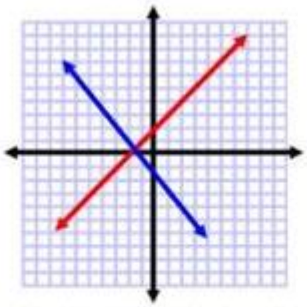
Systems of Equations
Unit Five



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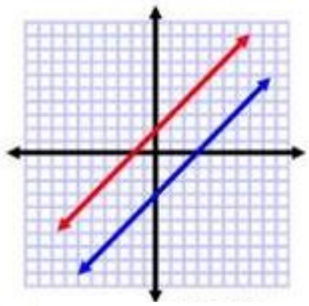

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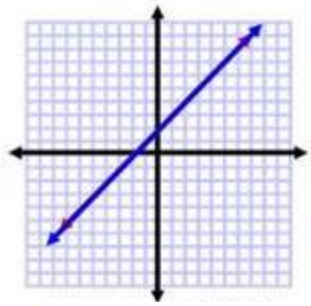

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Standards:

8.EE.8 – Analyze and solve pairs of simultaneous linear equations.
a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

8.F.2 – Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

Name: ____ **Period:**____________

Lesson #55 Systems of Equations

When a set of equations are listed together, they are called a _________________ ______________________________ These equations have solutions, just like algebraic equations. They may have, one, none or infinite solutions, that can be found algebraically or graphically.

To determine the solution(s) to a system of equations:

- Graph each equation using it's __________ and ____________. Find where the equations intersect. This is the ______________________.

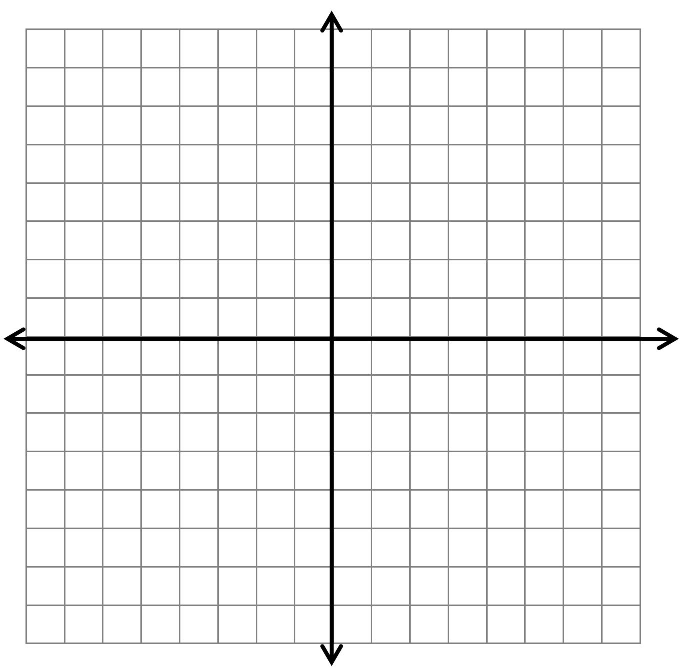
and/or

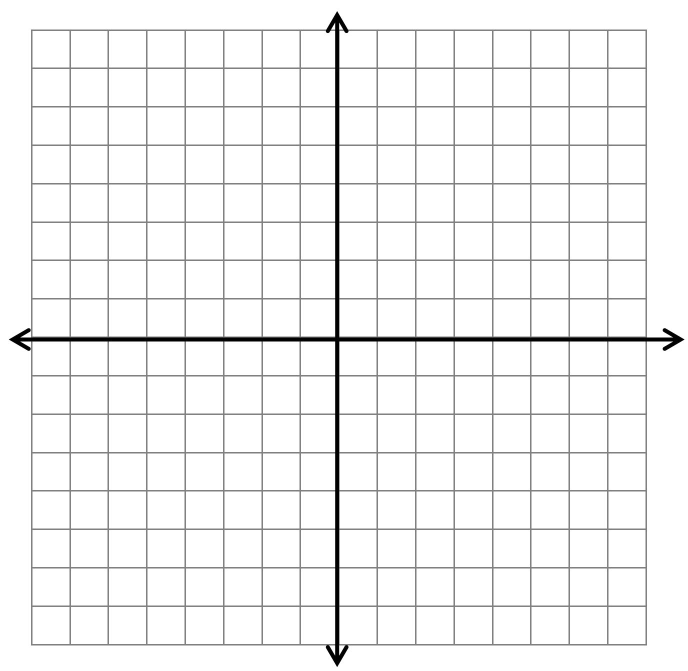
- Set the equations __________ to each other to solve for x and then substitute the value of x back into each equation to find the ________________________ y value. The x and y values found represent the __________ where the two lines would _________________ if graphed.

Solve graphically:

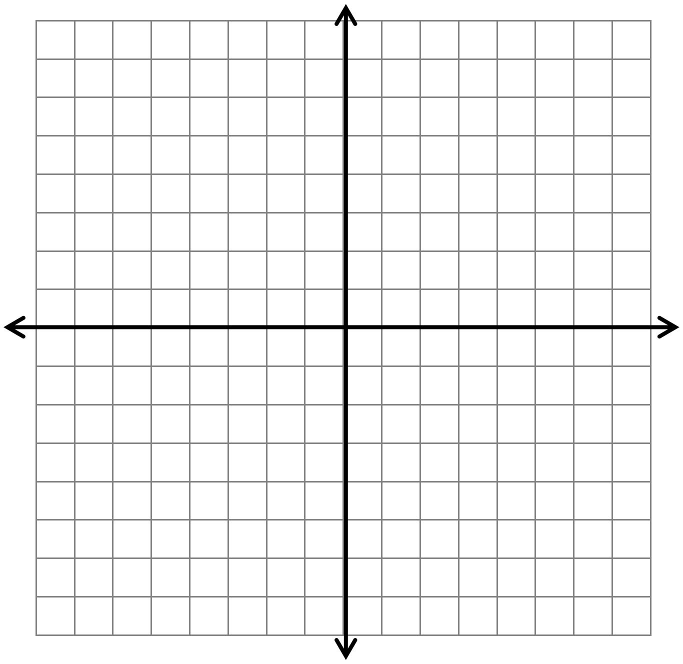
1. $\begin{cases} y = -2x + 6 \\ y = \frac{1}{2}x - 4 \end{cases}$

2. $\begin{cases} y = 3x - 7 \\ y = -\frac{2}{3}x + 4 \end{cases}$

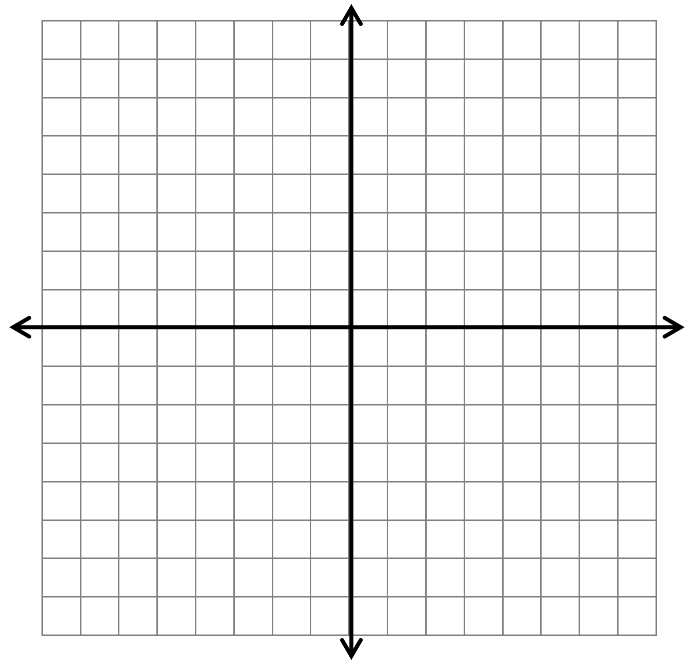




3. $\begin{cases} y = -x + 3 \\ y = \frac{1}{4}x - 2 \end{cases}$



4. $\begin{cases} y = 5 - \frac{1}{3}x \\ y = x + 1 \end{cases}$



Solve algebraically.

5. $\begin{cases} y = 3x + 15 \\ y = -x - 9 \end{cases}$

6. $\begin{cases} y = \frac{3}{2}x - 1 \\ y = 6 - 2x \end{cases}$

In all the examples above, each system of equations has one solution. What would a system of equations look like if they have….

