

2.7 Solve Multi-Step Equations

To solve equations with variables on both sides, use inverse operations to group the variable terms on one side of the equation.

Ex. 1 Solve

a) $3x - 7 = 8x + 8$

$$\begin{aligned} 3x - 7 - 8x &= 8x + 8 - 8x \\ -5x - 7 &= 8 \\ -5x - 7 + 7 &= 8 + 7 \\ -5x &= 15 \\ \frac{-5x}{-5} &= \frac{15}{-5} \\ x &= -3 \end{aligned}$$

b) $2x + 8x - 4 = 6x + 10 - 8$

$$\begin{aligned} 2x + 8x - 6x &= 10 - 8 + 4 \\ 4x &= 6 \\ \frac{4x}{4} &= \frac{6}{4} \\ x &= \frac{6}{4} \\ x &= \frac{3}{2} \end{aligned}$$

c) $4m - 7 + 2m = -4 + 6m - 9$

$$\begin{aligned} 6m - 7 &= -13 + 6m \\ 6m - 6m &= -13 + 7 \\ 0m &= -6 \\ \text{NO SOLUTION!} \end{aligned}$$

e) $5(x + 4) = 3x + 14$

$$\begin{aligned} 5x + 20 &= 3x + 14 \\ 5x - 3x &= 14 - 20 \\ 2x &= -6 \\ \frac{2x}{2} &= \frac{-6}{2} \\ x &= -3 \end{aligned}$$

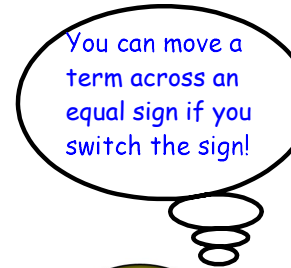
$$3x - 7 = 8x + 8$$

$$3x - 8x = 8 + 7$$

$$\frac{-5x}{-5} = \frac{15}{-5}$$

$$x = -3$$

Switch Sides
Switch signs

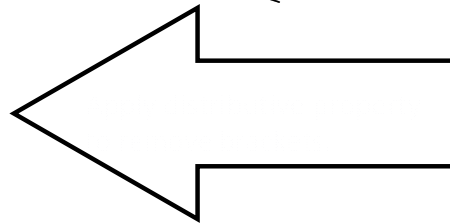


You can move a term across an equal sign if you switch the sign!

Communication
Keep equal signs aligned,
only one per line.

d) $k - 5 + 3k = -7 - k - 8$

$$\begin{aligned} 4k - 5 &= -15 - k \\ 4k + k &= -15 + 5 \\ 5k &= -10 \\ \frac{5k}{5} &= \frac{-10}{5} \\ k &= -2 \end{aligned}$$



$$f) 7 - (4m + 3) = -3(m + 2) - (2m + 3)$$

$$7 - 4m - 3 = -3m - 6 - 2m - 3$$

$$-4m + 4 = -5m - 9$$

$$-4m + 5m = -9 - 4$$

$$m = -13$$

g) check your solution to f)

<u>LS</u>	<u>RS</u>
$7 - (4m + 3)$	$-3(m + 2) - (2m + 3)$
Sub	$m = -13$
$= 7 - (4(-13) + 3)$	$= -3(-13 + 2) - (2(-13) + 3)$
$= 7 - (-52 + 3)$	$= -3(-11) - (-26 + 3)$
$= 7 - (-49)$	$= 33 - (-23)$
$= 7 + 49$	$= 33 + 23$
$= 56$	$= 56$

2. Solve.

$$a) 2(w - 4) + 3(3 - 2w) = -4(1 - w) - (2w + 1)$$

$$2w - 8 + 9 - 6w = -4 + 4w - 2w - 1$$

$$-4w + 1 = 2w - 5$$

$$1 + 5 = 2w + 4w$$

$$\frac{6}{6} = \frac{6w}{6}$$

$$1 = w$$

$$b) 5q - 2(3q + 1) = -4q + 2[3 - 2(3q - 5)]$$

$$5q - 6q - 2 = -4q + 2(3 - 6q + 10)$$

$$-q - 2 = -4q + 2(-6q + 13)$$

$$-q - 2 = -4q - 12q + 26$$

$$-q - 2 = -16q + 26$$

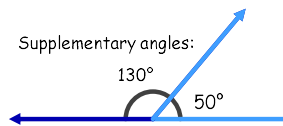
$$-q + 16q = 26 + 2$$

$$\frac{15q}{15} = \frac{28}{15}$$

$$q = \frac{28}{15}$$

Ex. 3: Two or more angles are supplementary if their sum is 180 degrees. An angle is 4 times the value of its supplement. Set up and solve an equation to find the measures of the two angles.

Let x represent the smaller angle
 Let $4x$ represent the bigger angle



$$4x + x = 180$$

$$\frac{5x}{5} = \frac{180}{5}$$

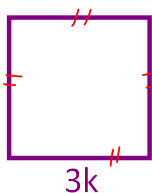
$$x = 36$$

$$x = 36^\circ$$

$$4x = 144^\circ$$

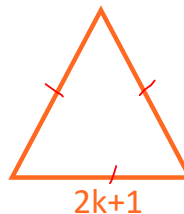
\therefore The angles are 36° and 144°

Ex. 4 The square and equilateral triangle shown have the same perimeters. What are the dimensions of each figure?



$$P = 4(3k)$$

$$= 12k$$



$$P = 3(2k+1)$$

$$= 6k+3$$

← SAME →

Side of square?

$$3k$$

Sub in $k = \frac{1}{2}$

$$3\left(\frac{1}{2}\right)$$

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

\therefore Square is

$$\frac{3}{2} \times \frac{3}{2}$$

$$12k = 6k+3$$

$$12k - 6k = 3$$

$$\frac{6k}{6} = \frac{3}{6}$$

$$k = \frac{3}{6}$$

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

Side of triangle?

$$2k+1$$

Sub in $k = \frac{1}{2}$

$$= 2\left(\frac{1}{2}\right) + 1$$

$$= 1 + 1$$

$$= 2$$

\therefore Triangle side is 2