

Name: Answer Key
Date: _____

Systems of Equations

How to find the coordinates of a point where 2 lines meet.

- Make both equations look like : ' $y = ax + b$ '
- Make both equations *equal* to each other
- Solve for 'x'
- Plug the value of 'x' back into one of the two equations and solve for 'y'

1) Solve for x then, solve for y.

a) $3x + 4 = 6x - 8$

$$\begin{aligned} \textcircled{1} \quad 3x - 6x &= -8 - 4 \\ \frac{-3x}{-3} &= \frac{-12}{-3} \\ x &= 4 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y &= 3x + 4 \\ y &= 3(4) + 4 \\ y &= 16 \\ (4, 16) \end{aligned}$$

c) $\frac{1}{4}x - 25 = -\frac{5}{8}x + 45$

$$\begin{aligned} \textcircled{1} \quad \frac{1}{4}x + \frac{5}{8}x &= 45 + 25 \\ \frac{2}{8}x + \frac{5}{8}x &= 70 \\ \frac{7}{8}x &= 70 \\ x &= 80 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y &= \frac{1}{4}x - 25 \\ y &= \frac{1}{4}(80) - 25 \\ y &= -5 \end{aligned} \quad (80, -5)$$

b) $11x + 7 = -15x - 32$

$$\begin{aligned} \textcircled{1} \quad 11x + 15x &= -32 - 7 \\ \frac{26x}{26} &= \frac{-39}{26} \\ x &= -1.5 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y &= 11x + 7 \\ y &= 11(-1.5) + 7 \\ y &= -9.5 \\ (-1.5, -9.5) \end{aligned}$$

d) $\frac{1}{2}x + 10 = \frac{3}{4}x - 2.5$

$$\begin{aligned} \textcircled{1} \quad \frac{1}{2}x - \frac{3}{4}x &= -2.5 - 10 \\ \frac{2}{4}x - \frac{3}{4}x &= -2.5 - 10 \\ -\frac{1}{4}x &= -12.5 \\ x &= 50 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y &= \frac{1}{2}x + 10 \\ y &= \frac{1}{2}(50) + 10 \\ y &= 35 \end{aligned} \quad (50, 35)$$

2) What are the coordinates of the point where the following two lines meet?

Equation 1: $y = 2x + 6$

Equation 2: $y = 6x - 8$

$$\begin{aligned} \textcircled{1} \quad 2x + 6 &= 6x - 8 \\ 2x - 6x &= -8 - 6 \\ -4x &= -14 \\ \frac{-4x}{-4} &= \frac{-14}{-4} \\ x &= 3.5 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad y &= 2x + 6 \\ y &= 2(3.5) + 6 \\ y &= 13 \end{aligned}$$

Answer (3.5 , 13)

3) What are the coordinates of the point where the following two lines meet?

Equation 1: $\frac{2y}{2} = \frac{-4x}{2} + \frac{16}{2}$

$$y = -2x + 8$$

$$\begin{aligned} \textcircled{1} \quad -2x + 8 &= 2x - 16 \\ -2x - 2x &= -16 - 8 \\ -4x &= -24 \\ \frac{-4x}{-4} &= \frac{-24}{-4} \\ x &= 6 \end{aligned}$$

Equation 2: $\frac{-10x}{5} + \frac{5y}{5} + \frac{80}{5} = 0$

$$-2x + y + 16 = 0$$

$$y = 2x - 16$$

$$\begin{aligned} \textcircled{2} \quad 2y &= -4x + 16 \quad \underline{\text{OR}} \quad y = -2x + 8 \\ 2y &= -4(6) + 16 \\ 2y &= -8 \\ \frac{2y}{2} &= \frac{-8}{2} \\ y &= -4 \end{aligned}$$

Answer (6 , -4)

4) What are the coordinates of the point where the following two lines meet?

$$\frac{3y}{3} = \frac{45x}{3} + \frac{180}{3} \quad \text{and} \quad \frac{2y}{2} = \frac{26x}{2} + \frac{160}{2}$$

$$y = 15x + 60$$

Find x

$$15x + 60 = 13x + 80$$

$$15x - 13x = 80 - 60$$

$$\frac{2x}{2} = \frac{20}{2}$$

$$x = 10$$

$$y = 13x + 80$$

Find y

$$y = 15x + 60$$

$$y = 15(10) + 60$$

$$y = 150 + 60$$

$$y = 210$$

Answer (10 , 210)

