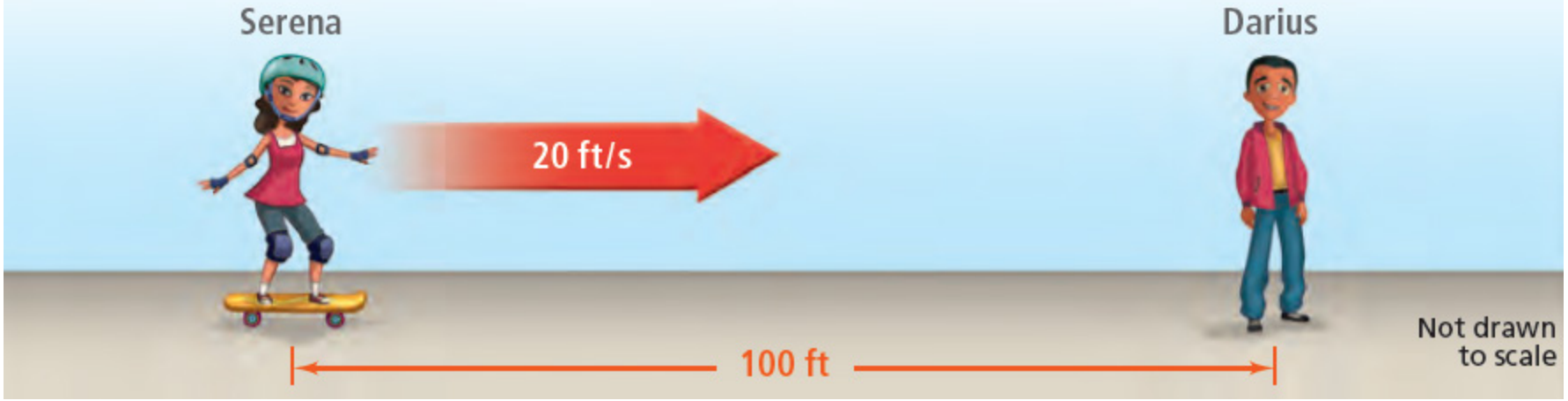
Name _____

3-6 Absolute Value Equations and Inequalities

OBJECTIVE: **I can write algebraic expressions**

Warm-Up

Serena skates toward Darius and then passes by him. She skates at a constant speed of 20 ft/s. At what time(s) is Serena 60 ft from Darius? Explain your reasoning.



Essential Understanding

Essential Understanding You can solve absolute value equations and inequalities by first isolating the absolute value expression, if necessary. Then write an equivalent pair of linear equations or inequalities.

Example #1 Solving an Absolute Value Equation

What are the solutions of $|x| + 2 = 9$? Graph and check the solutions.

Your Turn to Work it Out

1. What are the solutions of $|n| - 5 = -2$? Graph and check the solutions.

Concept Understanding

Some equations, such as $|2x - 5| = 13$, have variable expressions within absolute value symbols. The equation $|2x - 5| = 13$ means that the distance on a number line from 2x - 5 to 0 is 13 units. There are two points that are 13 units from 0: 13 and −13. So to find the values of x, solve the equations $2x - 5 = 13$ and $2x - 5 = -13$. You can generalize this process as follows.

Key Concept:

To solve an equation in the form $|A| = b$, where A represents a variable expression and $b > 0$, solve $A = b$ and $A = -b$.

Example #2 Solving an Absolute Value Equation

Multiple Choice Starting from 100 ft away, your friend skates toward you and then passes by you. She skates at a constant speed of 20 ft/s. Her distance d from you in feet after t seconds is given by $d = |100 - 20t|$. At what times is she 40 ft from you?

A -2 s and 8 s

B -3 s and 7 s

C 3 s and 7 s

D 2 s and 8

Your Turn to Work it Out

2. Another friend's distance d from you (in feet) after t seconds is given by $d = |80 - 5t|$. What does the 80 in the equation represent? What does the 5 in the equation represent? At what times is she 60 ft from you?

Example #3 Solving an Absolute Value Equation With No Solution

What are the solutions of $3|2z + 9| + 12 = 10$?

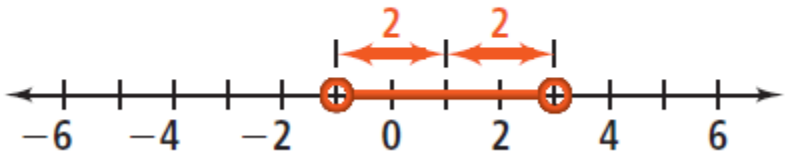
Your Turn to Work it Out

3. What are the solutions of $|3x - 6| - 5 = -7$?

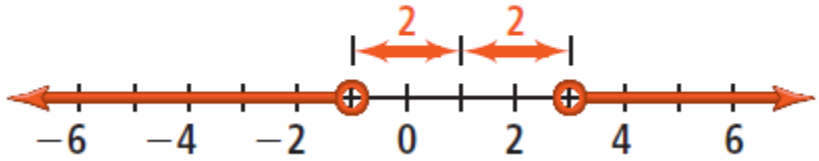
Concept Understanding

You can write absolute value inequalities as compound inequalities. The graphs below show two absolute value inequalities.

$|n - 1| < 2$



$|n - 1| > 2$



$|n - 1| < 2$ represents all numbers with a distance from 1 that is less than 2 units. So $|n - 1| < 2$ means $-2 < n - 1 < 2$.

$|n - 1| > 2$ represents all numbers with a distance from 1 that is greater than 2 units. So $|n - 1| > 2$ means $n - 1 < -2$ or $n - 1 > 2$.

Example #4 Solving an Absolute Value Inequality Involving ≥

What are the solutions of $|8n| \geq 24$? Graph the solutions.

Your Turn to Work it Out

4. What are the solutions of $|2x + 4| \geq 5$? Graph the solutions.

Example #5 Solving an Absolute Value Inequality Involving ≤

Manufacturing A company makes boxes of crackers that should weigh 213 g. A quality-control inspector randomly selects boxes to weigh. Any box that varies from the weight by more than 5 g is sent back. What is the range of allowable weights for a box of crackers?

Your Turn to Work it Out

5. A food manufacturer makes 32-oz boxes of pasta. Not every box weighs exactly 32 oz. The allowable difference from the ideal weight is at most 0.05 oz. Write and solve an absolute value inequality to find the range of allowable weights.