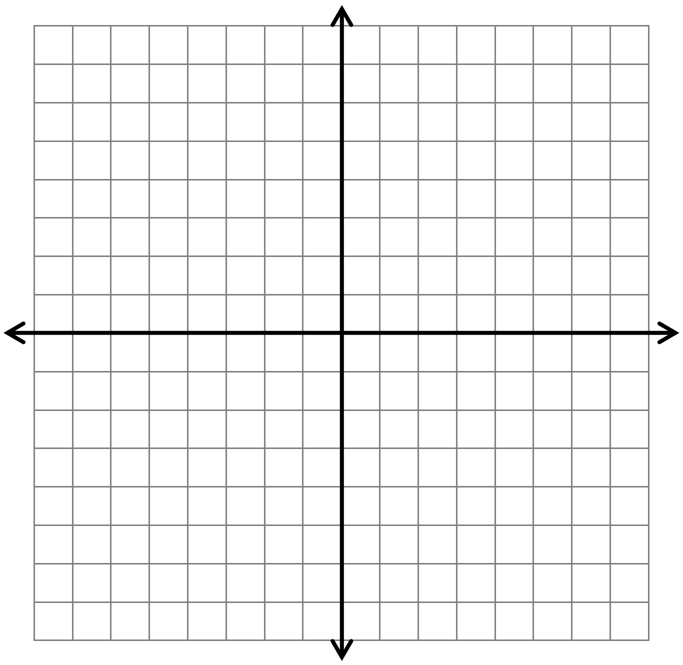
a. infinite solutions?

b. no solution?

HW #55 Systems of Equations

1. Find the solution graphically.

$$\begin{cases} y = -4x + 6 \\ y = \frac{3}{2}x - 5 \end{cases}$$



2. Find the solution algebraically.

$$\begin{cases} y = 19 - 6x \\ y = \frac{1}{2}x - 20 \end{cases}$$

3. Does the system of equations below have no solution or infinite solutions? Explain how you know!

$$\begin{cases} y = 3x - 1 \\ y = \frac{6}{2}x - 1 \end{cases}$$

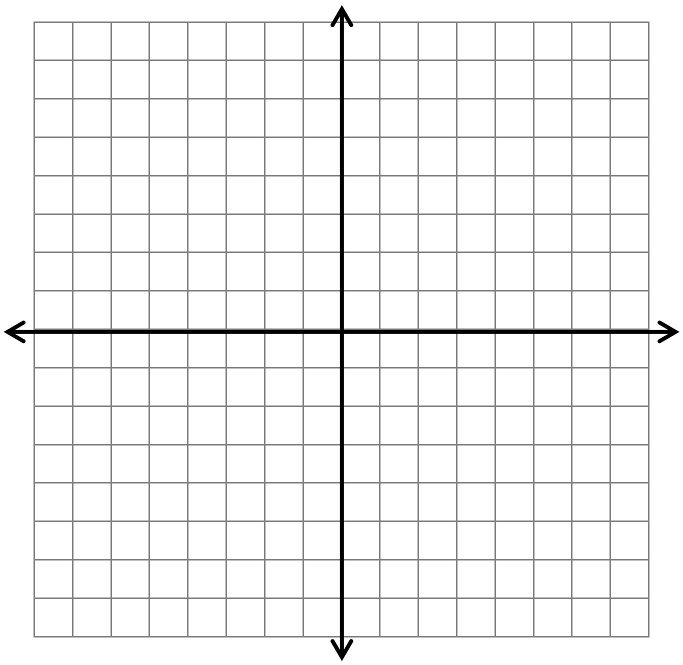
4. Does the system of equations below have no solution or infinite solutions? Explain how you know!

$$\begin{cases} y = -2x + 3 \\ y = -\frac{4}{2}x - 3 \end{cases}$$

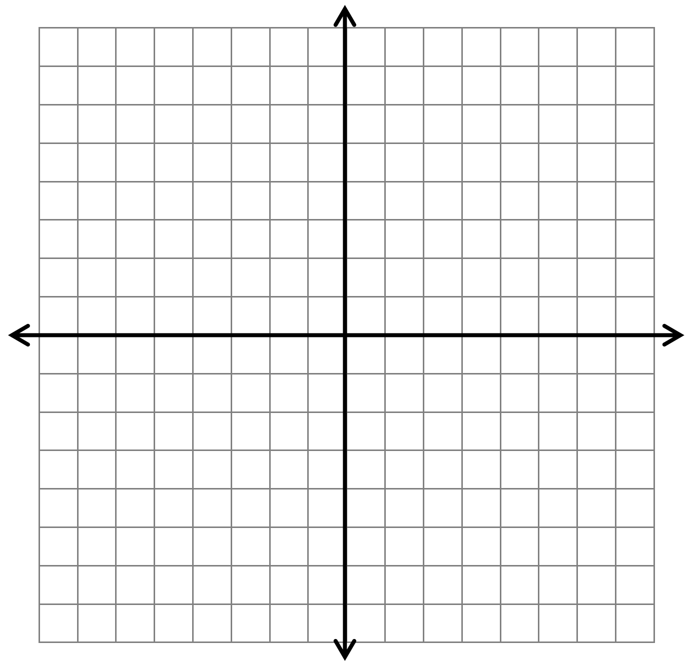
Lesson #56 Systems of Equations Continued

Solve graphically.

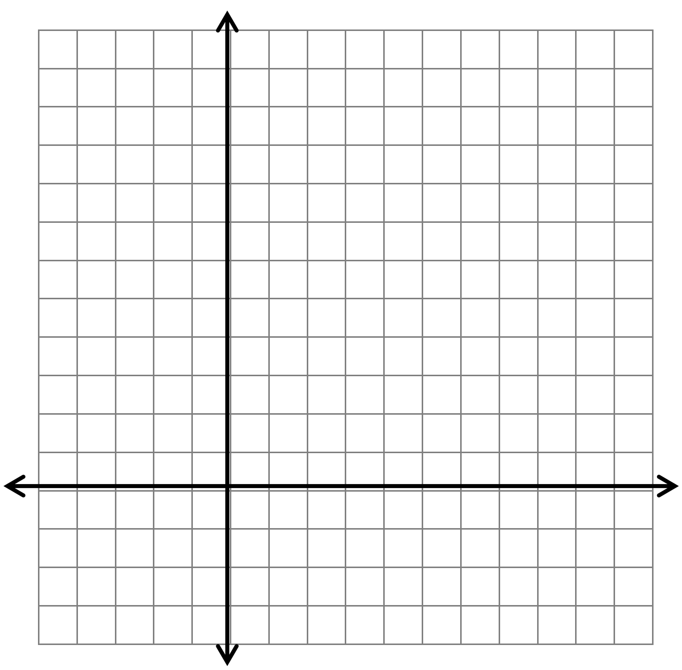
1. $\begin{cases} y = x - 6 \\ y = -3x + 6 \end{cases}$



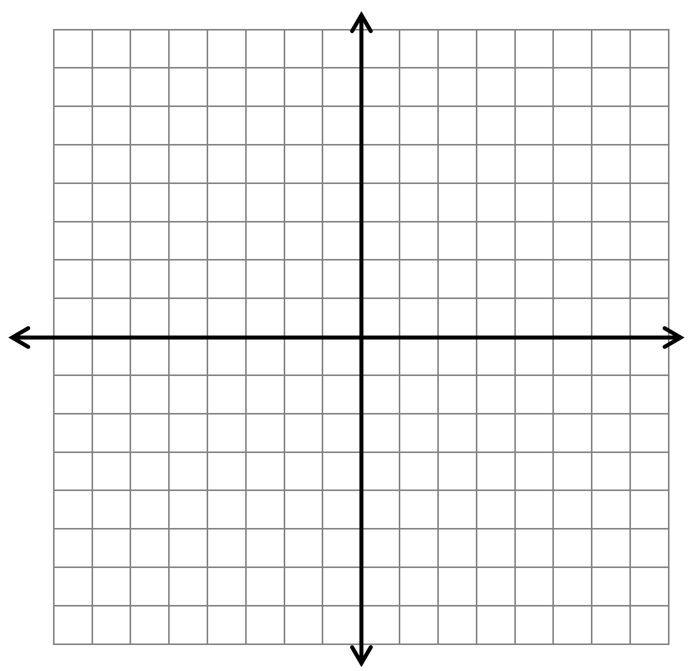
2. $\begin{cases} y = -2x + 3 \\ y = -\frac{6}{3}x \end{cases}$



