Linear Functions in the Real World

In a story, b is the starting amount or flat fee and m is the rate (the per-something). Write y = (rate)x + (start). Linear means a constant rate of change. Compare two by their b, their m, and where they are equal.

1 THE VOCABULARY
Words we use

Rate m in a story: per hour, per mile, per ticket. Negative when the amount goes down.

Starting value b in a story: the amount at the beginning, the flat fee, the value when x = 0.

Constant rate of change the same change every step. The test for linear.

Linear y = mx + b works; the graph is a line; a table shows equal differences.

Not linear the change itself grows or shrinks (doubling, squares, percent growth).

Compare get m and b from each representation; bigger b starts higher, bigger m grows faster, set equal to find the crossing.

- Watch out for these.
- Swapping start and rate: the one-time amount is b, the per-something is m.
- Forgetting the sign: draining, descending, and burning down have a negative m.
- Calling any table linear. Check the differences; they must all match (with equal x steps).
- Comparing only one thing. Ask all three: starts higher, grows faster, equal when.

2 THE METHOD
Story to model, and back

1. **FIND THE START** the one-time amount: fee, initial height, starting balance. That is b.
2. **FIND THE RATE** the per-something amount. That is m, negative if it goes down.
3. **WRITE AND USE** y = mx + b. Put in an x to predict; set y to a target and solve for x (Unit 1).
4. **TEST FOR LINEAR** equal x steps: subtract down the y column. All the same difference: linear, and difference over step is m.
5. **COMPARE TWO** m and b from each. Bigger b: starts higher. Bigger m: grows faster. Set the rules equal: when they match.

> **WHY CONSTANT RATE MEANS LINEAR**
> A rule y = mx + b adds the same m every step of x. So a table from it shows the same difference every row, and a graph of it is a straight line. If the differences change, no single m fits, and it is a different family.

3 COMPARING TWO PLANS
Plan A: 10x + 20. Plan B: a table starting at 50 and rising 5 a month

A: b = 20, m = 10	read straight off the equation: $20 to start, $10 per month
B: b = 50, m = 5	from the table: 50 at month 0, up 5 each month. B is 5x + 50
starts higher: B	50 is more than 20
grows faster: A	10 per month is more than 5
equal: 10x + 20 = 5x + 50	add –5x and –20 to both sides: 5x = 30, x = 6 months, both cost 80
before 6 months A is cheaper; after, B is	check x = 2: A is 40, B is 60. Check x = 10: A is 120, B is 100

> **ON THE GRAPH**
> Both lines drawn on one grid cross at (6, 80). The steeper one (A) starts lower and overtakes.

> **SAY IT OUT LOUD**
> Start is b, rate is m. Same change every step means linear. Starts higher, grows faster, equal when.

Unit 3, Lesson 5 in one line: b is the start, m is the rate, constant rate means linear, and two linear functions are compared by b, by m, and by where they meet.