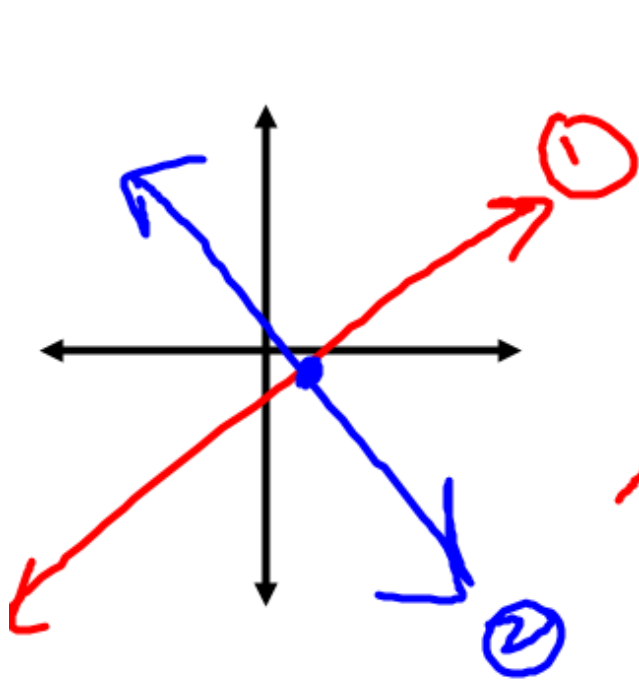


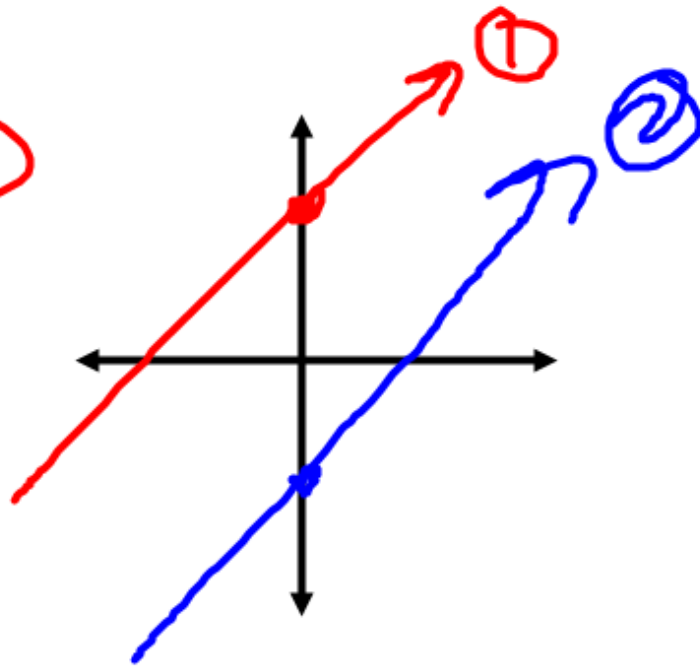
7.6 Properties of Systems of Linear Equations



$$\underline{m_1 \neq m_2}$$

intersecting

1 solution

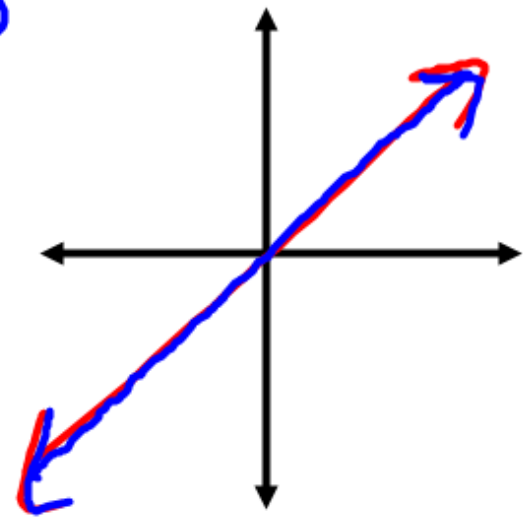


$$\underline{m_1 = m_2}$$

$$b_1 \neq b_2$$

parallel

no solutions



$$\underline{m_1 = m_2}$$

$$b_1 = b_2$$

coincident

infinite solutions

How can we determine the number of solutions in a linear system without solving it?

Example #1 Determine the number of solutions of each linear system.

$$\begin{array}{l} \text{a) } x + y = 3 \\ \quad -2x - y = -2 \end{array} \longrightarrow y = -x + 3$$

~~$m = -1$~~ $b = 3$

$$-y = 2x - 2$$

$$y = -2x + 2$$

$$\del{m = -2} \quad b = 2$$

1 solution

$$\text{b) } 4x + 6y = -10$$

$$-2x - 3y = 5$$

$$-3y = 2x + 5$$

$$y = -\frac{2}{3}x - \frac{5}{3}$$

$$m = -\frac{2}{3} \quad b = -\frac{5}{3}$$

$$\rightarrow 6y = -4x - 10$$

$$y = -\frac{4}{6}x - \frac{10}{6}$$

$$y = -\frac{2}{3}x - \frac{5}{3}$$

$$m = -\frac{2}{3} \quad b = -\frac{5}{3}$$

infinite solutions

$$\text{c) } 2x - 4y = -1 \quad \rightarrow \quad -4y = -2x - 1$$

$$3x - 6y = 2$$

$$y = \frac{-2}{-4}x - \frac{1}{-4}$$

$$y = \frac{1}{2}x + \frac{1}{4}$$

$m = \frac{1}{2}$ $b = \frac{1}{4}$

$$-6y = -3x + 2$$

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

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

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

NO SOLUTIONS

Example #2

$$y = 6x + 3$$

$m = 6$ $b = 3$

Given the equation
 $-6x + y = 3$, write another
linear equation that will form
a linear system with:

a) exactly one solution

b) no solution

c) infinite solutions

a) $y = 3x - 4$

b) $y = 6x - 1$

c) $2y = 12x + 6$

Your Turn #2

Determine the value of k if the following system has no solution.

$$4x - 30y = 20$$

$$3x - ky = 60$$

$$-30y = -4x + 20$$

$$y = \frac{-4x}{-30} + \frac{20}{-30}$$

$$y = \frac{2}{15}x - \frac{2}{3}$$

$$m = \frac{2}{15} \quad b = -\frac{2}{3}$$

$$m_1 = m_2$$

$$b_1 \neq b_2$$

$$-ky = -3x + 60$$

$$y = \frac{-3}{-k}x + \frac{60}{-k}$$

$$y = \frac{3}{k}x - \frac{60}{k}$$

$$m = \frac{3}{k} \quad b = -\frac{60}{k}$$

$$\frac{2}{15} = \frac{3}{K}$$

$$2K = 45$$

$$K = \frac{45}{2}$$

$$b = -\frac{2}{3}$$

$$b = -\frac{60}{K}$$

$$= -\frac{60}{\left(\frac{45}{2}\right)}$$

$$= -60 \left(\frac{2}{45}\right)$$

$$= -\frac{120}{45} = -\frac{8}{3}$$

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#'s 5, 6, 7, 12, 22