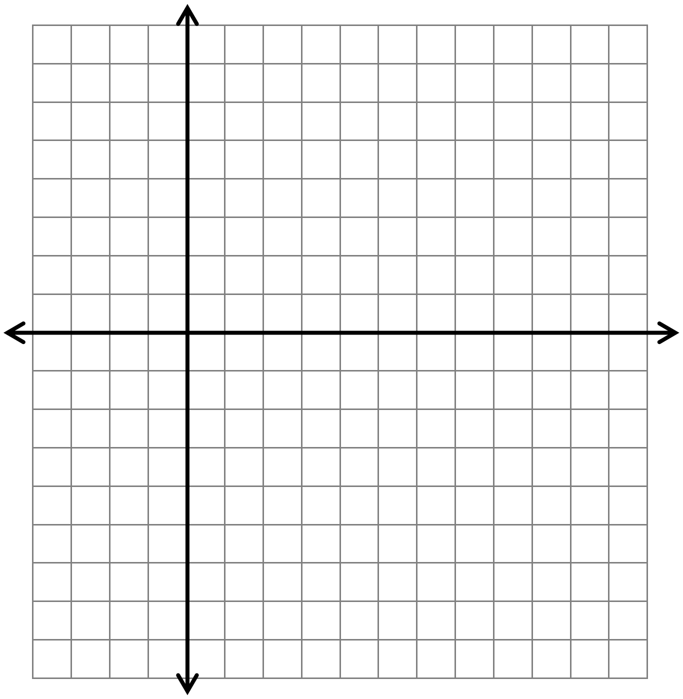
3. $\begin{cases} y = \frac{4}{3}x \\ y = -\frac{1}{2}x + 11 \end{cases}$



4. $\begin{cases} y = \frac{1}{2}(6x - 8) \\ y = 3x - 4 \end{cases}$



5. $\begin{cases} y = \frac{1}{3}(2x - 15) \\ y = -x + 5 \end{cases}$



6. One, none or infinite solutions?

a. $\begin{cases} y = \frac{1}{2}(6x - 2) \\ y = 3x \end{cases}$

b. $\begin{cases} y = \frac{3}{4}(8x - 20) \\ y = 15 - 6x \end{cases}$

c. $\begin{cases} y = \frac{2}{3}(9x - 3) \\ y = 6x - 2 \end{cases}$

Solve algebraically.

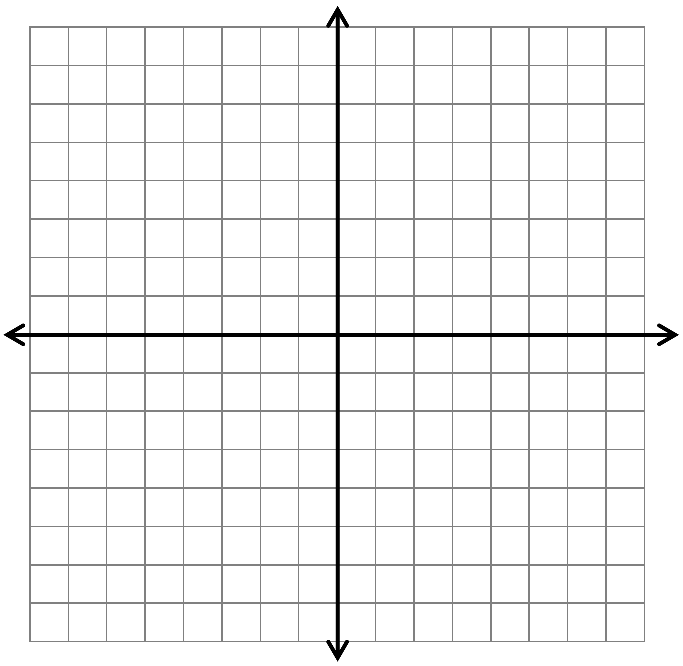
7. . $\begin{cases} y = \frac{1}{4}(2x - 12) \\ y = 8 - \frac{5}{2}x \end{cases}$

8. $\begin{cases} y = \frac{3}{8}(8x - 40) \\ y = 9 - x \end{cases}$

HW #56 Systems of Equations Continued

1. Solve graphically.

$$\begin{cases} y = \frac{2}{5}x - 7 \\ y = -2x + 5 \end{cases}$$



2. Solve algebraically.

$$\begin{cases} y = 3x - 14 \\ y = 5x + 18 \end{cases}$$

3. Does the system of equations below have no solution or infinite solutions? Explain how you know!

$$\begin{cases} y = \frac{1}{3}(3x - 12) \\ y = 2(\frac{1}{2}x - 2) \end{cases}$$

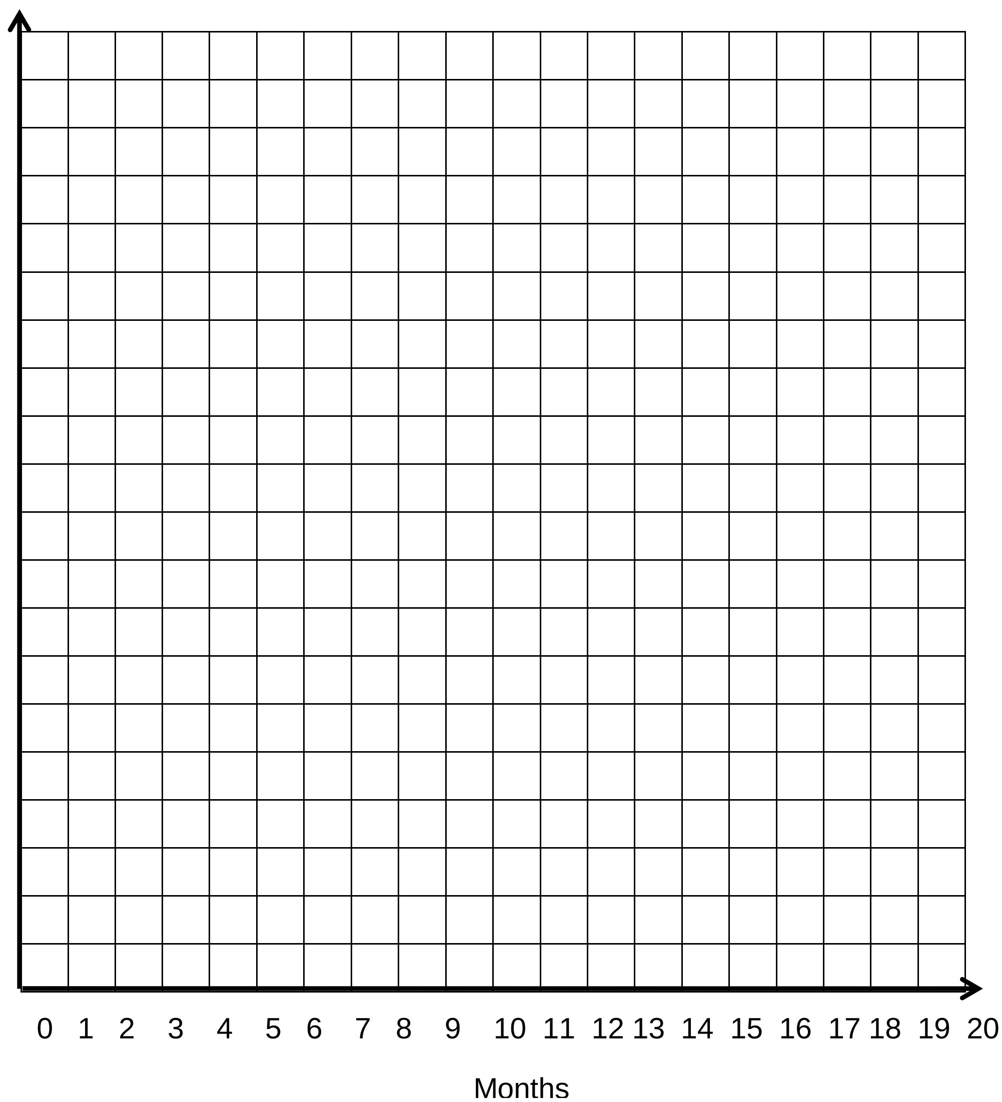
4. Does the system of equations below have no solution or infinite solutions? Explain how you know!

$$\begin{cases} y = -2(x - 4) \\ y = -\frac{1}{2}(4x + 6) \end{cases}$$

Lesson# 57 Graphing Real Life Situations – Bank Accounts

1. Arianna opened a savings account after her sweet sixteen birthday party, with plans of using the money to purchase her first car. For her birthday she was given $200 in gifts. After 10 months she has $950.

Part A: Graph the points on the coordinate plane, then find the function rule.



Part B Arianna's twin sister, Alyssa, received $150 in gifts on her birthday and plans to save $100 per month. Write a function rule for her savings account and graph it on the coordinate plane above.

Part C Who is saving more per month? Explain. When will they have the same amount of money?

