Name: _____

Date: _____

Period: _____

# Student Workbook

## Absolute Value Functions

**Learning Target:** I can write absolute value functions as piecewise functions, solve absolute value equations, and model real situations with them.

## Vocabulary

| Term | Meaning |
|---|---|
| Absolute Value Function | A function with a characteristic "V" shaped graph, f(x) = a\|x-h\| + k. |
| Vertex | The point (h, k) where the "V" turns — the minimum (or maximum) point of the graph. |
| Piecewise Function | A function defined by different rules (expressions) for different parts of its domain. |

## Key Concept: Absolute Value as a Piecewise Function

**DEFINITION**

$f(x) = |x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$

Absolute value "keeps" positive inputs the same but negates negative inputs, so the output is always $\geq 0$.

**EXAMPLE 1**

Write f(x) = |x+3| - 2 as a piecewise function.

The inside (x+3) is $\geq 0$ when $x \geq$ _____.

If $x \geq -3$: f(x) = (x+3) - 2 = _____

If $x < -3$: f(x) = -(x+3) - 2 = _____

## Key Concept: Solving Absolute Value Equations

**METHOD**

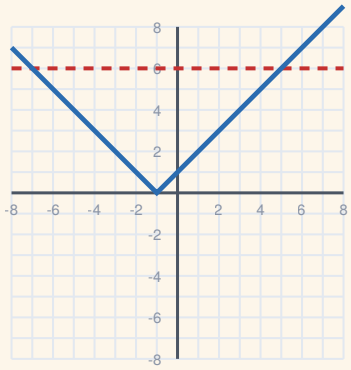
Isolate the absolute value expression, then split into two cases (positive and negative), just like in Algebra 1 — but now we can also think of it as f(x) = c and use a graph to visualize both solutions.

**EXAMPLE 2**

Solve |x - 4| = 7.

x - 4 = _____ OR x - 4 = _____ → x = _____ or x = _____

**EXAMPLE 3 — Solving with a Graph**




Solve |x+1| = 6 by finding where f(x) = |x+1| intersects g(x) = 6.

The graphs intersect at x = _____ and x = _____.

**COMMON MISTAKE**

Don't forget the SECOND solution! Since absolute value equations usually come from two different cases, most have TWO solutions — unless the equation is set equal to a negative number (no solution) or zero (exactly one solution).

## Guided Practice — Part A: Write as a Piecewise Function

**A1** f(x) = |x - 5|

**A2** f(x) = 2|x+1| - 3

## Guided Practice — Part B: Solve the Equation

**B1** |x + 6| = 10

**B2** $3|x - 2| - 4 = 11$

## Guided Practice — Part C: Solve Using a Graph Setup

**C1** $f(x) = |x+1|$, $g(x) = 6$. Solve $f(x) = g(x)$.

**C2** A graph shows $f(x) = |x-3| - 2$ intersecting the horizontal line $y = 4$ at two points. Find those x-values algebraically.

## Guided Practice — Part D: Apply It

**D1** A thermostat maintains temperature within 2°F of 70°F: $|T - 70| \leq 2$. Find the acceptable temperature range.

**D2** A manufactured part must measure 25 mm with a tolerance of 0.5 mm: $|L - 25| \leq 0.5$. Find the acceptable length range.

**BEFORE YOU MOVE ON**

Check with a partner: did you find BOTH solutions to each equation (unless the problem truly has only one)?