

Warm Up

3/7

Solve this equation for x:

$$2x - 5y = 12$$

$$\begin{array}{r} +5y \quad +5y \\ \hline \end{array}$$

Get x alone on one side

$$\begin{array}{r} 2x = 12 + 5y \\ \hline 2 \quad 2 \quad 2 \end{array}$$

Getting just 1x

$$x = 6 + \frac{5}{2}y$$

$$x = -\frac{5}{2}y + 6$$

} equivalent equations

When you write an equation in Slope Intercept form you are essentially solving it for y.
(Getting y alone on one side)

Homework Questions?

For each problem:

- Define your variables (Let $x =$, and Let $y =$)
- Write your equations (are there some totals involving both variables?)
- Use Desmos to solve your system of equations
- What does your solution mean in the context of the problem?

1. A theater production charges \$21 for adult tickets and \$15 for student tickets. If the production sold 102 tickets for its opening night and made \$1,932 in ticket sales, how many of each type of ticket were sold? *variables*

Let $x =$ # of adult tickets
Let $y =$ # of student tickets

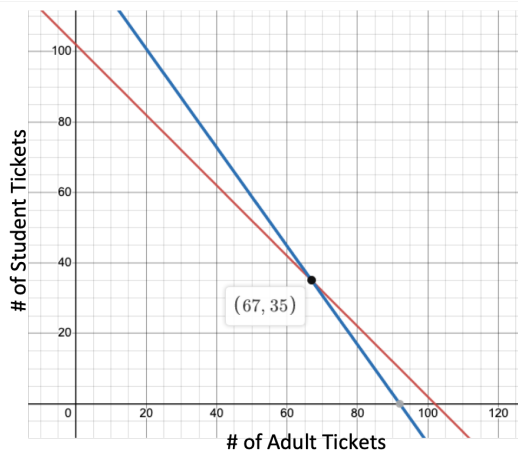
$$x + y = 102$$

$$21x + 15y = 1932$$

Totals

Common Solution: (67, 35)

They sold **67** adult tickets and **35** student tickets.



2. The player of a trivia game receives 100 points for each correct answer and loses 25 points for each incorrect answer. Leona answered a total of 30 questions and scored a total of 2125 points. How many questions did she answer correctly? *negative because losing points*

Let $x =$ # of correct answers
Let $y =$ # of incorrect answers

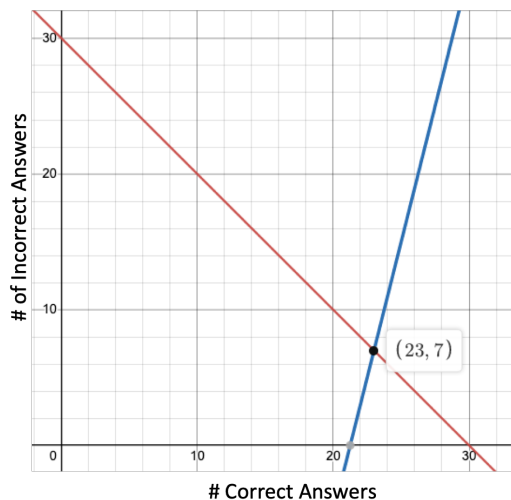
$$x + y = 30$$

$$100x - 25y = 2125$$

negative because losing points

Common Solution: (23, 7)

They answered **23** questions correctly and **7** questions incorrectly.



3. At a restaurant the cost for a breakfast taco and a small glass of milk is \$2.10. The cost for 2 tacos and 3 small glasses of milk is \$5.15. How much does a breakfast taco cost? How much does a small glass of milk cost?