___

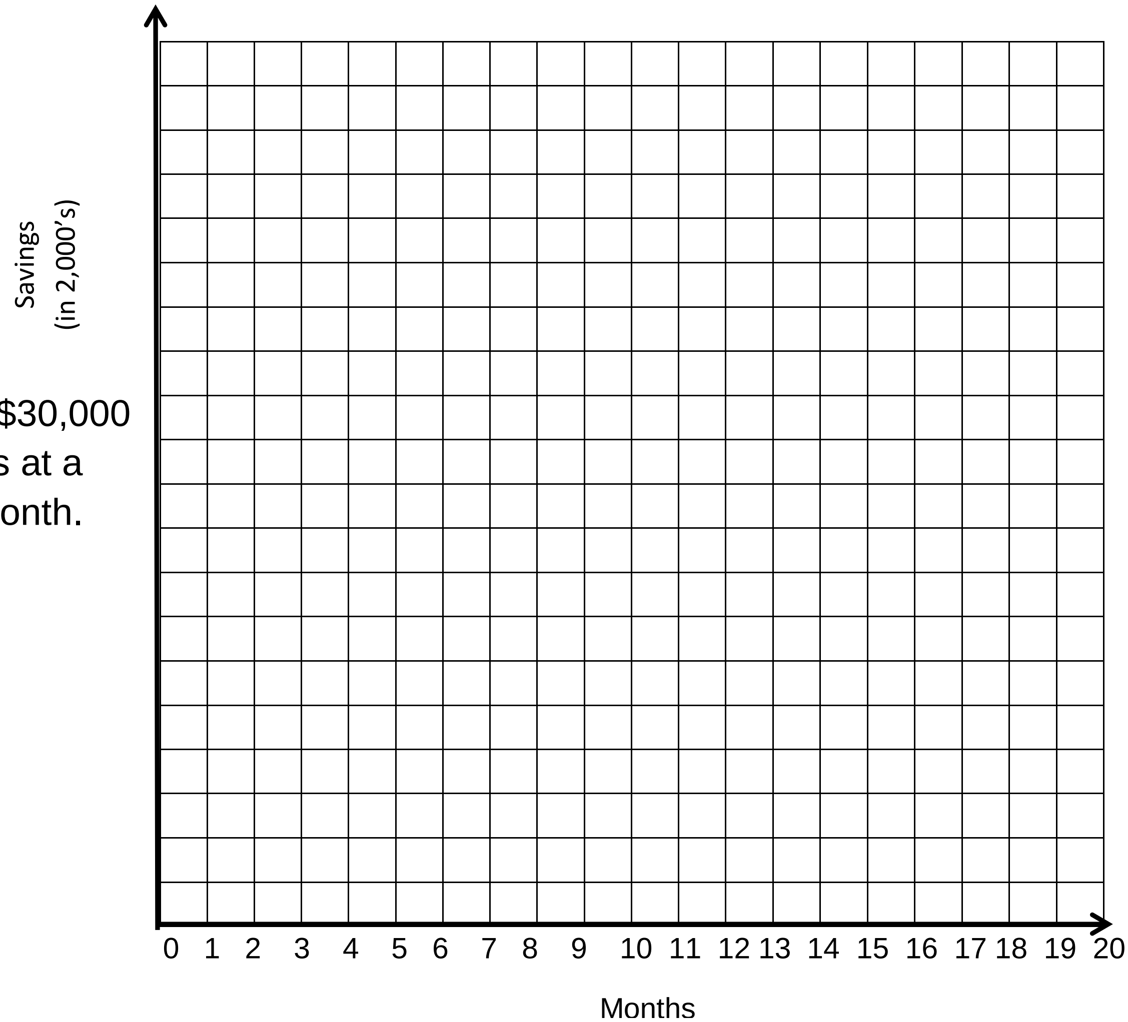
___

___

___

2. Bryan saved $40,000 and decided to take some time off from work. After four months he had $28,000.

Part A Graph the corresponding values on the coordinate plane then find the function rule that models Bryan's spending.



Part B Ricky saved $30,000 for a trip. He spends at a rate of $2,000 per month.

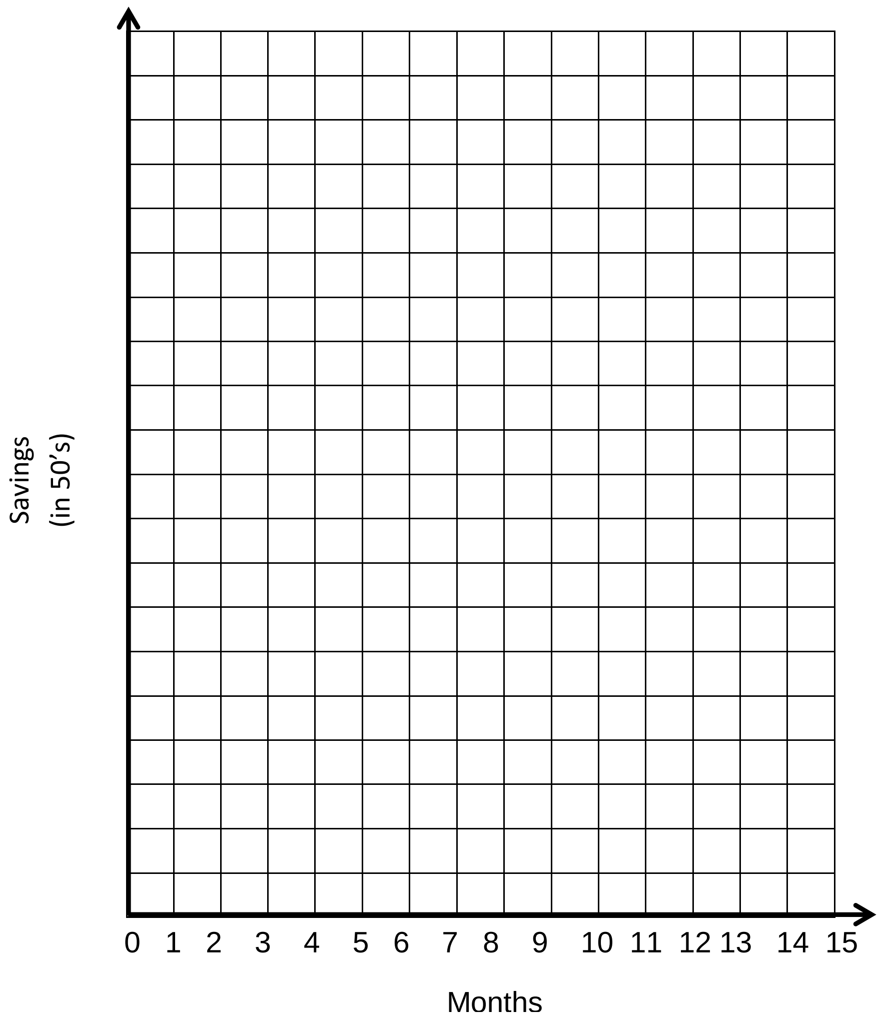
Part C Write two sentences comparing Bryan's and Ricky's spending, including when they will each run out of money.

HW #57 Bank Accounts as Function Rules

Jane and Fred each have separate savings accounts.

Part A At the beginning of the year, Jane's account had $475 and after nine months Jane's account has $700. Graph the corresponding values on the coordinate plane below and find the function rule that models Jane's account.

Part B Fred started the year with $350 in saving and plans to add $50 per month. Graph a line that models his account and find it's function rule.



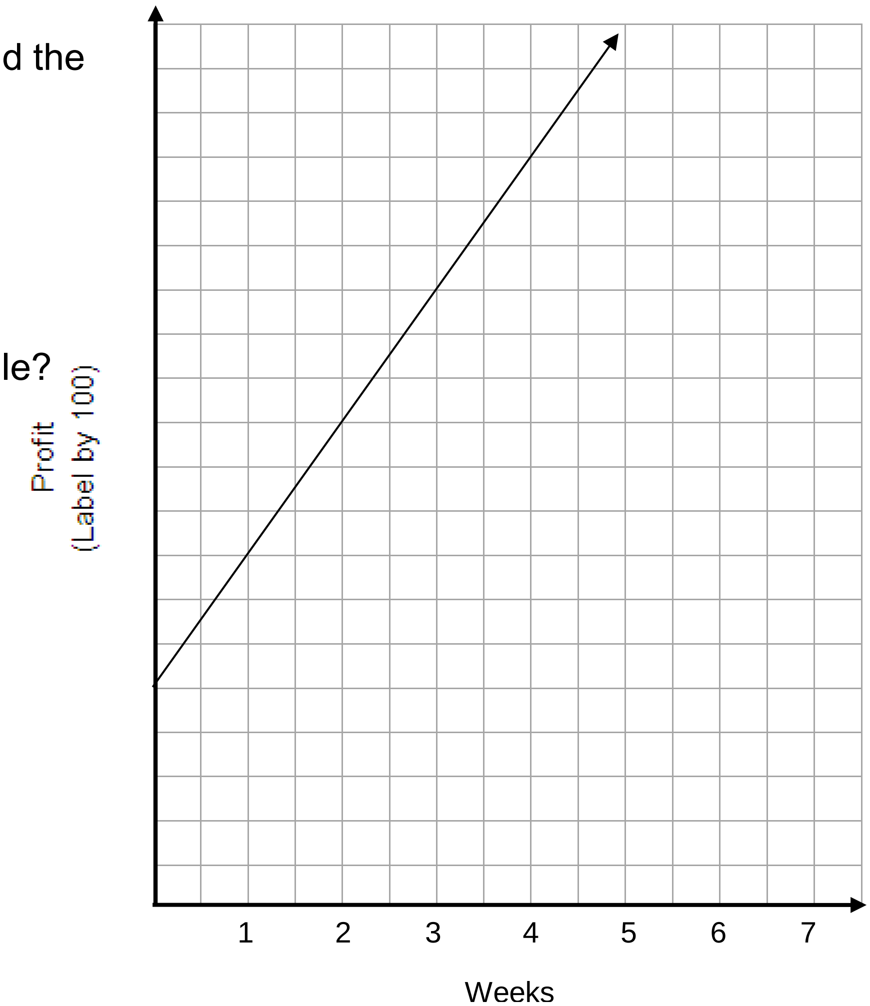
Part C Write two sentences comparing Jane and Fred's accounts.

