

Solving Absolute Value Notes

When solving absolute value equations, we will need to utilize the definition of absolute value to help us set up the equations.

Example 1... Solve the following absolute value equations.

a. $|x - 3| = 7$

$$\begin{array}{r} x - 3 = 7 \\ +3 \quad +3 \end{array}$$

$$\begin{array}{r} x - 3 = -7 \\ +3 \quad +3 \end{array}$$

$$\begin{array}{l} x = 10 \\ x = -4 \end{array}$$

b. $2|x| + 3 = 17$

$$\begin{array}{r} 2|x| + 3 = 17 \\ -3 \quad -3 \end{array}$$

$$\frac{2|x|}{2} = \frac{14}{2}$$

$$|x| = 7$$

$$\begin{array}{l} x = 7 \\ x = -7 \end{array}$$

c. $|3x - 2| = 8$

$$\begin{array}{r} 3x - 2 = 8 \\ +2 \quad +2 \end{array}$$

$$\frac{3x}{3} = \frac{10}{3}$$

$$\begin{array}{l} x = \frac{10}{3} \\ x = -2 \end{array}$$

$$\begin{array}{r} 3x - 2 = -8 \\ +2 \quad +2 \end{array}$$

$$\frac{3x}{3} = \frac{-6}{3}$$

d. $\frac{1}{3}|x + 2| - 1 = 5$

$$3\left(\frac{1}{3}|x + 2|\right) = (6)3$$

$$|x + 2| = 18$$

$$\begin{array}{r} x + 2 = 18 \\ -2 \quad -2 \end{array}$$

$$\begin{array}{r} x + 2 = -18 \\ -2 \quad -2 \end{array}$$

$$\begin{array}{l} x = 16 \\ x = 20 \end{array}$$

Example 2... Solve the following absolute value inequalities and graph the solution on a number line.

a. $|x + 2| \leq 6$

$$\begin{array}{r} -6 \leq x + 2 \leq 6 \\ -2 \quad -2 \quad -2 \end{array}$$

$$-8 \leq x \leq 4$$



b. $|2x - 1| > 5$

$$\begin{array}{r} 2x - 1 > 5 \\ +1 \quad +1 \end{array}$$

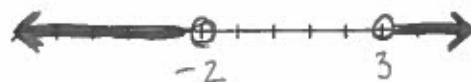
$$\frac{2x}{2} > \frac{6}{2}$$

$$x > 3$$

$$\begin{array}{r} 2x - 1 < -5 \\ +1 \quad +1 \end{array}$$

$$\frac{2x}{2} < \frac{-4}{2}$$

$$x < -2$$



$$c. 3|x| + 4 \geq 13$$

$$\begin{array}{r} -4 \quad -4 \\ 3|x| \geq 9 \\ \hline |x| \geq 3 \end{array}$$

$$|x| \geq 3$$

$$x \geq 3 \quad x \leq -3$$



$$d. \frac{1}{2}|x - 6| - 5 < 1$$

$$\begin{array}{r} +5 \quad +5 \\ 2\left(\frac{1}{2}|x-6|\right) < (6)2 \end{array}$$

$$|x+6| < 12$$

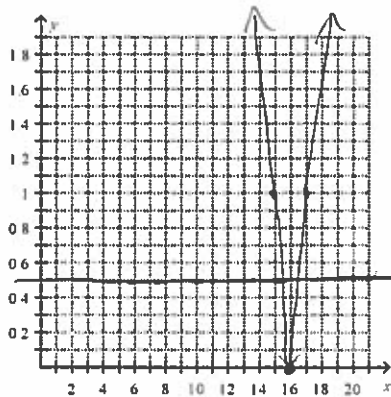
$$\begin{array}{r} -12 < x+6 < 12 \\ -6 \quad -6 \quad -6 \end{array}$$

$$-18 < x < 6$$



Example 3... Graph the given absolute value equation and the amount of tolerance. Determine which amounts meet/do not meet the specifications.

a. A jewelry company is making 16-inch bead necklaces. The specifications allow for a difference of 0.5 inch. The function $f(x) = |x - 16|$ represents the difference between the necklaces manufactured and the specifications. Graph the function. What necklace lengths meet the specifications?



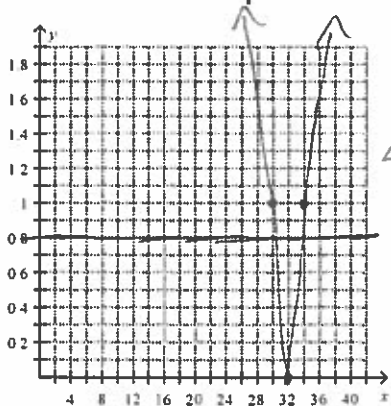
Necklace lengths between 15.5 and 16.5 inches.

← doesn't meet specifications

← .5 tolerance

← meet specifications

b. A cereal company is filling boxes with cereal sold by weight. Each box should contain 32 ounces of cereal. The specifications allow for a difference of 0.8 ounce. The function $f(x) = |x - 32|$ represents the difference between the weight of a box of cereal and the specifications. Graph the function. What weights do not meet the specifications?



← doesn't meet specifications

← meet specifications

Weights below 31.2 ounces and above 32.8 ounces.