

Algebra 1                    2.5

Evaluate absolute value expressions

Solve absolute value equations

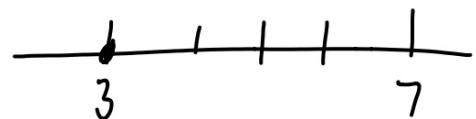
$|(-3)| = 3$   
distance from zero  
absolute value

activ: floor graphs      pos.

$|5| = 5$    not opposite

$$|-2| = 2$$

$$|-4| = 4$$



$$\begin{aligned} 7 - 3 &= 4 \\ |(3 - 7)| &= +4 \end{aligned}$$

## 1 Absolute Value Expressions

Expressions with absolute values define an upper and lower range in which a value must lie. Expressions involving absolute value can be evaluated using the given value for the variable.



### Example 1 Expressions with Absolute Value

Evaluate  $|m + 6| - 14$  if  $m = 4$ .

$$\begin{array}{l} |4 + 6| - 14 \\ |10| \\ \downarrow \\ 10 - 14 = -4 \end{array} \quad \begin{array}{l} |-8 + m| - 7 \\ |(-8 + 4)| - 7 \\ |-4| \\ \downarrow \\ 4 - 7 = -3 \end{array}$$

~~10 - 14 = -4~~

› **Guided Practice**

1. Evaluate  $23 - |3 - 4x|$  if  $x = 2$ .

$$23 - |3 - 4 \cdot 2|$$

$$23 - |3 - 8|$$

$$23 - | \downarrow -5 |$$

$$23 - 5 = 18$$

## • Why?

- In 2007, a telephone poll was conducted to determine the reading habits of people in the U.S. People in this survey were allowed to select more than one type of book.

The survey had a margin of error of  $\pm 3\%$ . This means that the results could be three points higher or lower. So, the percent of people who read religious material could be as high as 69% or as low as 63%.

### Most Popular Types of Books

Religious  
66%  $\pm 3$



69 - 63

Popular  
Fiction 50%  $\pm 3$



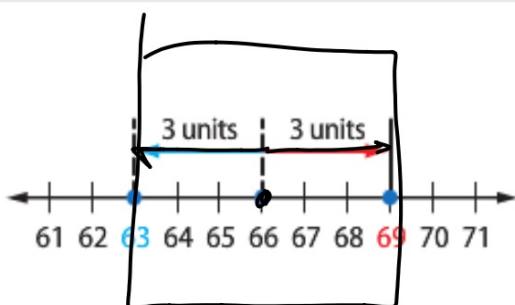
53 - 47

Romance  
20%  $\pm 3$



23 - 17

Source: CNN



## Floor graphs

## KeyConcept Absolute Value Equations

**Words** When solving equations that involve absolute values, there are two cases to consider.

**Case 1** The expression inside the absolute value symbol is positive or zero.

**Case 2** The expression inside the absolute value symbol is negative.

**Symbols** For any real numbers  $a$  and  $b$ , if  $|a| = b$  and  $b \geq 0$ , then  $a = b$  or  $a = -b$ .

**Example**  $|d| = 10$ , so  $d = 10$  or  $d = -10$ .

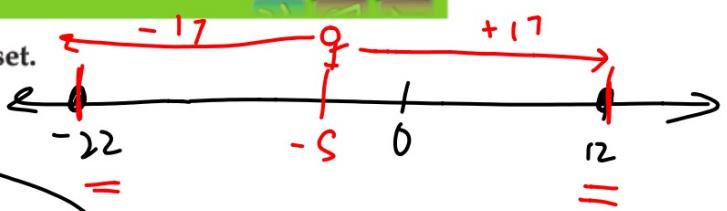
$$|2 + 1| = 3$$



### Example 2 Solve Absolute Value Equations

Solve each equation. Then graph the solution set.

a.  $|f + 5| = 17$



↓ Before ↓

$$\begin{array}{rcl} f + 5 & = & -17 \\ -5 & & -5 \\ \hline f & = & -22 \end{array}$$