5) What is the value of 'y' when both equations below intersect (meet)?

$$\frac{2y}{2} = \frac{3x}{2} - \frac{14}{2} \quad \text{and} \quad \frac{3y}{3} + \frac{4.5x}{3} - \frac{6}{3} = 0$$

$$y = 1.5x - 7$$

$$y + 1.5x - 2 = 0$$

$$y = -1.5x + 2$$

Find x

$$1.5x - 7 = -1.5x + 2$$

$$1.5x + 1.5x = +2 + 7$$

$$\frac{3x}{3} = \frac{9}{3}$$

$$x = 3$$

Find y

$$y = 1.5x - 7$$

$$y = 1.5(3) - 7$$

$$y = -2.5$$

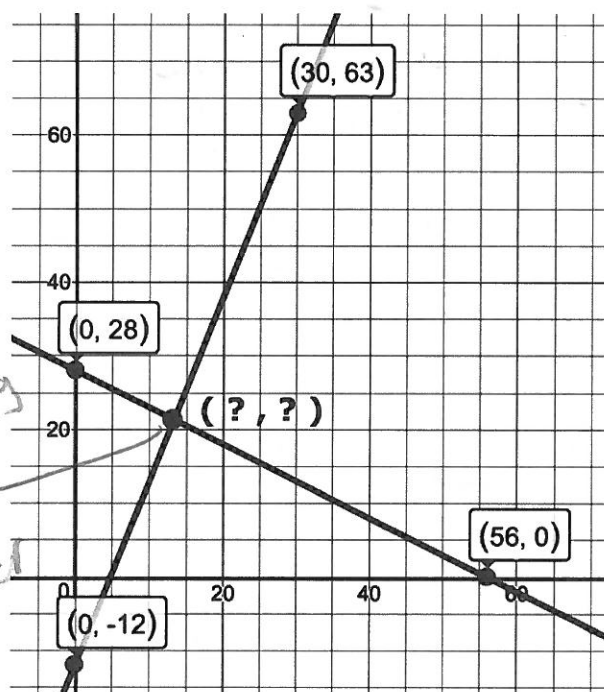
Answer -2.5

6) What are the coordinates of the point where both lines from the graph below intersect (meet)?

Two steps:

1) find the equation of both lines

2) then solve for x and y.



Line 1

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 28}{56 - 0} = \frac{-28}{56} = -\frac{1}{2}$$

$$y = ax + b$$

$$y_1 = -\frac{1}{2}x + 28$$

Line 2

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{63 - (-12)}{30 - 0} = \frac{75}{30} = \frac{5}{2}$$

$$y_2 = \frac{5}{2}x - 12$$

Find x

$$y_1 = -\frac{1}{2}x + 28$$

$$y_2 = \frac{5}{2}x - 12$$

$$-\frac{1}{2}x + 28 = \frac{5}{2}x - 12$$

$$-\frac{1}{2}x - \frac{5}{2}x = -12 - 28$$

$$-\frac{6}{2}x = -40$$

$$x = \boxed{\frac{40}{3}} = 13.\bar{3}$$

Find y

$$y = -\frac{1}{2}\left(\frac{40}{3}\right) + 28$$

$$y = -\frac{40}{6} + 28$$

$$y = -\frac{40}{6} + \frac{168}{6}$$

$$y = \frac{128}{6} = \boxed{\frac{64}{3}} = 21.\bar{3}$$

Answer ($\frac{40}{3}, \frac{64}{3}$)

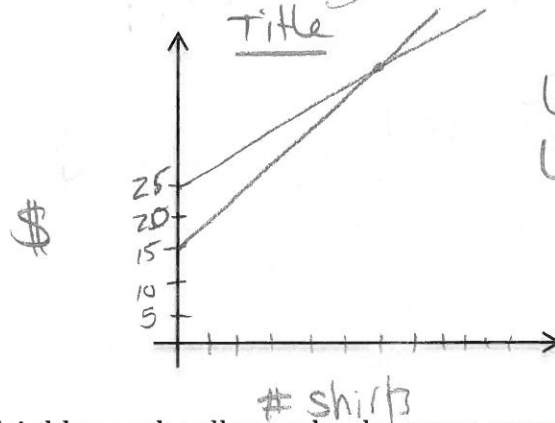
7) Sarah and Ashley both work at the same store.