Lesson #58 Graphing Real Life Situations – Businesses

1. Emily started a coffee shop with $200. After three weeks she showed a profit of $1,400. Down the road, Erica also opened a coffee shop. Erica's profit is shown by the line below.

Part A: Graph the values that represent Emily's profit then find the function rule that models it.

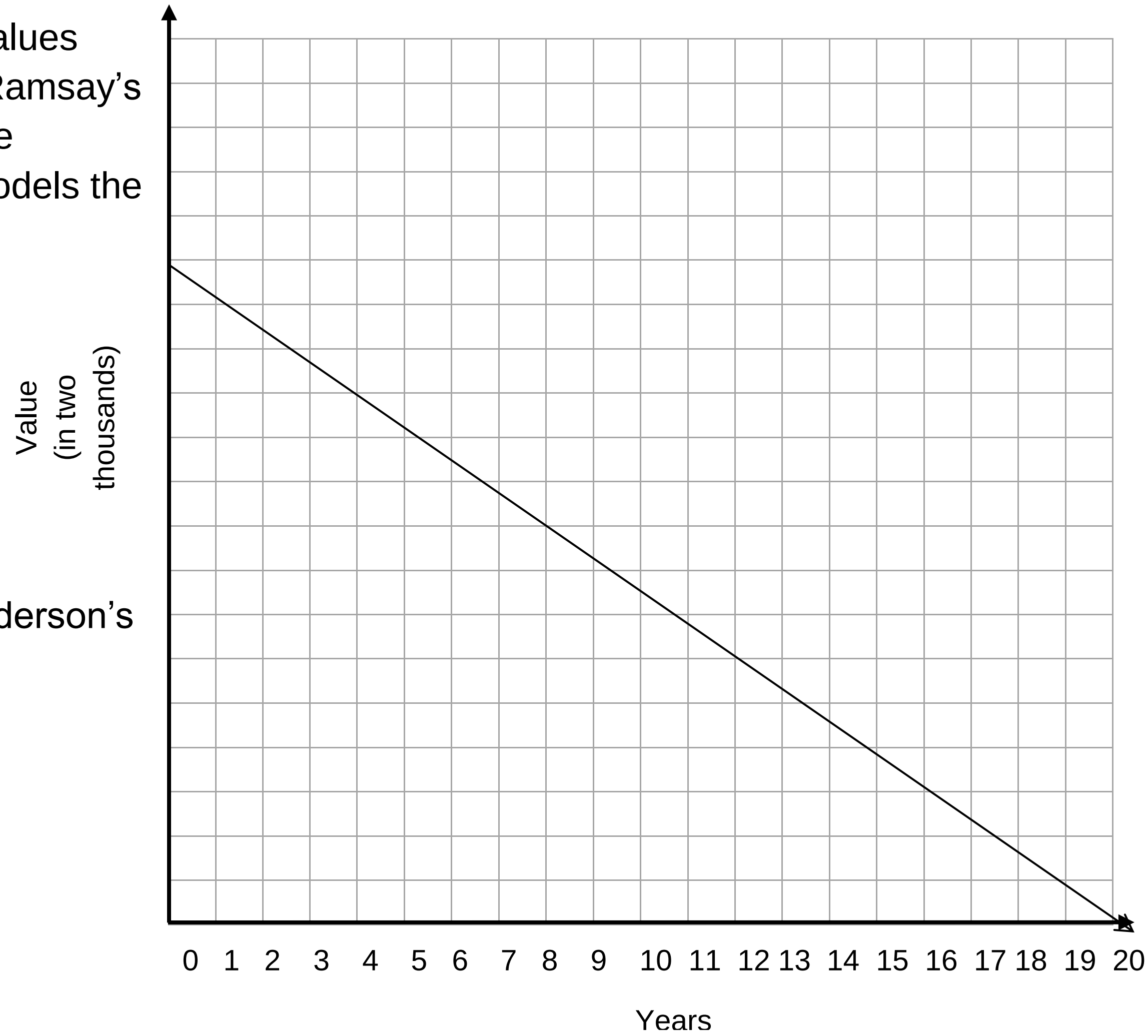
Part B: Find Erica's function rule?



Part C: Algebraically determine when Emily's business will have earned $1,000 more than Erica's business.

2. Mr. Ramsay purchased a car for 20,000. After five years the car is only worth $15,000. Ms. Anderson also purchased a car. The value of her car is displayed below.

Part A Graph the values that represent Mr. Ramsay's car and then find the function rule that models the value of her car.



Part B Find Ms. Anderson's function rule.

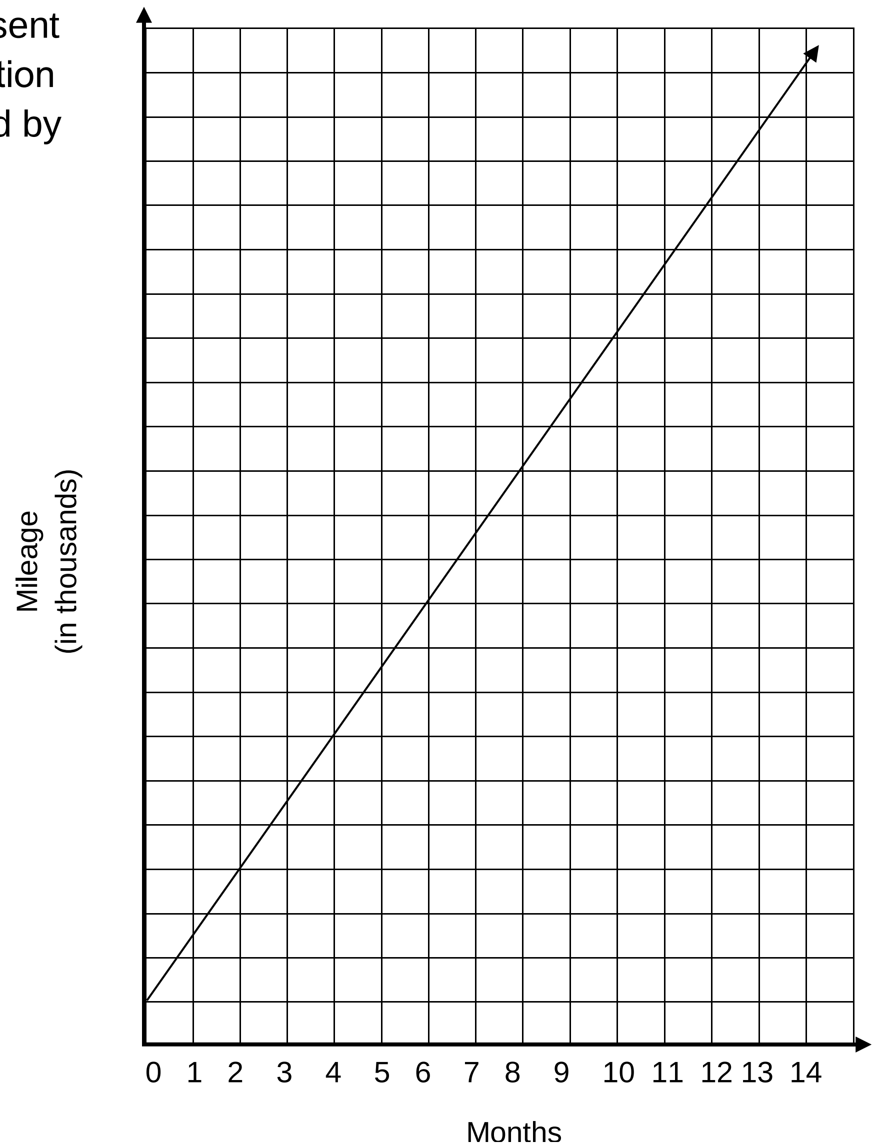
Part C Whose car is depreciating faster? Explain.

