MPM 1DI - Unit 5
Linear Relations

Day 7
Linear Systems

Linear system - A set of two or more linear equations that are considered simultaneously.

Point of intersection - The point where two (or more) lines cross.

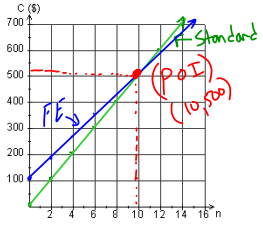
Word Problem: Mike wants to join a ski club for the winter. He is considering the Standard Rate ($50 per day) and the Frequent Extremist ($100 registration plus $40 per day).

a. Write an equation that relates the total cost to the number of days for both payment options.

$y = 50x$ ← standard rate

$y = 40x + 100$ ← FE

b. Graph both equations on the same graph.



c. When do both options cost Mike the same amount?

they will cost the same at 10 days

d. Which payment option should Mike choose?

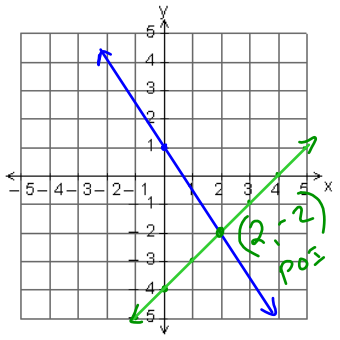
If mike is going for less than 10 days he should choose the standard and if he is going for more than 10 days he should choose the FE.

Example 1 Graph the following lines and identify the point of intersection: $y = -\frac{3}{2}x + 1$ and $x - y = 4$, verify your solution.

$-x \quad -x$

$\frac{-y}{-1} = \frac{-x}{-1} + \frac{4}{-1}$

$y = x - 4$



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

$y = \frac{-3}{2}\left(\frac{2}{-1}\right) + 1$

$y = \frac{-6}{2} + 1$

$y = -3 + 1$

$y = -2$

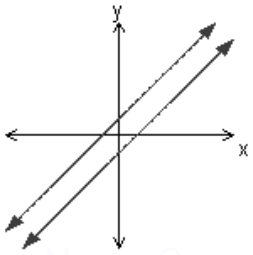
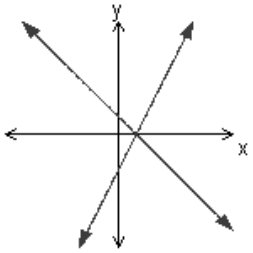
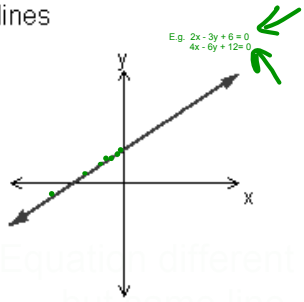
$x - y = 4$

$2 - y = 4$ $+y \quad +y$

$2 = 4 + y$ $-4 \quad -4$

$-2 = y$

Example 2 How many different solutions (POI) are there to a linear system of two equations?

Case #1 – two parallel lines	Case #2 – two non-parallel lines	Case #3 – two identical lines
		
Never Cross No Point of Intersection zero	Intersect at 1 point one	Equation different but same line All points on the line satisfy equation of either line Infinite number of Solutions
No solution	ONE solution (x, y) In this case (1, 0)	

Example 3 How many solutions do the following linear systems have?

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

1 solution because the slope is different

Slope - same
Parallel Identical
0 - different ∞
1 solution

b) y = -5x - 3 and y = -5x - 10

Zero solutions because the slope is the same but the y intercept is different

c) y = x + 1 and 2x - 2y + 2 = 0

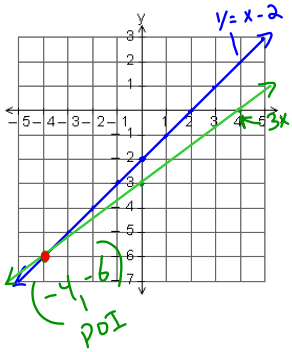
$2x - 2y = -2$

$\frac{-2y}{-2} = \frac{-2x}{-2} - \frac{2}{-2}$

$y = x + 1$

Infinite # of solutions because equations are the same

Example 4 Find the equation of the line that passes through the point of intersection of y = x - 2 and 3x - 4y = 12 and is parallel to x - 4y + 1 = 0.



$-4y = -3x + 12$

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

$x - 4y + 1 = 0$

$x - 4y = -1$

$-4y = -x - 1$

$y = \frac{1}{4}x + \frac{1}{4}$

new equation

$m = \frac{1}{4}$

$b = -5$

$x = -4$

$y = -6$

$y = mx + b$

$-6 = \frac{1}{4}\left(\frac{-4}{1}\right) + b$

$-6 = \frac{-4}{4} + b$

$-6 = -1 + b$

$-5 = b$

$y = \frac{1}{4}x - 5$

Assigned work

Pg 348-351 # 1, [redacted], 7, 9, 10, 13, 14