

Grade 8 - Linear Functions as Models - Lesson

Common Core 8.F.B.4, 8.F.B.5 · maths-pdf.fr/en/

A linear function $y = mx + b$ models a situation with a constant rate of change m and an initial value b , the output when the input is 0. You can find m and b from two points, a table, or a graph, and interpret them with units. Graphs can also be described in words.

Grade 8 · Common Core State Standards: **8.F.B.4, 8.F.B.5**

Key facts

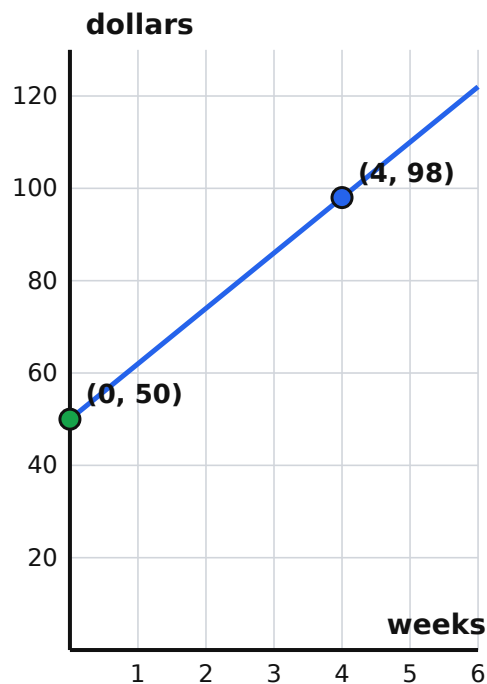
- Rate of change $m = \frac{\text{change in } y}{\text{change in } x}$; initial value b is y when $x = 0$.
- Build a model: find m , solve for b with one point, write $y = mx + b$.
- A negative rate means the quantity decreases.
- A flat segment has rate 0; a curve means the rate is not constant.
- Always say what m and b mean in the situation, with units.

What are rate of change and initial value?

A linear function $y = mx + b$ describes a situation with a constant rate. The **rate of change** m is how much y changes for each 1-unit change in x . The **initial value** b is the value of y when $x = 0$.

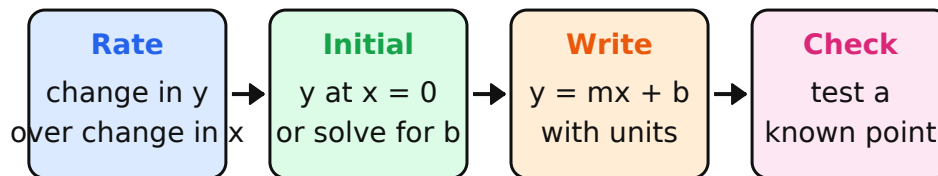
Reading a linear model

In $y = mx + b$: m is the rate of change (slope) and b is the initial value (y-intercept). For a savings account $S = 12w + 50$, the rate is \$12 per week and the initial value is \$50.



Savings in dollars after w weeks.

How do you build a function from data?

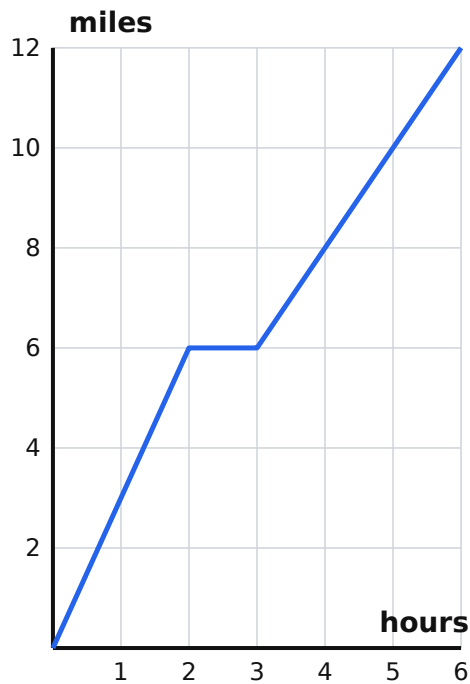


Four steps to build a model.