Part D: When will their cars have the same value? Prove algebraically.

HW #58 Graphing Functions – Car Mileage and Value

Amanda and Paul bought new cars at the same time. Amanda bought a used with 6,000 miles on it and calculates that she drives1,000 per month. Paul bought new car that was used at the dealership. Paul's mileage per month is displayed in the graph below.

Part A Graph the values that represent Amanda's mileage and write a function rule that represents the lines formed by them.



Part B Find Paul's function rule.

Part C Who uses their car more? Explain.

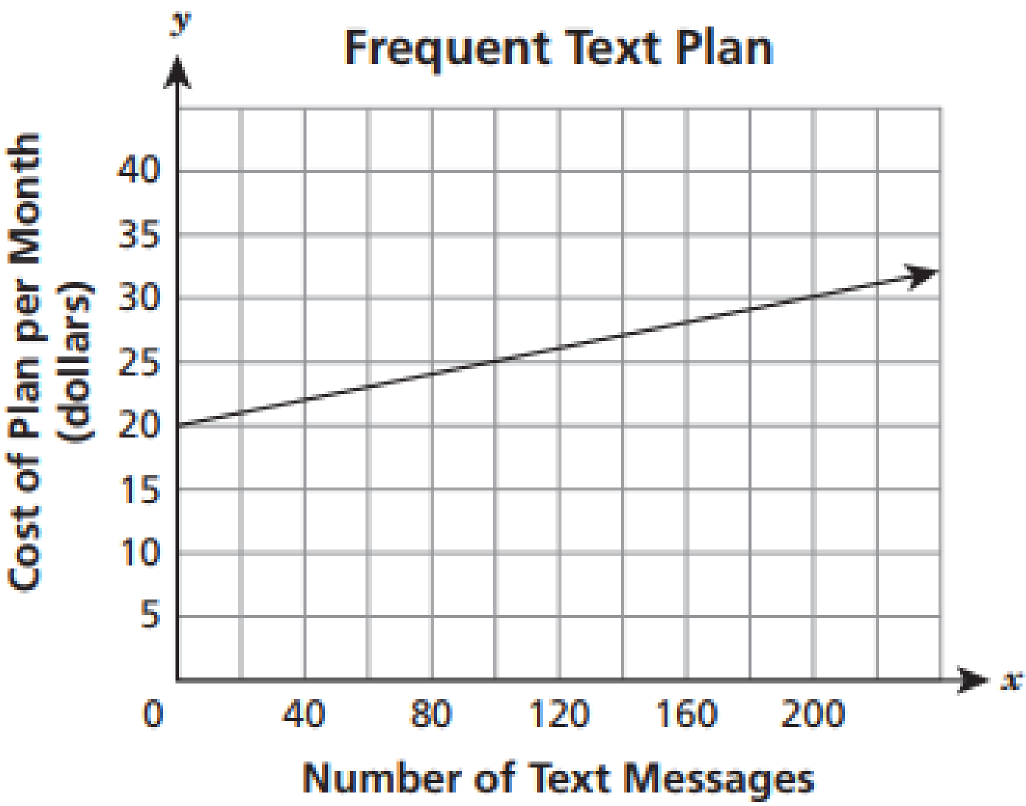
Part D Algebraically determine how many years have passed when Paul's car has 10,000 more miles on it than Amanda's car if this pattern continues.

Lesson #59 More Real Life Systems of Equations

1. A customer is comparing two different text message plans at Cellular Bargains. He wants to find out which plan allows the most text messages for the same cost.

The Pay Per Text Plan charges $10 per month and $0.10 for each text message. Write a function that models this plan, stating what your variables represent.

The Frequent Text Plan is modeled by the graph shown below.

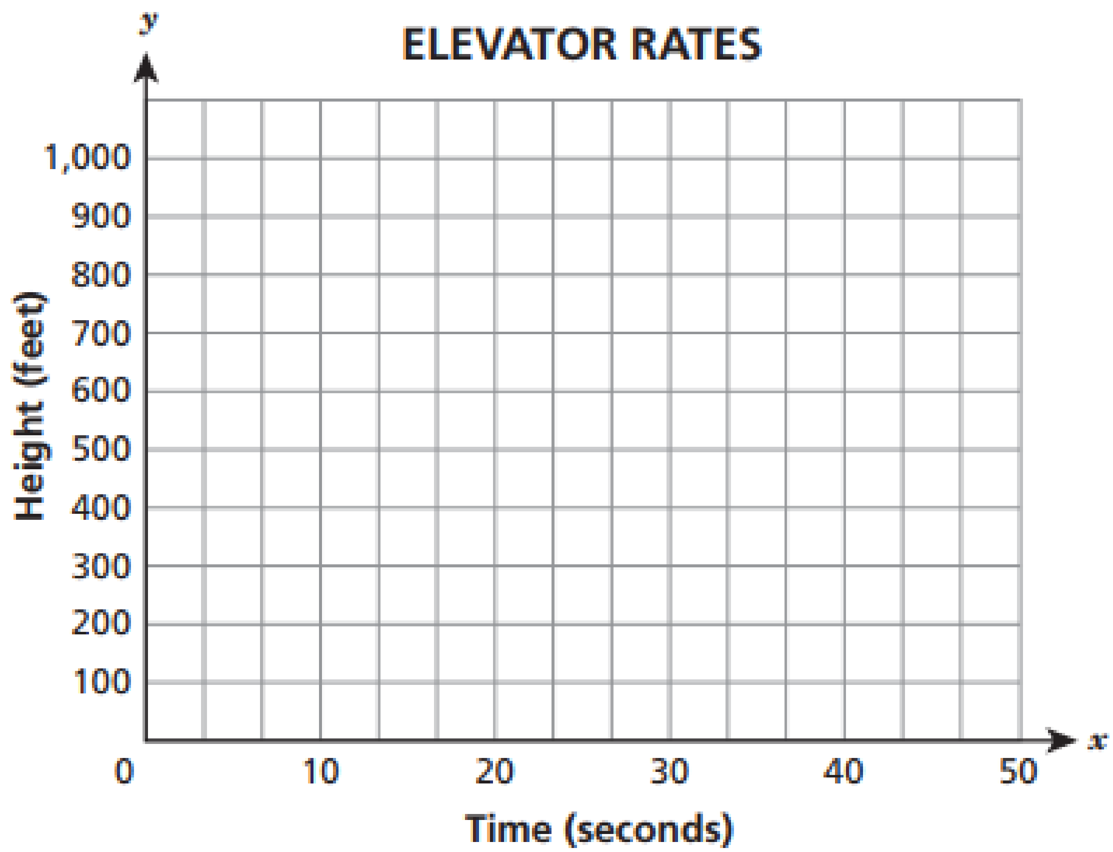


How many text messages would result in the same cost per month for the two plans? Show your work.

2. The express elevator in the Empire State building in New York City travels nonstop from the ground floor to the top floor at a rate of 1,400 feet per minute.

The express elevator at the John Hancock Center in Chicago travels nonstop from the ground floor to the observatory on the top floor at a rate represented by the equation $y = 30x$, where y is the height, in feet, and x is the number of seconds.

Graph the two relationships on the grid below to compare the rates of the two elevators.



Which elevator travels at a faster rate? Explain.

