

**Lesson: Solving Equations - Multi-Step****Simplify, and then solve:**

Some equations, you may have to start by first collecting like terms to simplify the equation.

## Example 1

$$3x + 10 - 6x = 8 - 4$$

$$-3x + 10 = 4 \quad \leftarrow \text{simplify by collecting like terms}$$

$$\quad \leftarrow \text{now, solve the two-step equation}$$

## Example 2

$$7x + 3 - 4x + 5x = 3 - 5 + 9$$

**Variable on both sides:**

Other multi-step equations have the variable on both sides. These can be a little trickier. To solve, you must have all the variable terms on one side of the equation. When eliminating an entire term from an equation, we either (+) or (-) the term.

## Example 3

$$8x + 8 = 2x - 4$$

$$-2x \quad -2x \quad \leftarrow \text{do the same to both sides and}$$

$$\quad \quad \quad \leftarrow \text{collect your like terms}$$

$$6x + 8 = -4 \quad \leftarrow \text{now, solve the two-step equation}$$

## Example 4

$$5x - 23 = 3 - 8x$$

**Practice: Solving Equations - Multi-Step**

a.  $5 + 3x + 4x = 19$

b.  $15y - 6 - 10y = 9$

c.  $32 - 5 = -4a - 5a$

d.  $5m + 3 - 9m + 13 = 0$

e.  $6w + 8 = 4w + 18$

f.  $-8k - 5 = 2k + 15$

g.  $3b - 6 = -b - 2$

h.  $5 + 4d = -13 - 2d$

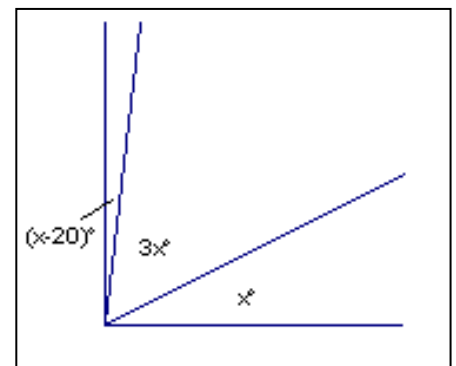
i.  $7t + 8 = 3t - 12$

j.  $5c - 3 - 4c = 2c + 2$

k.  $0 = 4x + 3 - x - 9$

l.  $14 - n - 7 = 5n + 1$

m. Three angles are complementary (they add up to  $90^\circ$ ). For the diagram to the right, this can be expressed by the equation:  $3x + x + x - 20 = 90$ . Find the value of the three angles.



ANSWERS: a.  $x=2$ , b.  $y=3$ , c.  $a=-3$ , d.  $m=4$ , e.  $w=5$ , f.  $k=-2$ , g.  $b=1$ , h.  $d=-3$ , i.  $t=-5$ ,  
j.  $c=-5$ , k.  $x=2$ , l.  $n=1$ , m.  $2^\circ, 22^\circ, 66^\circ$

**Lesson: Solving Equations - with Brackets****Recap: eliminating brackets**

Simplify the following expressions:

a.  $(5x + 2) + (-x - 9)$

b.  $(2y + 4) - (5y - 12)$

c.  $3(x - 5)$

Before 'solving' an equation, we sometimes will have to simplify → this may also include eliminating brackets.

**Simplify by Adding/Subtracting Polynomials**

Example 1

$$(3x + 5) + (x - 1) = -2$$

Example 2

$$(5x - 4) - (9 - x) = -3$$

**Simplify using Distributive Law**

Example 3

$$2(x - 4.5) + 3x = 11$$

Example 4

$$3(x + 5) = 2(x - 4)$$

**Simplify**

Example 5

$$5(x - 8) = (2x - 2) + (4x + 5)$$

Example 6

$$(3x + 7) - 4x = 2(9 + 4x)$$

**Practice: Solving Equations – with Brackets**

a.  $5(x + 4) = 3x + 14$

b.  $5q - 6 = 2(q + 3)$

c.  $4t + 3(2 - t) = 13$

d.  $u = 3(5 - u) + 1$

e.  $3(r + 4) + 2(r + 5) = 32$

f.  $5(y - 3) - 3(y - 4) = 12$

g.  $4(v + 3) = 2(v + 6) - 8$

h.  $2(y - 4) = -3(y + 2) + 8$

i.  $6(3w + 4) = 10(2w - 1)$

j.  $4(m + 3) + 2(m - 3) = 3(m - 2)$

k.  $p - (4p + 3) = -3(p + 2) - (2p + 3)$

l. Polly solved the following equation. She is incorrect. Circle her two mistakes and explain why she is incorrect.

$$\begin{array}{l} 3(x+5) - (x+4) = 3 \\ 3x + 5 - x + 4 = 3 \\ 3x - x + 5 + 4 = 3 \\ 2x + 9 = 3 \\ \quad +9 \quad +9 \\ 2x = 12 \\ \div 2 \quad \div 2 \\ x = 6 \end{array}$$

ANSWERS: a)  $x=-3$ , b)  $q=4$ , c)  $t=7$ , d)  $u=4$ , e)  $r=2$ , f)  $y=7.5$ , g)  $v=-4$ , h)  $y=2$ , i)  $w=17$ , j)  $m=-4$ , k)  $p=-3$ , l) 2<sup>nd</sup> line: just dropped the brackets for both polynomials. Should have  $3x+15 - x - 4$ , AND 5<sup>th</sup> line  $+ 9$  (should have subtracted 9).