Essential Question: How do we solve equations involving absolute value?

Questions

Absolute Value is the distance from a NUMBER to ZERO on a number line.

| | means the distance between x and 0 is 4 units.

\[ |x| = 4 \text{ means the distance between } x \text{ and } 0 \text{ is 4 units.} \]

If \(|x| = 4\), then \(x = 4\) or \(x = -4\). The solution set is \(\{4, -4\}\).

***You Try - Solve each equation:

a) \(|x| = 18\)
   \[x = 18 \text{ or } x = -18\]

b) \(|x| = -5\)
   \[\text{No solution}\]

Evaluate each expression if \(m = 4\) and \(n = 5\):

\[
\begin{align*}
|m + 6| - 14 & \quad |3n - 20| + 3 \\
|4 + 6| - 14 & \quad |3(5) - 20| + 3 \\
|110| - 14 & \quad |15 - 20| + 3 \\
10 - 14 &= -4 \\
1 - 51 + 3 & \quad 5 + 3 = 8
\end{align*}
\]

To solve an absolute value equation, we must consider two separate cases. Solve each equation. Then graph the solution set.

a) \(|f + 5| = 7\)

\[
\begin{align*}
\text{Case 1} & \quad \text{Case 2} \\
\begin{array}{c}
f + 5 = 7 \\
-5
\end{array} & \quad \begin{array}{c}
f + 5 = -7 \\
-5
\end{array} \\
\begin{array}{c}
f = 2 \\
\text{or}
\end{array} & \quad \begin{array}{c}
f = -12 \\
\text{or}
\end{array}
\end{align*}
\]

\[
\begin{align*}
-15 & \quad -10 & \quad -5 & \quad 0 & \quad 5 & \quad 10 & \quad 15
\end{align*}
\]
b) \( |4t - 8| = 20 \)

\[
\begin{align*}
4t - 8 &= 20 \\
\frac{4t - 8}{4} &= \frac{20}{4} \\
4t &= 28 \\
4t &= \frac{28}{4} \\
t &= \frac{7}{1} \\
\text{or } t &= -3
\end{align*}
\]

\( t = 7 \)

\( \text{distance cannot be negative} \)

No solution

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

**SNAKES** The temperature of an enclosure for a pet snake should be about 80°F, with an allowance of 5°F. Write and solve an equation to find the maximum and minimum temperatures for the snake enclosure.

\[
| x - 80 | = 5
\]

The minimum temperature is 75°F and the maximum temperature is 85°F.

Write an equation involving absolute value for each graph:

a)

Write an equation involving absolute value for each graph:

b)