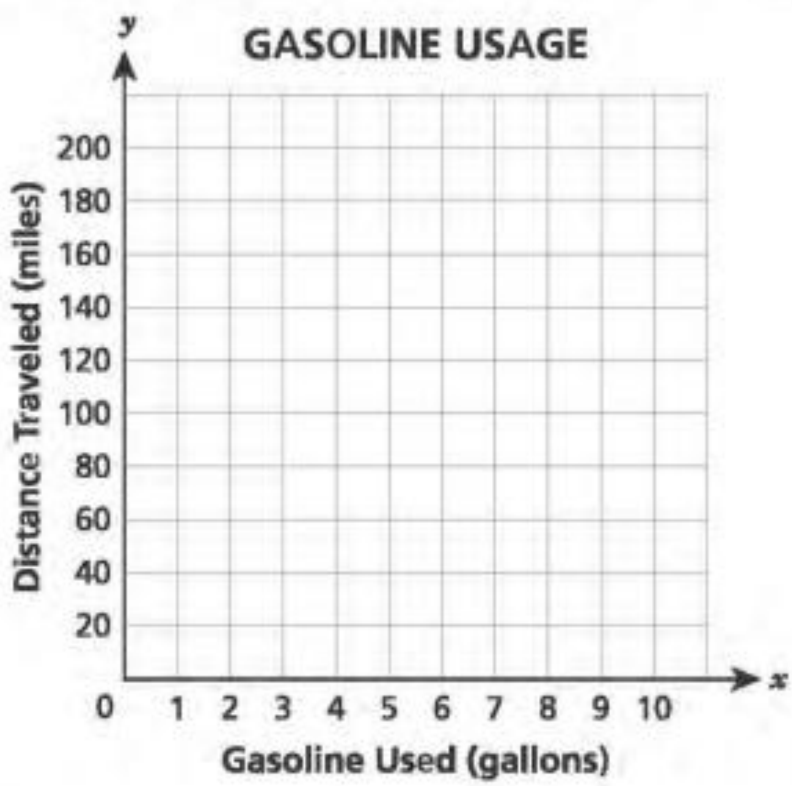
HW #59 More Real Life Systems

Stanley drove his car on a business trip. When he left, the mileage was 840 miles, and when he returned, the mileage was 1,200 miles. The car used 12 gallons of gasoline for this trip. Write an equation that models the average gas mileage during this trip.

Draw a graph on the grid below to show the relationship between gasoline used, x, and the distance traveled, y, during Stanley's trip.

Carla made the same trip as Stanley, but her car used only 10 gallons of gasoline. Write a second equation that models Carla's average gas mileage.

Graph the gasoline usage of Carla's car on the same grid as Stanley's car.



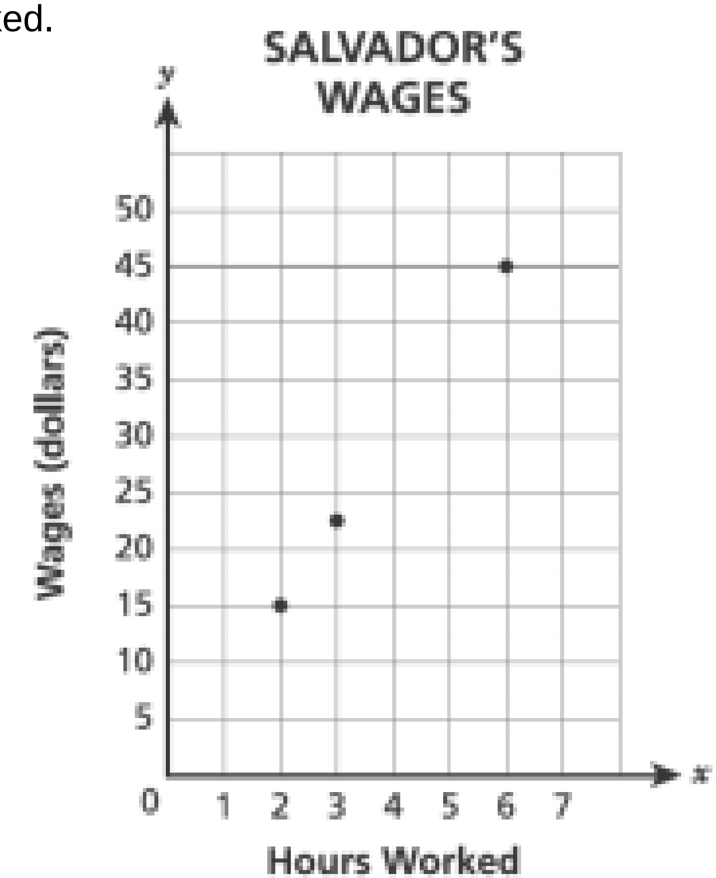
How do the slopes for Stanley's and Carla's cars compare?

Lesson #60 More Real Life System Scenarios

1. The table and the graph below show Josie's and Salvador's wages, respectively, based on the number of hours worked.

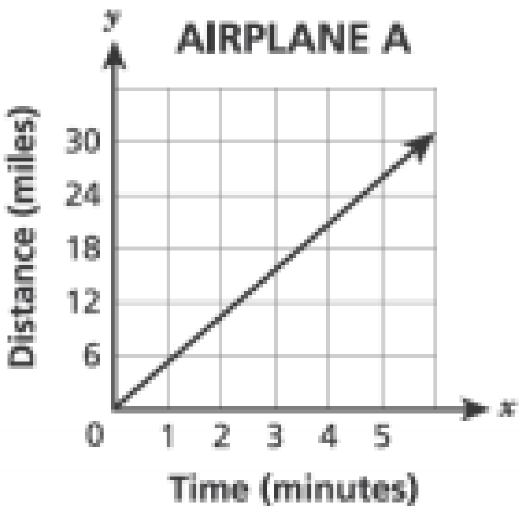
JOSIE'S WAGES

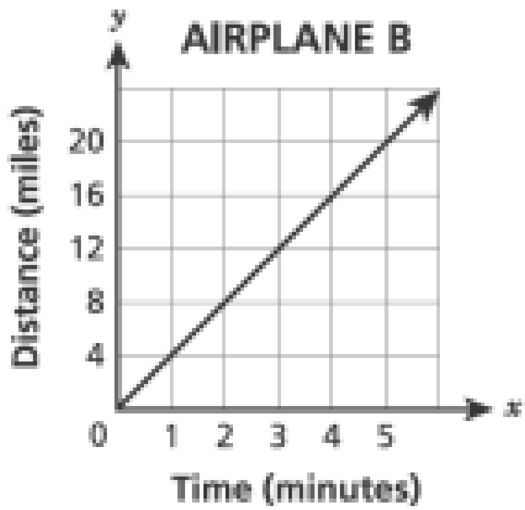
Hours Worked	Wages (dollars)
3	26.25
5	43.75
7	61.25



In 2010, Josie and Salvador each worked an eight-hour day for five days each week. How many weeks did it take Josie to earn $1,000 more than Salvador? Show your work.

2. The graphs below show the relationship between elapsed time and distance traveled by airplane A and airplane B after each airplane reached its cruising speed. Write an equation that models each of their speeds.



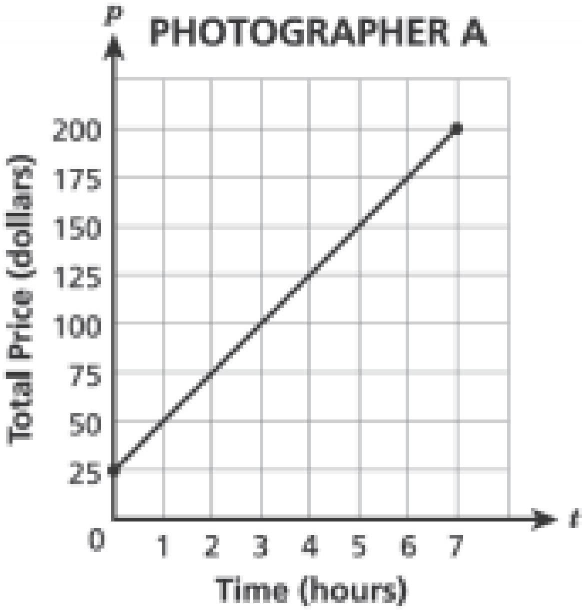


Airplane C is traveling at a different cruising speed. The equation $y = \frac{27}{6}x$ can be used to determine the number of miles traveled in minutes. Order the Airplanes from least to greatest cruising speeds.

If all three airplanes were to take off from the same airport, how many minutes would it take Airplane A to be 150 miles further than Airplane C? Show your work.

HW #60 More Real Life Systems

Two photographers offer different pricing plans for their services. The graph below models the prices Photographer A charges. The table below shows the prices Photographer B charges. Each photographer charges a one time equipment fee and an hourly rate.



PHOTOGRAPHER B

Time (hours)	2	4
Total Price	$80	$110

Write a function that models each Photographer's prices.

Who charges more per hour? Explain.

At what amount of time with both photographer charge the same amount? Show your work.

Lesson #61 Linear Function Word Problems in Two Variables

Equations that require two variables are written is what is called standard form, ax + by = c. Use this formula to create equations that model the following scenarios.

1. Justin went to the Bagel Store to order coffees and bagels for his staff at work. Each bagel cost \$2.50 and each coffee costs \$1.75. Justin has a total of \$50 to spend.

Part A Write a function that represents the number of coffees (x) and bagels (y) that Justin can purchase.

Part B Use the function created above to determine how many bagels Justin can get if he gets 10 coffees.

Part C Use the same function to determine how many coffees Justin can get if he gets 6 bagels.