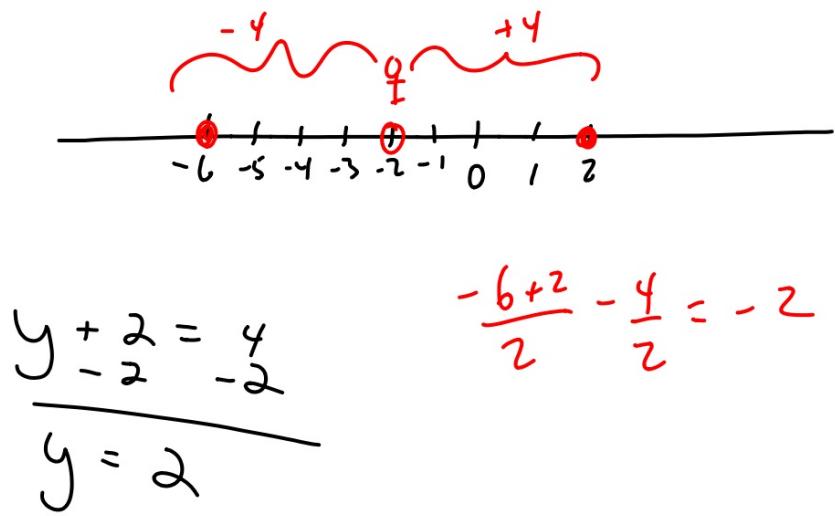
$$\begin{array}{rcl} f + 5 & = & 17 \\ -5 & & -5 \\ \hline f & = & 12 \end{array}$$

$$\begin{aligned} -\frac{22 + 12}{2} &= -\frac{10}{2} \\ &= -5 \end{aligned}$$

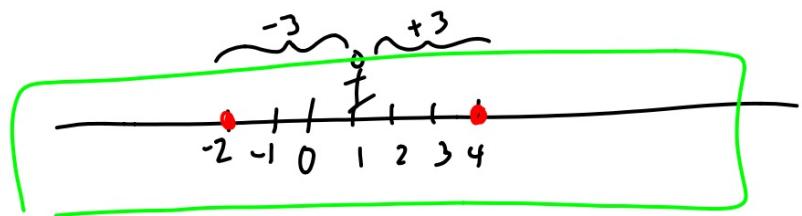
## Guided Practice

2A.  $|y + 2| = 4$

$$\begin{array}{rcl} y + 2 & = & -4 \\ -2 & & -2 \\ \hline y & = & -6 \end{array}$$



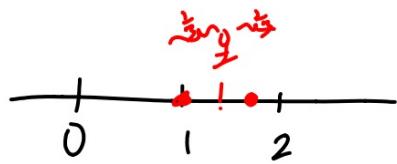
$$\text{b. } |b - 1| = 3$$



$$\begin{array}{r} b - 1 = -3 \\ +1 \quad +1 \\ \hline b = -2 \end{array}$$

$$\begin{array}{r} b - 1 = 3 \\ +1 \quad +1 \\ \hline b = 4 \end{array}$$

$$\frac{-2+4}{2} = \frac{2}{2} = 1$$



2B.  $|3n - 4| = 1$

$$\begin{array}{rcl}
 \cancel{3n - 4} & = & -1 \\
 +4 & & +4 \\
 \hline
 \frac{3n}{3} & = & \frac{3}{3} \\
 n & = & 1
 \end{array}$$

$$\begin{array}{rcl}
 \cancel{3n - 4} & = & 1 \\
 +4 & & +4 \\
 \hline
 \frac{3n}{3} & = & \frac{5}{3} \\
 n & = & 1\frac{2}{3}
 \end{array}$$

$$\begin{array}{rcl}
 \frac{1 + 1\frac{2}{3}}{2} & = & \frac{2\frac{2}{3}}{2} \\
 & & = 1\frac{1}{3}
 \end{array}$$

Absolute value equations occur in real-world situations that describe a range within which a value must lie.



### Real-World Example 3 Solve an Absolute Value Equation

**SNAKES** The temperature of an enclosure for a pet snake should be about  $80^{\circ}\text{F}$ , give or take  $5^{\circ}$ . Find the maximum and minimum temperatures.

$$\begin{array}{l} \pm 5 \\ 85 - 75 \end{array} \quad |80 - x| = 5$$



#### Real-World Link

In 2001, the number of households in the U.S. that had either a turtle, snake, lizard, or other reptile as a pet was 1,678,000.

