

DO NOW

1. $|-10| + |3|$

$$\begin{array}{r} 10+3 \\ \hline 13 \end{array}$$

2. $|3(-4) + 2|$

$$\begin{array}{r} |-12+2| \\ |-10| \\ \hline 10 \end{array}$$

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4.5 Solving Absolute Value Equations

absolute value: distance from zero

★ also a grouping symbol

If $|x| = 3$, then...

$$x = 3 \text{ or } x = -3$$

To solve an absolute value equation:

★ realize there are 2 different solutions

↳ the positive version

↳ the negative version

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If $|x| = a$, then....

$$x = a \text{ or } x = -a$$

Procedure:

1. Get absolute value alone

2. Rewrite as 2 equations using OR

3. Solve both equations

4. Check

★ Some solutions will not check in the original.
↳ reject these

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Practice:

1. $|x + 3| = 9$

$$x + 3 = 9 \text{ or } x + 3 = -9$$

$$x = 9 - 3 \quad x = -9 - 3$$

$$x = 6 \text{ or } x = -12$$

2. $|4z| = 8$

$$4z = 8 \text{ or } 4z = -8$$

$$z = \frac{8}{4} \quad z = \frac{-8}{4}$$

$$z = 2 \text{ or } z = -2$$

3. $|2x - 7| = 5$

$$2x - 7 = 5 \text{ or } 2x - 7 = -5$$

$$2x = 5 + 7 \quad 2x = -5 + 7$$

$$2x = 12 \quad 2x = 2$$

$$x = \frac{12}{2} \quad x = \frac{2}{2}$$

$$x = 6 \text{ or } x = 1$$

4. $|7 - 3a| = 2$

$$7 - 3a = 2 \text{ or } 7 - 3a = -2$$

$$-3a = 2 - 7 \quad -3a = -2 - 7$$

$$-3a = -5 \quad -3a = -9$$

$$a = \frac{-5}{-3} \quad a = \frac{-9}{-3}$$

$$a = \frac{5}{3} \text{ or } a = 3$$

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5. $|3m - 7| + 3 = 8$

$$|3m - 7| = 8 - 3$$

$$|3m - 7| = 5$$

$$3m - 7 = 5 \text{ or } 3m - 7 = -5$$

$$3m = 5 + 7 \quad 3m = -5 + 7$$

$$3m = 12 \quad 3m = 2$$

$$m = \frac{12}{3} \quad m = \frac{2}{3}$$

$$m = 4 \text{ or } m = \frac{2}{3}$$

check:

$$\begin{array}{r|l} |3m-7|+3 & 8 \\ \hline |3(4)-7|+3 & 8 \\ |12-7|+3 & 8 \\ |5|+3 & 8 \\ 5+3 & 8 \\ 8 & 8 \checkmark \end{array}$$

$$\begin{array}{r|l} |3m-7|+3 & 8 \\ \hline |3(\frac{2}{3})-7|+3 & 8 \\ |2-7|+3 & 8 \\ |-5|+3 & 8 \\ 5+3 & 8 \\ 8 & 8 \checkmark \end{array}$$

6. $5|2x - 3| - 8 = 22$

$$5|2x - 3| = 22 + 8$$

$$5|2x - 3| = 30$$

$$|2x - 3| = \frac{30}{5}$$

$$|2x - 3| = 6$$

$$2x - 3 = 6 \text{ or } 2x - 3 = -6$$

$$2x = 6 + 3 \quad 2x = -6 + 3$$

$$2x = 9 \quad 2x = -3$$

$$x = \frac{9}{2} \quad x = \frac{-3}{2}$$

$$x = 4.5 \text{ or } x = -1.5$$

check:

$$\begin{array}{r|l} 5|2x-3|-8 & 22 \\ \hline 5|2(4.5)-3|-8 & 22 \\ 5|9-3|-8 & 22 \\ 5|6|-8 & 22 \\ 30-8 & 22 \\ 22 & 22 \checkmark \end{array}$$

$$\begin{array}{r|l} 5|2x-3|-8 & 22 \\ \hline 5|2(-1.5)-3|-8 & 22 \\ 5|-3-3|-8 & 22 \\ 5|-6|-8 & 22 \\ 30-8 & 22 \\ 22 & 22 \checkmark \end{array}$$

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7. $|4y + 1| = 5y$

$$4y + 1 = 5y \text{ or } 4y + 1 = -5y$$

$$1 = 5y - 4y \quad 1 = -5y - 4y$$

$$1 = y \quad 1 = -9y$$

$$\frac{1}{-9} = y$$

$$\frac{1}{-9} = y$$

$$\text{reject}$$

check:

$$\begin{array}{r|l} |4y+1| & 5y \\ \hline |4(1)+1| & 5(1) \\ |4+1| & 5 \\ 5 & 5 \checkmark \end{array}$$

$$\begin{array}{r|l} |4y+1| & 5y \\ \hline |4(\frac{1}{-9})+1| & 5(\frac{1}{-9}) \\ |-\frac{4}{9}+1| & -\frac{5}{9} \\ \frac{5}{9} & -\frac{5}{9} \times \end{array}$$

8. $|4b - 2| = 3b + 2$

$$4b - 2 = 3b + 2 \text{ or } 4b - 2 = -(3b + 2)$$

$$4b - 2 - 3b = 2 \quad 4b - 2 = -3b - 2$$

$$4b - 3b = 2 + 2 \quad 4b - 2 + 3b = -2$$

$$b = 4 \quad 7b = 0$$

$$b = 4 \quad b = 0$$

$$b = 4 \text{ or } b = 0$$

check:

$$\begin{array}{r|l} |4b-2| & 3b+2 \\ \hline |4(4)-2| & 3(4)+2 \\ |16-2| & 12+2 \\ 14 & 14 \checkmark \end{array}$$

$$\begin{array}{r|l} |4b-2| & 3b+2 \\ \hline |4(0)-2| & 3(0)+2 \\ |0-2| & 0+2 \\ 2 & 2 \checkmark \end{array}$$

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HOMEWORK

Worksheet - HW 4.5