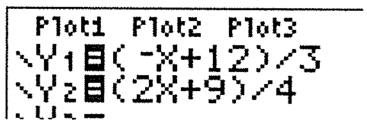
Section 2.6 Simultaneous Equations

Systems of equations can be solved many ways. One way is graphing and another is algebraically by either substitution or elimination.

Example: Solve the system of equations below by graphing.

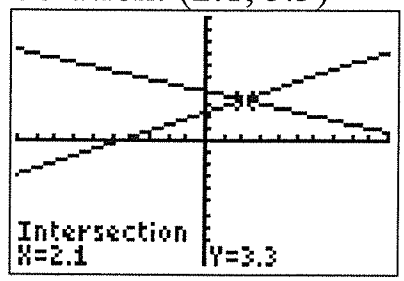
$$x + 3y = 12$$
$$-2x + 4y = 9$$

Solve each equation for y



Now graph and use CALC (2nd TRACE) & Intersect to find the solution.

Solution: (2.1, 3.3)



Example: Use substitution to solve the system above.

$$x + 3y = 12$$
$$-2x + 4y = 9$$

This system is already set up to fairly easily substitute in the x.

$$x = -3y + 12$$

$$-2(-3y + 12) + 4y = 9$$
$$6y - 24 + 4y = 9$$
$$10y - 24 = 9$$
$$y = 3.3$$

Now that you've found y plug it back in to find x.

$$x + 3(3.3) = 12 \qquad x = 2.1$$

Solution: $(2.1, 3.3)$

Example: Use elimination to solve the system above.

Multiply the first equation by 2, add the new equations, and solve for y.

$$x + 3y = 12 \quad \xrightarrow{\text{times 2}} \quad 2x + 6y = 24$$
$$-2x + 4y = 9 \qquad\qquad -2x + 4y = 9$$

$$10y = 33$$
$$y = 3.3$$

Plug back into an original eq to find x…

$$x + 3(3.3) = 12$$
$$x = 2.1$$

Solution: $(2.1, 3.3)$

Example: Use elimination to solve the system below.

Sometimes you may have to multiply both equations by something…

$2m + 4n = -4$ (times 3)

$3m + 5n = -3$ (times −2)

First decide what letter you want to get rid of and then make them opposites…

Let's get rid of the *m*'s

$6m + 12n = -12$

$\underline{-6m - 10n = 6}$

$2n = -6$

$n = -3$

Plug back into an original eq to find *m*…

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

$m = 4$

Solution: (4, – 3)

Types of Systems:

	Consistent/Independent	Consistent/Dependent	Inconsistent
Graphically	Two Intersecting Lines	Only 1 Line	Parallel Lines
Algebraically	1 Solution (x, y)	Infinite Solutions (0=0)	No Solution (0 = #)

Story Problems: In general, you need two equations representing two totals. Use variables representative of the info in the problem as opposed to just using *x* and *y*.

Example: A hardware store sells 3-litre paint cans for £15 (15 British pounds) and 5-litre paint cans for £20. In one day the store sells 71 litres of paint, worth a total of £320. How many paint cans did the store sell?

Let's let *t* stand for 3-litre paint cans and *f* stand for 5-litre paint cans.

Money equation: $15t + 20f = 320$
Litre equation: $3t + 5f = 71$

Solve. Let's multiply the litre equation by –5 and then add the money equation to it

$-15t - 25f = -355$

$\underline{15t + 20f = 320}$

$-5f = -35$ So $f = 7$

or 19 cans total ☺

Answer: 7 of the 5-litre cans and thus 12 of the 3-litre cans

Example: Two young trees, 6 feet and 9 feet tall, are planted in a garden. The smaller tree grows at a rate of 2 feet per year, and the taller tree grows at a rate of 1.5 feet per year. Use a system of equations to find what year the smaller tree first passes the taller tree in height.

Write an equation to represent the growth of each tree. Then set them equal to find when they would have the same height.

Smaller Tree: 6 feet + 2 feet per year $\Rightarrow 6 + 2f$
Larger Tree: 9 feet + 1.5 feet per year $\Rightarrow 9 + 1.5f$

$6 + 2f = 9 + 1.5f \quad \Rightarrow \quad$ So $f = 6$ years.

Answer: Some time during the 6th year the smaller tree will surpass the larger tree.

See page 59 in your book for instructions on how to use a program called **PlySmlt2** to solve equations. This should be located in the APPS button on your graphing calculator...