

## 2.8 Absolute Value Equations

Definition of Absolute Value

$$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$$

Condition #1  
assume  
 $2x-7$  pos

$$2x-7=9$$

+7 +7 or

$$\frac{2x}{2} = \frac{16}{2}$$

$$x = 8 \text{ or}$$

$$x = \{8, -1\}$$

Ex1:  $|2x-7|=9$

Condition #2  
assume  
 $2x-7$  neg

$$-(2x-7)=9$$

$$2x-7=-9$$

$$\frac{2x}{2} = \frac{-2}{2}$$

$$x = -1$$

Ex2:  $3|x+3|+12=6$  *\*Isolate the Absolute Value*

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

$$|x+3| = -2$$

$\emptyset$  neg

Ex3:  $\left| \frac{2x-1}{x+3} \right| = 1$

$$\frac{2x-1}{x+3} = 1 \quad \text{or} \quad \frac{2x-1}{x+3} = -1$$

$$2x-1 = x+3$$

$$x-1 = 3$$

$$x = 4 \quad \text{or}$$

$$x = \left\{ 4, \frac{2}{3} \right\}$$

$$2x-1 = -(x+3)$$

$$2x-1 = -x-3$$

$$3x-1 = -3$$

$$3x = -2$$

$$x = -\frac{2}{3}$$

Ex4:  $|x+6| = 3x-2$  ← must check

$$\begin{array}{l} x+6 = 3x-2 \quad \text{or} \quad x+6 = -(3x-2) \\ -3x \quad -3x \quad \quad \quad x+6 = -3x+2 \\ -2x+6 = -2 \quad \quad \quad +3x \quad \quad \quad +3x \\ -6 \quad -6 \quad \quad \quad 4x+6 = 2 \\ -2x = -8 \quad \quad \quad 4x = -4 \\ \underline{-2} \quad \underline{-2} \quad \quad \quad \underline{4} \quad \underline{4} \end{array}$$

$$x = 4 \quad \text{or}$$

$$\cancel{x = -1}$$

extraneous

$$x = \{4\}$$

Ex5:  $|5x+2| = |3x-6|$

Condition 1

$$5x+2 > 0 \quad 3x-6 > 0$$

$$5x+2 = 3x-6$$

cond 2

$$5x+2 > 0 \\ 3x-6 < 0$$

$$5x+2 = -(3x-6)$$

cond 3

$$5x+2 < 0 \\ 3x-6 > 0$$

$$-(5x+2) = 3x-6$$

cond 4

$$5x+2 < 0 \\ 3x-6 < 0$$



$$-(5x+2) = -(3x-6)$$

$$5x+2 = 3x-6 \quad \text{or} \quad 5x+2 = -(3x-6)$$

$$\begin{array}{r} 5x+2 \\ -3x \end{array} = \begin{array}{r} 3x-6 \\ -3x \end{array}$$

$$2x+2 = -6$$

$$2x = -8$$

$$x = \left\{ -4, \frac{1}{2} \right\} \quad x = -4 \quad \text{or}$$

$$5x+2 = -3x+6$$

$$8x+2 = 6$$

$$8x = 4$$

$$x = \frac{1}{2}$$

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