Worked example. A line passes through $(2,11)$ and $(5,20)$. The rate is $\frac{20-11}{5-2} = 3$. Use $11 = 3 \cdot 2 + b$, so $b = 5$. The function is $y = 3x + 5$. Check: $3 \cdot 5 + 5 = 20$.

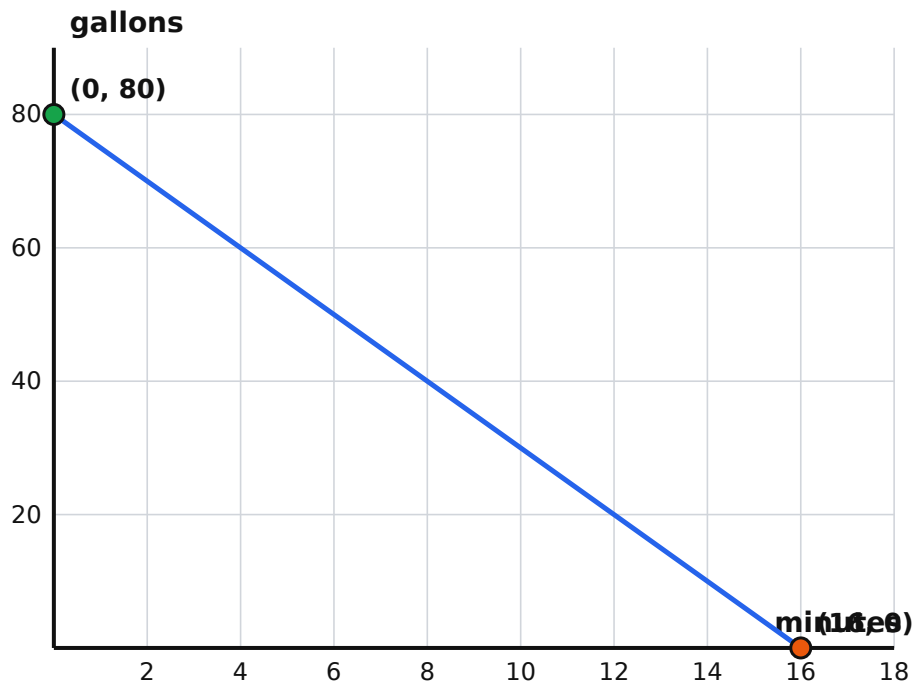
How do you describe a graph in words?

Read the graph from left to right. Where the graph rises, the quantity is **increasing**; where it falls, it is **decreasing**; where it is flat, it is **constant**. A straight line is linear. A curve is nonlinear.



A hike: steady walking, a rest, then a faster walk.

In this hike graph the first segment has slope 3 miles per hour, the flat segment has slope 0 (a rest), and the last segment has slope 2. Each segment is linear, but the whole graph is not one line.



The tank is empty at 16 minutes.

Always include units when you interpret a model. In $V = 80 - 5t$, the 80 gallons is the starting amount, the rate -5 means the tank loses 5 gallons per minute, and the tank is empty when

$80 - 5t = 0$, at $t = 16$ minutes.

Questions about linear functions as models

What is the difference between rate of change and initial value?

The rate of change is how fast the output changes per unit of input. The initial value is where the output starts when the input is zero.

What does a negative rate of change mean?

The output decreases as the input increases, such as a phone battery draining or a gas tank emptying.

How do I find the initial value from a table without $x = 0$?

Find the rate, then work backwards, or substitute a point into $y = mx + b$ and solve for b .

How can I tell a graph is linear?

A linear graph is a single straight line with a constant slope. If it bends or has a flat part followed by a steeper part, it is not one linear function.

Why include units in my answer?

Units give the numbers meaning. Saying 12 only is unclear, while 12 dollars per week tells exactly what the rate means.