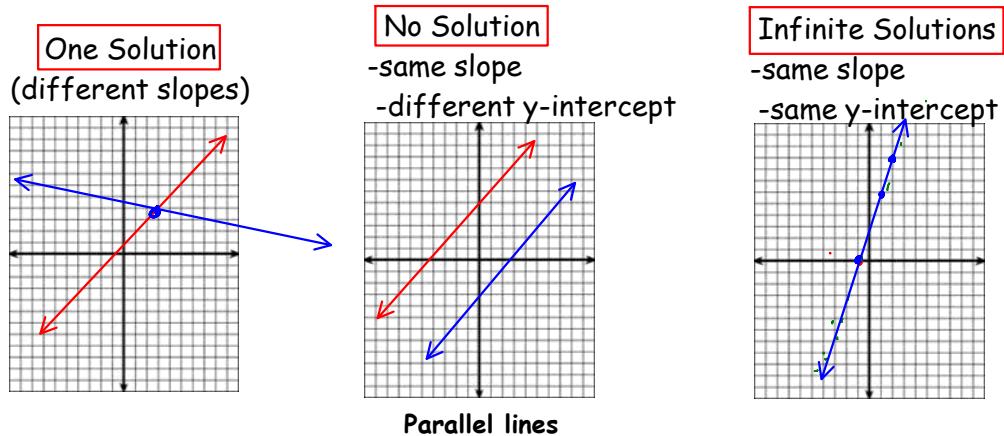


8.3 Number of Solutions of Linear Systems

When two lines are graphed on the same grid, they do not always have exactly one point of intersection.

Three possible scenarios when graphing a system of linear equations:



Predict and confirm the number of solutions

Find the slope of the following equations:

a) $2x + 3y = 12$

$$\frac{3y}{3} = -\frac{2x}{3} + \frac{12}{3} \rightarrow y = -\frac{2}{3}x + 4$$

b) $2x - 3y = 6$

$$m = \frac{-2}{3} = \frac{2}{3} \quad b = \frac{6}{-3} = -2$$

c) $2x + 3y = 20$

$$m = \frac{2}{3} \quad b = \frac{20}{3}$$

d) $4x + 6y = 24$

$$m = \frac{4}{6} = \frac{-2}{3} \quad b = \frac{24}{6} = 4$$

$$Ax + By = C$$

$$By = -Ax + C$$

$$\frac{By}{B} = \frac{-Ax}{B} + \frac{C}{B}$$

$$y = -\frac{A}{B}x + \frac{C}{B}$$

a, c, d

a, d

Which equations have the same slope? Which lines are coincidental?

* Find C so that the system of equations has no solution.

$$6y - 4x = C \quad \leftarrow \text{by } -4x = C$$

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

$$m = \frac{2}{3} \quad b = 1$$

$$6y = 4x + C$$

$$y = \frac{2}{3}x + \frac{C}{6}$$

lines are parallel
- same slope
- diff. y-int.

$$\frac{C}{6} \neq 1$$

$$C \neq 6$$

$$C = \text{Any } \# \text{, except } 6$$

Note:

You can reduce equations to lowest terms to identify identical lines that have infinite solutions.

$$2x - y = 6 \quad \text{and} \quad \frac{12x}{6} - \frac{6y}{6} = \frac{36}{6} \quad \leftarrow \text{GCF in all terms, Reduce.}$$

Same $\rightarrow 2x - y = 6$

\therefore infinite Solutions

Example

Determine, by inspection, whether each linear system has a infinite number of solutions or no solution. *Find Number of Solutions

1. start with slope...if different, then one solution
2. If the slope is the same, but different y-intercept....no solution
3. If the slope is the same, and the y-intercept is the same....infinite solutions

a) $2x + 10y - 16 = 0 \Rightarrow x + 5y - 8 = 0$ } same
 $x + 5y - 8 = 0$

Infinite Solutions

b) $x + 2y + 4 = 0$
 $x + 2y - 6 = 0$

$$\begin{aligned} 2y &= -\frac{x}{2} - 4 \\ y &= -\frac{1}{2}x - 2 \end{aligned}$$

$$\begin{aligned} 2y &= -\frac{x}{2} + 6 \\ y &= -\frac{1}{2}x + 3 \end{aligned}$$

sum
but diff "b"

No solution

Example

Four vehicles travel on a long, straight stretch of the Trans-Canada Highway. Their current distances and speeds are shown the table of values.

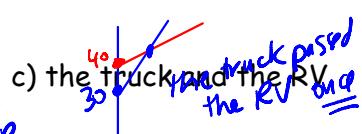
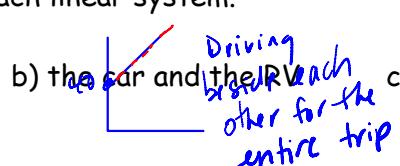
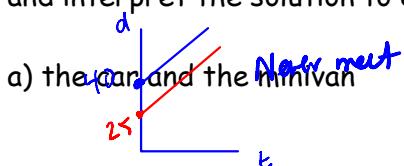
	Current Distance (km)	Current Speed (Km/h)
Car	40	90
Mini van	25	90
Truck	30	110
RV	40	90

$$d = 90t + 40$$

$$d = 90t + 25$$

$$d = 110t + 30$$

For each pair of vehicles, represent the distance time relationship using system of linear equations. Suppose the vehicles continue at their current speeds. Identify and interpret the solution to each linear system.



Assignment: p454 #1-7, 9,11,12,14