Our variables are what they are asking us to solve for

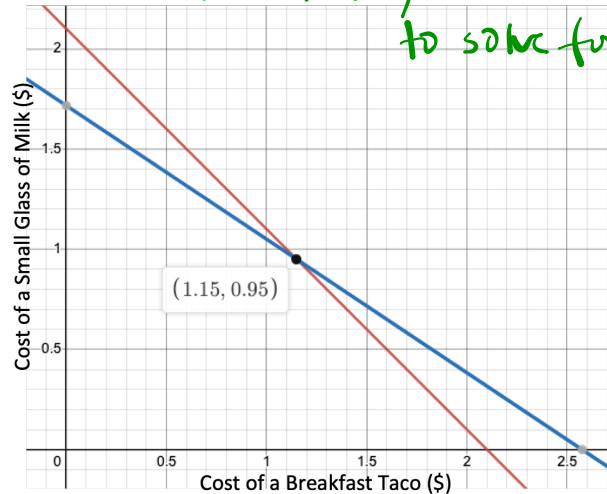
Let x = cost of a breakfast taco
Let y = cost of a small glass of milk

$$x + y = 2.10$$

$$2x + 3y = 5.15$$

Common Solution: (1.15, 0.95)

The breakfast taco costs **\$1.15** and the small glass of milk costs **\$0.95**.



4. The Frosty Ice Cream Shop sells sundaes for \$2 and banana splits for \$3. On a hot summer day, the shop sold 8 more sundaes than banana splits and made \$156. How many banana splits did they sell?

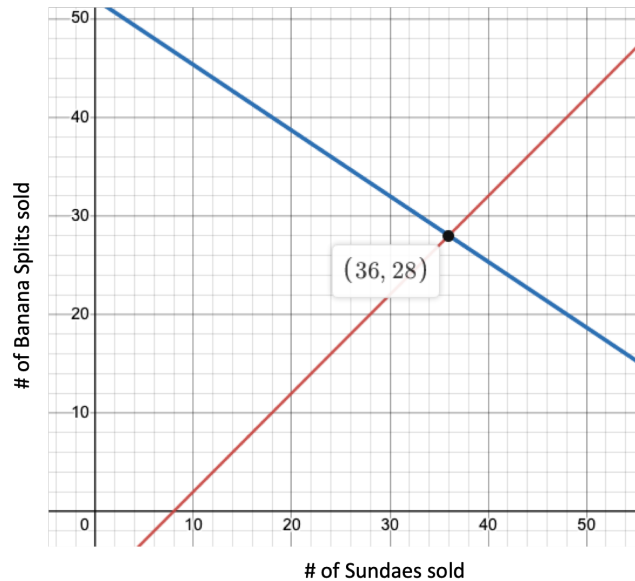
Let x = # of sundaes sold
Let y = # of banana splits sold

$$x = y + 8$$

$$2x + 3y = 156$$

Common Solution: (36, 28)

They sold **28** Banana Splits.



Solving Linear Systems Symbolically

Algebraically

Your work in Investigation 1 revealed key facts about solving linear equations.

- The solutions of equations in the form $Ax + By = C$ are ordered pairs of numbers.
- The graph of the solutions for an equation $Ax + By = C$ is a straight line.
- The solution of a system of two linear equations is the coordinates of the point where the lines intersect.

Finding an exact solution is not always easy to do from a graph of the pair of linear equations. In this Investigation, you will develop symbolic methods for solving systems of linear equations.

Algebraic 

2.1 Shirts and Caps Again

Solving Systems With $y = mx + b$

Recall the T-shirt and cap sale from Investigation 1.



- What two equations represent the relationship between the number of shirts sold and the number of caps sold?
- How can you find the number of shirts and the number of caps sold? Explain your reasoning.

Let $x = \#$ of shirts

Let $y = \#$ of caps

$$\begin{cases} x + y = 18 \\ 5x + 10y = 125 \end{cases}$$

Nyla and Jimfa have different ways to solve this system of equations.

Let's check them out ...

The 2 methods

Nyla

Write a system of two linear equations.

$$\begin{cases} y + x = 18 \\ 10y + 5x = 125 \end{cases}$$

Write equivalent equations.

$$y = -x + 18$$

$$y = -0.5x + 12.5$$

Graph the two equations.
The solution of the system is the point where the graphs of the equations meet.



Jimfa

Write a system of two linear equations.

$$\begin{cases} y + x = 18 \\ 10y + 5x = 125 \end{cases}$$

Write equivalent equations.

$$y = -x + 18$$

$$y = -0.5x + 12.5$$

Write one linear equation.

$$-x + 18 = -0.5x + 12.5$$

Solve the linear equation for x .
Then find the related value of y .

