Linear Systems - Graphing

WARM UP: Intersecting Lines

Go-Go Taxi charges $5 to ride their taxi plus $0.30/km.
Take-Me-There Taxi charges $8 to ride, plus $0.20/km.

Express each scenario as a linear equation, where x represents the number of kilometres and y represents the total charge.

Go-Go Taxi: $y = 0.30x + 5$

Take-Me-There Taxi: $y = 0.20x + 8$

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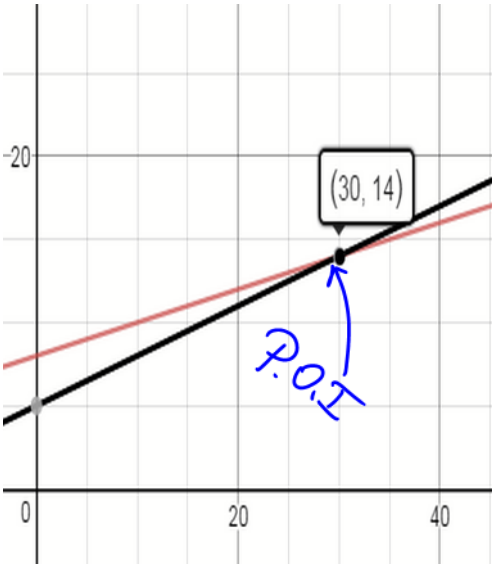
1. Using the graphing calculator, sketch the two graphs on the grid provided.

2. Touch/click on the point of intersection (P.O.I) and determine the coordinates. Label this point on your graph.



A linear system:

① $y = 0.30x + 5$
② $y = 0.20x + 8$

KEY CONCEPTS

- When 2 or more equations are used to model a problem, it is called a system of linear equations. A system of linear equations is simply 2 or more lines intersecting never (11), once, or always (someline). A linear system with two unknowns consists of 2 (or more) linear equations involving 2 variables.
- A solution to a linear system is an ordered pair, (x, y), that satisfies (LS=RS) all the equations in the system.
- If there is a single solution to the linear system, it is represented by the point of intersection of the 2 lines.
- There are several methods to solve linear systems: guess and check, graphing, substitution, and elimination.

Method 1: Guess and Check

To determine whether a point (x, y) is a solution to a linear system using this method, the x and y values must be substituted into the left and right sides of both equations. If same for both equations, then (x, y) is a solution.

Ex1. Determine whether (30, 14) is a solution to the linear system above.

① $y = 0.30x + 5$ (x ↓, y ↓)

LS	RS
y	$0.30x + 5$
14	$= 0.3(30) + 5$
	$= 9 + 5$
	$= 14$

↘ LS = RS

② $y = 0.20x + 8$

LS	RS
y	$0.20x + 8$
14	$= 0.20(30) + 8$
	$= 6 + 8$
	$= 14$

↘ LS = RS

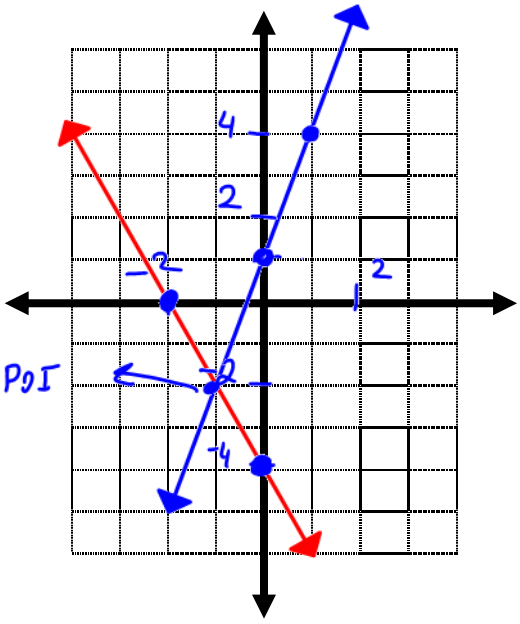
∴ (30, 14) is the solution

Method 2: Graphing

To determine the solution to a linear system using this method, both lines are graphed and the solution is the point of intersection (x, y) of the two lines. Solutions found using this method must be checked by substituting the x and y values into the left and right sides of both original equations.

Ex2. Find the solution to the linear system below

① $y = 3x + 1$
② $6x + 3y = -12$



slope, y-int → ① $y = 3x + 1$

slope = 3 ⇒ $\frac{\text{rise}}{\text{run}} = \frac{3}{1}$

y-int = 1

intercepts → ② $6x + 3y = -12$

x-int: $6x + 3(0) = -12$, $\frac{6x}{6} = \frac{-12}{6}$, $x = -2$

y-int: $6(0) + 3y = -12$, $\frac{3y}{3} = \frac{-12}{3}$, $y = -4$

The P.O.I is (-1, -2)

Check solution in left and right sides of both equations:

Sub $x = -1$, $y = -2$

Equation ① $y = 3x + 1$

LS	?	RS
y		$3x + 1$
-2		$= 3(-1) + 1$
		$= -3 + 1$
		$= -2$

LS = RS ↘

Equation ② $6x + 3y = -12$

LS	RS
$6x + 3y$	-12
$= 6(-1) + 3(-2)$	
$= -6 - 6$	
$= -12$	

LS = RS

∴ The sol. is (-1, -2)