the graph, and the words all become one short sentence.

> THE HABIT TO BUILD
>
> Finger on the origin, ruler on the line. Both tests, every graph.