They both started the same way:

1. Write a system of equations:

$$y + x = 18$$

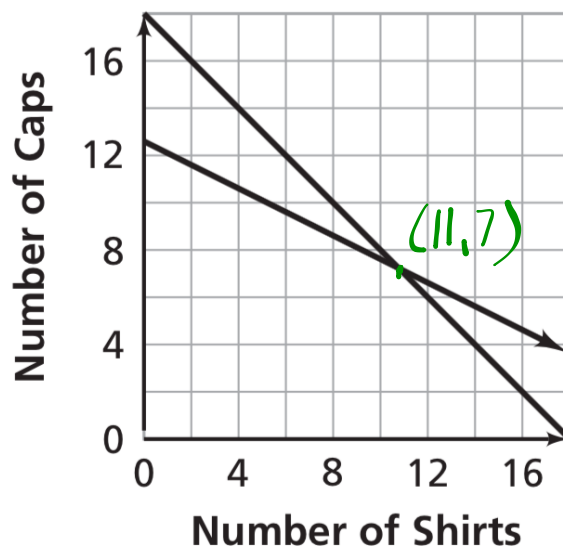
$$10y + 5x = 125$$

2. Create equivalent equations in Slope-Intercept form:

Nyla graphed the equations.

$$y = -x + 18$$

$$y = -0.5x + 12.5$$



Not everyone in class got this same solution!

What do you think?



Graphing may not always be accurate due to many factors:

size of graph

accuracy of graph

estimating decimals on a graph

Jimfa took the 2 equations and made one.

$$y = -x + 18$$

$$y = -0.5x + 12.5$$

} equivalent eq's

equivalent expressions

$$-x + 18 = -0.5x + 12.5$$

-18

-18

$$-x = -0.5x - 5.5$$

$$+0.5x \quad +0.5x$$

$$-0.5x = -5.5$$

$$-0.5 \quad -0.5$$

$$x = 11$$

what is the y value
when $x = 11$?

$$y = -x + 18$$

$$y = -11 + 18$$

$$y = 7$$

(11, 7)

↑ shirts ↑ caps

Let's try B1 together?

- B** Use symbolic ^{Algebraic} methods to find values of x and y that satisfy each system. Check your solution by substituting the values into the equations and showing that the resulting statements are true.

1.
$$\begin{cases} y = 1.5x - 0.4 \\ y = 0.3x + 5 \end{cases}$$

$$\begin{array}{r} 1.5x - 0.4 = 0.3x + 5 \\ -0.3x \quad -0.3x \\ \hline \end{array}$$

$$\begin{array}{r} 1.2x - 0.4 = 5 \\ +0.4 \quad +0.4 \\ \hline \end{array}$$

$$\begin{array}{r} 1.2x = 5.4 \\ \hline 1.2 \quad 1.2 \end{array}$$

$$x = 4.5$$

x -value = 4.5
How to find y -value?

$$y = 1.5x - 0.4$$

$$y = 1.5(4.5) - 0.4$$

$$y = 6.35$$

Common Solution = (4.5, 6.35)

Check this is correct:

Use the OTHER equation $y = 0.3x + 5$

$$6.35 = 0.3(4.5) + 5$$

$$6.35 = 6.35 \checkmark$$

Problem 2.1 B

- B** Use ~~symbolic methods~~ ^{Algebra} to find values of x and y that satisfy each system. Check your solution by substituting the values into the equations and showing that the resulting statements are true.

1.
$$\begin{cases} y = 1.5x - 0.4 \\ y = 0.3x + 5 \end{cases}$$

2.
$$\begin{cases} x + y = 3 \\ x - y = -5 \end{cases}$$

3.
$$\begin{cases} 3x - y = 30 \\ x + y = 14 \end{cases}$$

4.
$$\begin{cases} x + 6y = 15 \\ -x + 4y = 5 \end{cases}$$

5.
$$\begin{cases} x - y = -5 \\ -2x + 2y = 10 \end{cases}$$

6.
$$\begin{cases} x - y = -5 \\ -2x + 2y = 8 \end{cases}$$

Remember to solve all equations for one variable first.

Do we make this $x =$ or $y =$?

It is easier to rewrite each equation, to solve for x (no fractions) than to solve for y .

Homework

Finish classwork, 2.1 a and B.