Part D Can Justin order exactly 12 coffees and 12 bagels? Show your work.

Part E Are the following coordinates also solutions? Show your work.

(8, 15) (30, 3)

2. A pet sitting company watches cats and dogs daily. They charge \$40 for dogs and \$25 for cats. One day the company collected \$1600.

Part A Write a function that represents the number of dogs (x) and cats (y) that the company watched that day.

Part B Use the function above to determine how many dogs were there on the day described if there were 8 cats.

Part C Use the function above to determine how many cats were there on the day described in there were 30 dogs.

Part D Use the function above to determine if there could have been 25 cats and 25 dogs there that day.

Part E Are the following coordinates also solutions? Show your work.

(24, 25)   (4, 38)

HW #61 Linear Function Word Problems in Two Variables

Mrs. Keesler is ordering expo markers and white boards for her classroom. Each package of expo markers costs $12 and each white board costs $2.40. She has a total of $300 to spend.

Part A Write a function that represents the number of packages of expo markers (x) and white boards (y) that Mrs. Keesler can purchase with $300.

Part B Use the function above to determine how many white boards Mrs. Keesler can order if she needs 8 packages of markers.

Part C Use the function about to determine how many packages of markers Mrs. Keesler can order if she needs 30 white boards.

Part D Use the function to determine if Mrs. Keesler can order exactly 17 packages of markers and 40 white boards.

Part E Are the following coordinates also solutions? Show your work.

(22, 15) (50, 10)

Lesson #62 Using Elimination to Solve a System of Equations written in Standard Form

To use the elimination method:

1. Determine if there is a pair of x or y coefficients that are ______________________.

   a. If there is go to step two.

   b. If not,_____________________ one of the equations by a number that will make the equation have an _________________coefficient for one of the variables.

2. Line up the equations vertically and combine like terms so that either the x values of y values _____________________.

3. Solve for the remaining ____________________.

4. Substitute the answer from step three into each equation to find the ____________ for the other variable.

5. Write the final solution as a ______________________.

Examples:

1. $\begin{cases} 2x + 5y = 22 \\ x - 5y = -19 \end{cases}$

2. $\begin{cases} 3x - 7y = -27 \\ -3x + 8y = 30 \end{cases}$

3. $\begin{cases} 6x + y = 3 \\ 4x - y = -23 \end{cases}$

4. $\begin{cases} 7x - 3y = 46 \\ -7x + 8y = -76 \end{cases}$

5. $\begin{cases} 4x + y = 8 \\ 5x - 2y = 23 \end{cases}$

6. $\begin{cases} 5x - 6y = 20 \\ 4x + 2y = -18 \end{cases}$

7. $\begin{cases} 3x - 8y = 15 \\ 9x - 24y = 45 \end{cases}$

8. $\begin{cases} 2x + 7y = 30 \\ 4x + 14y = 30 \end{cases}$

HW #62 Using Elimination to Solve a System of Equations written in Standard Form

Find the solution for each of the following systems of equations:

1. $\begin{cases} 3x - 5y = 26 \\ x + 5y = -18 \end{cases}$

2. $\begin{cases} 6x + 10y = 24 \\ -6x - 22y = 12 \end{cases}$

3. $\begin{cases} -6x + 8y = 38 \\ 4x - 4y = -24 \end{cases}$

4. $\begin{cases} 5x - 6y = 1 \\ 2x + 2y = 18 \end{cases}$

Lesson #63 Using Elimination to Solve a System of Equations written in Standard Form

1. $\begin{cases} x + y = 12 \\ x - y = 2 \end{cases}$

2. $\begin{cases} 3x + 4y = 9 \\ -3x - 2y = -3 \end{cases}$

3. $\begin{cases} 10x - 7y = 2 \\ -5x + 3y = -3 \end{cases}$

4. $\begin{cases} 8x - 3y = 4 \\ -4x + 4y = 8 \end{cases}$

5. $\begin{cases} x - 4y = 2 \\ 3x + 5y = 40 \end{cases}$

6. $\begin{cases} 12x + 3y = 18 \\ -4x + 2y = 12 \end{cases}$

7. $\begin{cases} 2x - 5y = 80 \\ 7x + 4y = 65 \end{cases}$

8. $\begin{cases} 9x + 15y = 42 \\ 4x + 20y = -8 \end{cases}$

None or Infinite? Why?

9. $\begin{cases} 12x - 20y = -8 \\ 3x - 5y = 2 \end{cases}$

10. $\begin{cases} 24x + 18y = 36 \\ 8x + 6y = 12 \end{cases}$

HW #63 Using Elimination to Solve a System of Equations written in Standard Form

1. $\begin{cases} 2x - 5y = -76 \\ 3x + 4y = 24 \end{cases}$

2. $\begin{cases} 2x + y = -4 \\ 3x + 4y = 9 \end{cases}$

3. $\begin{cases} -x - 4y = 5 \\ -5x + 7y = -56 \end{cases}$

4. $\begin{cases} -3x + 8y = 4 \\ 4x - 9y = 84 \end{cases}$

None or Infinite? Why?

5. $\begin{cases} 9x - 12y = -24 \\ 18x - 24y = -48 \end{cases}$

6. $\begin{cases} 6x + 15y = 40 \\ 30x + 75y = 90 \end{cases}$

Lesson #64 Real World Systems of Equations

1. _____________ the problem.
2. Identify the two _____________________.
2. Write _____________________________ that can be used to solve the system using elimination.
3. _____________ for one variable.
4. ________________________the solution found in step three into each equation to find the solution for the _____________________________.

Examples:

1. Jenna babysits and works at a coffee shop. One week she babysat for 4 hours and served coffee for 10 hours and earned a total of $127. Another week she babysat for 8 hours and served coffee for 8 hours and earned $140. How much does she make per hour at each job?

2. Mrs. Keesler went shopping for rulers and scissors; she bought 30 items in all. Rulers cost $0.50 and scissors cost $1.25. She spent a total of $31.50. How many rulers and scissors did she buy?

3. Mr. Haver went shopping for whiteboards and markers; he bought 40 items in all. Whiteboards cost $3 each and markers cost $0.50 each. He spent a total of $70. How many of each did he buy?

4. Jodi runs a daycare. One day she had four infants and five toddlers and made a total of $390. The next day she had two infants and six toddlers and made a total of $342. Determine how much she charges per day for infants and toddlers.

5. The drama club is selling tickets to see their play. Tickets for students cost $6, otherwise they are $8 each. They have a total of 300 seats available and want to raise $2000. How many of each ticket must they sell?

HW #64 Real World Systems of Equations

1. A group of students and teachers went to the zoo on a field trip. One student ticket and one chaperone ticket together cost $30. 150 students and 15 chaperones went on the trip for a total of $2,070. Write a system of equations to determine the cost of a student ticket and a chaperone ticket.

2. The white team teachers bought 15 pizza pies and 8 bottles of iced tea for their students at the end of the school year and their bill came to $182.60. One pie and one bottle of iced tea only cost $13.20. Write a system of equations to determine how much one pie and one bottle of iced tea cost.

Lesson #65 Systems of Equations Continued

Create and solve a system of equations for each scenario given.

1. Charlotte runs a pet-sitting service, for cats and dogs, out of her house. She takes care of 8 animals total per day and charges $20 per day for cats and $25 per day for dogs. One day she made a total of $185. How many of each pet did she have?

2. Mrs. Keesler brought her son and daughter to the movies to see CoCo. Two children's tickets and one adult ticket cost $23. The following weekend they went again and brought more people to see Jumangi. Five children's tickets and two adult tickets cost 52.50. How much does each ticket cost?

3. A baseball manager bought 4 bats and 9 balls for $76.50. On another day, she bought 3 bats and one dozen balls at the same prices and paid $81. How much did she pay for each bat and ball?

4. Mr. Moran orders out of Friday night. One weekend he ordered one pizza pie and an order of wings for $21.75. The following weekend he had guests over and ordered five pies and three orders of wings for $89.25. Find the price of a pizza pie and one order of wings.

5. A concert venue sells tickets floor level seating for $120 and balcony seats for $75, One night they had 800 seats sold for a total of $73,320. How many of each seat were sold?

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Create and solve a system of equations for each scenario given.

1. The girls scouts are selling cookies and brownies. One box of cookies and one box of brownies together cost $7.50. One day Elizabeth sold 12 boxes of cookies and 6 boxes of brownies for a total of $66. How much does each box of cookies and each box of brownies cost?

2. Jonathan works for a landscaping company and a car wash while going to college. One week he worked 20 hours landscaping and 8 hours washing cars and made a total of $296. Another week her worked 16 hours landscaping and 16 hours washing cars and made $328. How much money per hour does he make at each job?