Systems of Linear Equations

- Two lines that don't have the same slope must intersect (cross) at one point.
- We call two lines sharing the same plane a "system".
- Finding the point of intersection is called "solving a system".

There are three (3) ways to solve a system.

1. Graph it

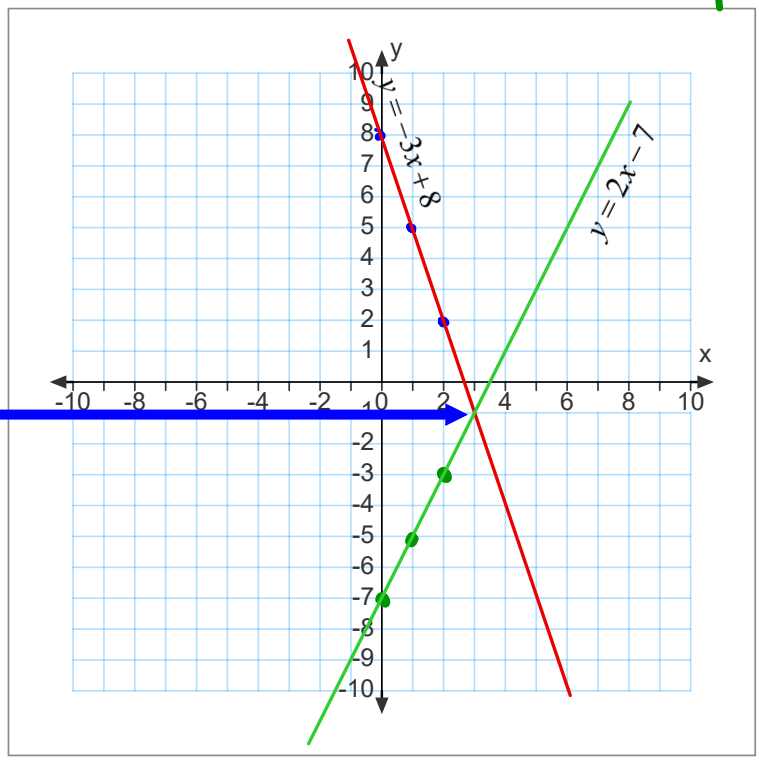
2. Make a table of values

3. Use algebra (3 methods)

Example: Solve the system $y = -3x + 8$ y-int (0,8) $m = -\frac{3}{1}$ $\frac{rise}{run}$

$y = 2x - 7$ y-int (0,-7) $m = \frac{2}{1}$

1. Graph



Read the point from the graph

Solution: $(3,-1)$

1 $y = -3x + 8$

2 $y = 2x - 7$

2. Table of values

For each line, choose several of the same values for x. Find the y-values for each equation. The solution is found when you get the same y-value.

x	y_1
-1	11
0	8
1	5
2	2
3	-1

x	y_2
-1	-9
0	-7
1	-5
2	-3
3	-1

x_1	x_1	y_2
-2	14	-11

Solution: $(3, -1)$

1 $y = -3x + 8$

2 $y = 2x - 7$

A = B
B = C
∴ A = C

3. Algebraic Method #1: Comparison

$$-3x + 8 = 2x - 7$$

$$-3x + 3x + 8 = 2x + 3x - 7$$

$$8 = 5x - 7$$

$$8 + 7 = 5x - 7 + 7$$

$$15 = 5x$$

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

$$3 = x$$

To find y, choose one of the original equations, fill in your x and solve.

$$y = 2(3) - 7$$

$$y = 6 - 7$$

$$y = -1$$

check

$y = -3(3) + 8$

$= -9 + 8$

$= -1$

Solution: $(3, -1)$

Systems of Linear Equations

1) Comparison: best used when both of the equations are in standard form.

Example: Solve the following system using the comparison method.

$$y = -5x + 17$$
$$y = 5x - 9$$

$$-5x + 17 = 5x - 9$$
$$+5x \qquad +5x$$
$$17 = 10x - 9$$
$$+9 \qquad +9$$
$$26 = 10x$$
$$\div 10 \quad \div 10$$
$$2.6 = x$$

$$y = -5x + 17$$
$$y = -5(2.6) + 17$$
$$y = -13 + 17$$
$$y = 4$$

check

$$y = 5x - 9$$
$$y = 5(2.6) - 9$$
$$y = 13 - 9$$
$$y = 4$$

Solution: $(2.6, 4)$

Example: Solve the following system using the comparison method.

$$y = \frac{7}{4}x + 5$$

$$y = \frac{3}{4}x - 3$$

$$\frac{7}{4}x + 5 = \frac{3}{4}x - 3$$

$$\frac{7}{4}x - \frac{3}{4}x + 5 = \frac{3}{4}x - \frac{3}{4}x - 3$$

$$\frac{4}{4}x + 5 = -3$$

$$x + 5 - 5 = -3 - 5$$

$$x = -8$$

$1.75x + 5 = 0.75x - 3$

$-0.75x \quad -0.75x$

or $x + 5 = -3$

check:

$$y = \frac{3}{4}(-8) - 3$$

$$y = -6 - 3$$

$$y = -9$$

$$y = \frac{7}{4}(-8) + 5$$

$$y = -14 + 5$$

$$y = -9$$

Solution: $(-8, -9)$

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6. a) $y = 2x + 9$
$y = -3x - 1$

$2x + 9 = -3x - 1$
$5x + 9 = -1$
$5x = -10$
$x = -2$

$y = 2(-2) + 9$
$= 5$

$y = -3(-2) - 1$
$= 5$

$(-2, 5)$

b) $x = 2y + 7$
$x = -4y - 5$

$2y + 7 = -4y - 5$
$6y + 7 = -5$
$6y = -12$
$y = -2$

$x = 2(-2) + 7 = 3$
$x = -4(-2) - 5 = 3$

$(3, -2)$

c) $y = \frac{3}{4}x + \frac{1}{2}$
$y = \frac{2}{3}x - 1$

$\left(\frac{3}{4}x + \frac{1}{2} = \frac{2}{3}x - 1\right) \times 12$
$9x + 6 = 8x - 12$
$x + 6 = -12$
$x = -18$

$(-18, -13)$

$y = -13.5 + 0.5$
$= -13$

$y = -12 - 1$
$= -13$

Frank works at a clothing store. His salary is $200 plus 10% of his total sales. Nancy works at another store and makes $250 plus 8% of her total sales.

multiply

How much would they have to sell in order to make the same salary?

① Identify the variables salary: y sales: x (y depends on x)

② Write the equations

$y = 0.1x + 200$ or $y = 200 + 0.1x$

$y = 0.08x + 250$ or $y = 250 + 0.08x$

③ Solve the system

$0.1x + 200 = 0.08x + 250$

$0.02x + 200 = 250$

$0.02x = 50$

$2x = 5000$

$x = 2500$

F: $y = 0.1(2500) + 200$

$y = 250 + 200$

$y = 450$ ✓

N: $y = 0.08(2500) + 250$

$= 200 + 250$

450 ✓

④ Answer the question:

They would sell $2500 worth of merchandise.

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