Sarah gets a **15\$ base salary** and earns **4\$ for every shirt** that she sells.

Ashley gets a **25\$ base salary** and earns **3\$ for every shirt** that she sells.

Sketch a graph of this situation

Not drawn to scale



Identify variables:

let x = # of shirts
let y = Money earned

a) How many shirts must Sarah and Ashley each sell to make the **same amount of money**?

b) How much money will they each earn?

Sarah's Rule:

$$y_1 = 4x + 15$$

Ashley's Rule:

$$y_2 = 3x + 25$$

$$\begin{aligned} \text{a)} \quad 4x + 15 &= 3x + 25 \\ 4x - 3x &= 25 - 15 \\ x &= 10 \end{aligned}$$

They have to each sell 10 shirts to make the same amount of money

b) Plug x value into one of the original equations

$$\begin{aligned} y &= 4x + 15 \\ y &= 4(10) + 15 \\ y &= 55 \end{aligned}$$

They will each earn 55\$

a) Number of shirts when they make the same money = 10 shirts

b) Amount of money they earn when they make the same money = \$ 55

coordinates

→ (x, y)

8) What is the **point of intersection** between the lines defined by the linear equations below?

Eq. 1) $y = 4.5x + 8$

Eq. 2) $y = -3.5x - 64$

① Find x
 $4.5x + 8 = -3.5x - 64$

$$4.5x + 3.5x = -64 - 8$$

$$8x = -72$$

$$x = -9$$

② Find y

$$y = 4.5x + 8$$

$$y = 4.5(-9) + 8$$

$$y = -32.5$$

Answer (-9 , -32.5)

(x, y)

9) What is the **point of intersection** between the lines defined by the equations below?

Eq. 1) $\frac{6y}{6} = \frac{5x}{6} - \frac{42}{6}$

Eq. 2) $\frac{1x}{3} + \frac{3y}{3} - \frac{84}{3} = 0$

$$y = \frac{5}{6}x - 7$$

$$y = -\frac{1}{3}x + 28$$

① Find x
 $\frac{5}{6}x - 7 = -\frac{1}{3}x + 28$

$$\frac{5}{6}x + \frac{1}{3}x = 28 + 7$$

$$\frac{5}{6}x + \frac{2}{6}x = 28 + 7$$

$$\frac{7}{6}x = 35$$

$$x = 30$$

② Find y

$$y = \frac{5}{6}(x) - 7$$

$$y = \frac{5}{6}(30) - 7$$

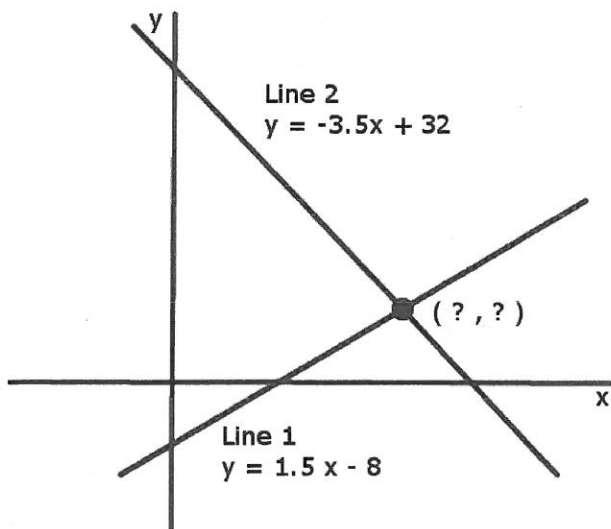
$$y = 18$$

Answer (30 , 18)

(x, y)

10) What is the **point of intersection** between lines 1 and 2 shown below?

