

Student Workbook

Modeling with Linear Functions

Name: _____

Date: _____

Period: _____

Learning Target: I can build linear function models from real-world situations, use them to make predictions, and find break-even points.

Vocabulary

Term	Meaning
Mathematical Model	A function that represents a real-world situation.
Initial Value	The starting amount (the y-intercept, b) before any input is applied.
Constant Rate of Change	The slope, m — how much the output changes per unit of input.
Break-Even Point	Where two models produce the same output — found by setting them equal.

Key Concept: Building a Linear Model

METHOD

1. Identify the rate of change (slope, m) — usually a "per unit" phrase like "\$8 per item."

2. Identify the initial value (y-intercept, b) — a fixed or starting amount.

3. Write $f(x) = mx + b$.

EXAMPLE 1

A company has a fixed cost of \$500 plus a variable cost of \$8 per item produced. Write the cost function $C(x)$, then find the cost of producing 50 items.

$C(x) =$ _____

$C(50) =$ _____

Key Concept: Using a Model to Predict or Solve

TWO DIFFERENT QUESTIONS

Evaluate $C(x)$ to predict the output for a given input.

Solve $C(x) = \text{target}$ to find the input that produces a specific output.

EXAMPLE 2

A car's value depreciates: $V(x) = -2000x + 25000$, where x is years. Find when the value reaches \$9000.

$$-2000x + 25000 = 9000 \rightarrow -2000x = \underline{\hspace{2cm}} \rightarrow x = \underline{\hspace{2cm}}$$

Key Concept: Break-Even Analysis

METHOD

When two linear models represent competing costs (or a cost and a revenue), set them EQUAL to each other and solve for x . This tells you where they produce the same value.

EXAMPLE 3

Company A: $C(x) = 8x + 500$ (cost). Company A also has revenue $R(x) = 15x$. Find the break-even point.

$$8x + 500 = 15x \rightarrow 500 = \underline{\hspace{2cm}} \rightarrow x = \underline{\hspace{2cm}}$$

COMMON MISTAKE

Real-world models often have a PRACTICAL domain that's smaller than "all real numbers"! A negative number of items, miles, or hours usually doesn't make sense — always check whether your answer is realistic.

Guided Practice — Part A: Build the Model

- A1** A gym charges a \$10 registration fee plus \$12 per session. Write $C(x)$.

- A2** A phone plan has no signup fee but charges \$0.10 per text plus a \$20 base monthly fee. Write $C(x)$.

Guided Practice — Part B: Predict Using the Model

- B1** Using A1, find the cost for 8 sessions.

- B2** Using A2, find the cost for 150 texts.

Guided Practice — Part C: Solve for the Input

- C1** Using A1, find how many sessions cost \$130.

- C2** Using A2, find how many texts cost \$35.

Guided Practice — Part D: Break-Even / Intersection

- D1** Company A: $C(x) = 6x + 300$. Company B: $C(x) = 10x + 150$. Find the break-even point.

- D2** Candle A: $h(x) = -0.5x + 12$. Candle B: $h(x) = -0.75x + 15$. Find when they're the same height.

BEFORE YOU MOVE ON

Check with a partner: does your final answer make sense in the real-world context (no negative time, no negative cost, etc.)?