Things to Know

- Absolute value refers to distance a number is from zero on the number line.
- The absolute value of a number is always greater than or equal to zero. The absolute value cannot be negative.
- To solve an absolute value equation, isolate the absolute value expression on one side of the equation. Then set the expression inside the absolute value equal to the numbers with the given absolute value.

\[ |x| = 10 \]

\[ x = 10 \quad \text{or} \quad x = -10 \]
- $|X| = c$ is equivalent to $X = c$ or $X = -c$ if $c > 0$
- $|X| = 0$ is equivalent to $X = 0$.
- $|X| = c$ has no solution if $c < 0$.

- To solve an absolute value inequality, use compound inequalities.
  - $|X| > c$ is equivalent to $X > c$ or $X < -c$ if $c > 0$
  - $|X| < c$ is equivalent to $X < c$ and $X > -c$ if $c > 0$
    - $-c < X < c$
Simple absolute value equation

Solve for $x$.

$$-3|x| = -27$$

$$\frac{-3}{-3} \quad \frac{-27}{-3}$$

$$|x| = 9$$

$$x = 9 \text{ or } x = -9$$
Solving an equation involving absolute value: Basic

Solve for \( y \).

\[
|6y - 18| = 0
\]

\[
6y - 18 = 0
\]

\[
6y = 18
\]

\[
y = 3
\]

\[
|x+5| = 2
\]

\[
x+5 = 2 \quad \text{or} \quad x+5 = -2
\]

\[
x = -3 \quad \quad x = -7
\]
Solving an inequality involving absolute value

Solve.

\[7|w + 8| + 1 > 50\]

\[7|w + 8| > 49\]

\[|w + 8| > \frac{49}{7}\]

\[|w + 8| > 7\]

\[w + 8 \geq 7 \quad \text{or} \quad w + 8 \leq -7\]

\[w \geq -1 \quad \text{or} \quad w \leq -15\]

\((-\infty, -15) \cup (-1, \infty)\)
Solving an inequality involving absolute value: Basic

Graph the solution to the inequality on a number line.

\[ |v + 7| \leq 2 \]

\[ v + 7 \leq 2 \text{ AND } v + 7 \geq -2 \]

\[ v \leq -5 \text{ AND } v \geq -9 \]

\([-9, -5]\)