Find x



$$\begin{aligned} \textcircled{1} \quad & -3.5x + 32 = 1.5x - 8 \\ & -3.5x - 1.5x = -8 - 32 \\ & \underline{-5x} = \underline{-40} \\ & \underline{-5} \quad \underline{-5} \\ & x = 8 \end{aligned}$$

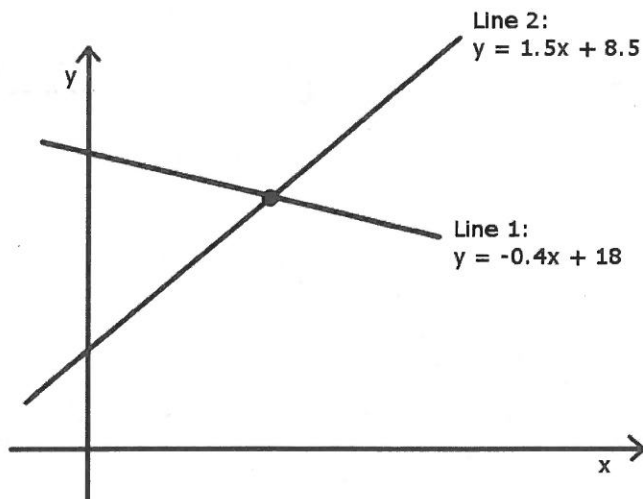
Find y

$$\begin{aligned} \textcircled{2} \quad & y = -3.5x + 32 \\ & y = -3.5(8) + 32 \\ & y = -28 + 32 \\ & y = 4 \end{aligned}$$

Answer (8 , 4)

(x, y)

11) What is the **point of intersection** between lines 1 and 2 shown below?



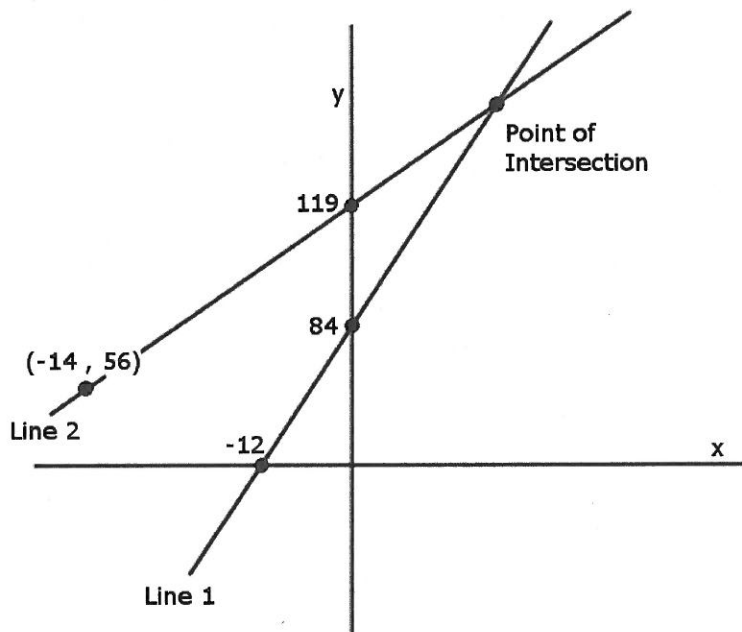
$$\begin{aligned} \textcircled{1} \quad & 1.5x + 8.5 = -0.4x + 18 \\ & 1.5x + 0.4x = 18 - 8.5 \\ & \underline{1.9x} = \underline{9.5} \\ & \underline{1.9} \quad \underline{1.9} \\ & x = 5 \end{aligned}$$

$$\begin{aligned} \textcircled{2} \quad & y = 1.5x + 8.5 \\ & y = 1.5(5) + 8.5 \\ & y = 16 \end{aligned}$$

Answer (5 , 16)

(x,y)

12) Find the point of intersection between lines 1 and 2.



Find equation of line 1

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{84 - 0}{0 - (-12)} = \frac{84}{12} = 7$$

$$y_1 = 7x + 84$$

Find equation of line 2

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{119 - 56}{0 - (-14)} = \frac{63}{14} = 4.5$$

$$y_2 = 4.5x + 119$$

Find x

$$7x + 84 = 4.5x + 119$$

$$7x - 4.5x = 119 - 84$$

$$\frac{2.5x}{2.5} = \frac{35}{2.5}$$

$$x = 14$$

Find y

$$y = 7x + 84$$

$$y = 7(14) + 84$$

$$y = 182$$

Point of Intersection (14 , 182)