Connect the Dots: From Points to a Line

Every input, even 0.5 or 2.25, has one output, so it is one point, and it lands on the same line as the dots. The line is all of the points at once. Connect the dots only when the in-between inputs are real.

1 THE VOCABULARY
Words we use

Line all of the points of a rule at once: every input with its one output, drawn together.

In-between input a decimal or fraction input like 0.5 or 2.25. Feed it in like any number; its point lands on the line.

Continuous every in-between input is real (time, temperature, distance, height), so connect the dots into a solid line.

Discrete only whole things are real (people, tickets, pizzas), so leave the dots separate.

Function a rule with one output for each input. That promise is why every input makes exactly one point.

- Watch out for these.
- Thinking the line is a guess. It is not: every point on it comes from the rule.
- Connecting dots for tickets or people. There is no point at 2.5 tickets.
- Leaving the dots separate for time. Minute 2.5 is real, so the graph is a solid line.
- Checking a point by its x only. A point is on the line only when its y equals the rule's output for that x.

2 THE METHOD
From dots to a line

1. **FILL THE TABLE, PLOT THE ROWS** as in Lesson 1: each row is a point (x, y).
2. **TRY AN IN-BETWEEN INPUT** x = 0.5 in y = 2x – 1 gives y = 0, the point (0.5, 0). It sits between the dots, on the same path.
3. **MAKE THE LEAP** any input at all gives one output, so one point, on that same path. The line is every point at once.
4. **ASK: IS THE INPUT CONTINUOUS OR DISCRETE?** any number is real: draw the line. Only whole things: leave the dots separate.

> **WHY THE DOTS LINE UP**
> For a rule like y = 2x – 1, every step of 1 to the right adds the same amount to y. Same step, same climb, every time. That is what makes the path straight. Unit 3 measures that climb and names it.

3 AN IN-BETWEEN INPUT
y = 2x – 1 at x = 2.25

y = 2x – 1	the rule. The table's dots: (0, –1), (1, 1), (2, 3), (3, 5)
y = 2 × 2.25 – 1	feed in the in-between input 2.25, exactly like a whole number
y = 4.5 – 1 = 3.5	one input, one output
(2.25, 3.5)	the point. It sits between (2, 3) and (3, 5), a little past the middle, right on the straight path through the dots
x = –1.5: y = 2(–1.5) – 1 = –4	a negative decimal works the same way: the point (–1.5, –4) is on the line too

> **CHECK: IS (1.5, 7) ON THE LINE OF Y = 3X + 2?**
> 3 × 1.5 + 2 = 6.5, not 7. Off the line. A point is on the line only when its y matches the rule for its x.

> **SAY IT OUT LOUD**
> Any input gives one output, so one point, on the same line. Connect the dots when the in-between inputs are real.