

Title: Whose Line is it Anyway?

Brief Overview:

Students will use Systems of Equations to develop ideas relating to savings plans and a spending budget that they would use for their senior trip or any trip they would plan for.

NCTM Content Standard/National Science Education Standard:

- Student will demonstrate the ability to develop systems of linear equations to model real-world situations.
- Systems of linear equations will be solved using a variety of methods and the solutions will be interpreted in the context of the problem.

Grade/Level:

Grades 8 – 10, Algebra I

Duration/Length:

Four 50-minute lessons

Student Outcomes:

Students will be able to:

- Organize and interpret graphs of systems of linear equations with two unknowns.
- Write, solve and describe systems of linear equations.
- Take the skills of systems of equations in both slope-intercept and general form and apply those skills to real world scenarios and differentiate when each one is appropriate.
- Extract information from a system of equations.
- Calculate the point of intersection if it exists.
- Interpret the rates of change in the context of the problem.
- Analyze the system to choose the best outcome for the desired situation.

Materials and Resources:

- Graphing calculator
- Communicators
- Dry Erase markers
- Graph paper
- Paper
- Pencils
- Guided worksheets

- Selected Response Cards
- Matching Systems overhead transparencies
- Match Me an Equation!
- System of Equations Guided Notes
- System of Equations Exit Ticket
- System of Equations Homework
- Concentric Circles game
- Earning Money for Your Graduation Trip: #1 - 3
- Guided worksheet template
- Scoring Rubric
- Homework Day 2
- System of Equations in Slope-Intercept Form Quiz
- Spending Money for Your Graduation Trip #1 – 3
- Homework Day 3
- Systems of Equations Summary

Development/Procedures:

Lesson 1

Preassessment – Distribute a set of “Selected Response Cards” to students. Each student should receive four cards, with ‘A’, ‘B’, ‘C’, and ‘D’ printed on them. Display a graph of a system of equations along with four possible systems of equations to match the graph (see “Matching Systems” worksheet) as an overhead transparency. Ask students to hold up the corresponding letter of selected response that matches the system. Repeat this process for all six systems of equations. Note that the answer to each system appears at the bottom, right corner of each sheet. Be sure to cover this with a sticky note so students cannot see this when the transparency is projected. Play a multiple choice game for five to six minutes to review these entry level skills.

Launch – Administer the “Match Me an Equation!” worksheet that requires students to match slope-intercept to standard form equations. After ten minutes, review the worksheet. Choose two equations to form a system of equations. Graph and solve the system using the graphing calculator to ensure skill competency. Summarize skill prerequisites for five minutes. Conduct a brief five minute summary to ensure that prerequisite skills are mastered. Skills include identifying and understanding the roles of slope, y-intercept, and the point of intersection. Students should be reminded of three ways to find the point of intersection: constructing a table of values, graphing the lines, or solving algebraically.

Teacher Facilitation – Presentation of the new concept. Teacher will conduct a short discussion about planning a trip, such as a graduation trip, and all factors that are involved. This can be driven by the individual teacher to prepare based on their personal experiences with travel, or by discussing with students who may never have had an experience going on vacation. They can make a list of what is important or necessary, such as hotel, food, and entertainment. Teacher will have student brainstorm the elements for five minutes. After brainstorming, teacher will guide the conversation to include two major elements: earning and spending. Ask students to find a connection between earning and spending. They should be able to conclude that the more one earns, the more one has to spend. Explain to students that over the next few days they will learn how to construct personalized systems of equations to make decisions regarding their income and spending habits. Teacher will distribute guided notes that include the necessary vocabulary words and an example of a real life system of saving money. Presentation of the new concept. Teacher will introduce the scenario of planning for a graduation trip. Teacher will have students brainstorm the elements involved for five minutes. After brainstorming, teacher will guide the conversation to include two major elements: earning and spending. Teacher will distribute guided notes that include the necessary vocabulary words and an example of a real life system of saving money.

Student Application– The students will discuss the example on the guided notes sheet titled, “System of Equations Guided Notes”. The teacher will ask students for their explanations of the vocabulary terms and then state the appropriate definition to fill in the worksheet. The worksheet will model three time related questions which will help students to write a system of equations in slope-intercept form, given a real world situation.

Embedded Assessment– Distribute the “System of Equations Exit Ticket” which includes an additional word problem for students to complete to ensure their understanding of word problems involving a system of equations. Teacher should collect the exit tickets to check for student competency.

Reteaching/Extension – At the end of the lesson, ask students if they can think of some of their own real-life scenarios that can translate into a system of equations. For homework,

students will complete a worksheet that contains various scenarios involving systems. The students will be required to interpret the data in the word problems, set up equations, and perform simple computations. A worksheet that follows the same format as the class assignment will be distributed for homework. To modify worksheets for students needing additional support, omit questions from the sheets. A modified homework sheet is supplied for those students requiring additional support. Problems were retrieved from Punchline Algebra Book A@2006 March Mathworks.

Lesson 2

Preassessment - Review the answers to the Exit ticket and homework problems. The Concentric Circles game will be implemented as a warm-up to review entry level skills. The game will include questions that require students to analyze linear graphs (slope, y – intercept, consistent, inconsistent and dependent.) To play the concentric circles game, arrange the desks/chairs in the classroom into two concentric circles, with the two circles facing each other. Divide the class in half. Half of the students will sit in the outside circle, and the other half will sit in the inside circle. Any additional students will rotate in as one student rotates out so that all will get a turn. Distribute one card for each pair. The pairs will work together to solve the problem. When the timer goes off, the students should have completed the problem and then they will rotate seats. The outer circle will rotate clockwise, and the inner circle will move counterclockwise. All students will answer each question and be paired with a different partner as the circles rotate.

Launch – Select various problems from the concentric circles preassessment, display them on the overhead and discuss student responses to questions listed therein.

Teacher Facilitation – Teacher will divide students into groups of two to three and have each group randomly select one of three options of systems related to senior trip and earnings. Teacher should make note to point out that the earning systems of equations are in slope intercept form. Teacher will distribute the guided worksheet for groups to complete. The guided worksheet should include the rubric for students to follow as their presentation grade will be based

from rubric. Teacher will also distribute a worksheet to help students graph the systems. Students will use the worksheets to present their conclusions later on.

Student Application – Each group must determine the independent and dependent variables, set up the equations, and answer all questions on the selected system. Groups must make sure all questions are answered in the context of the problem. After working through the scenario, each group is required to complete their presentation on day four on a Communicator that will be collected at the end of this day. A rubric will be attached to each scenario to guide students for completeness.

Embedded Assessment – Trade and grade for groups that have the same problem.

Reteaching/Extension – Each group will receive worksheets to complete for homework related to an alternate scenario.

Lesson 3

Preassessment – Review homework for accuracy. When teacher determines student competency, a brief one system quiz will be administered.

Launch – Engage students in a discussion on how well they gathered earnings data for their trip. The purpose of this discussion is to get students to see that most of the earnings systems of equations dealt with the slope-intercept format of equations. It related to earning money through jobs, savings accounts etc. Now there are two things they will be spending money on at the same time, and we need to get them to switch their train of thinking over to standard form of the equation. Direct the discussion from making money to spending money on their vacations. Discussion should include major costs incurred on vacation. Discuss what are priorities, such as hotel preference (economy v. luxury), transportation (flying v. ground transportation), food (fancy v. fast food), and entertainment (low budget v. high budget).

Teacher Facilitation – Teacher should select the personal choice of their desired vacation or restaurant to model constructing a standard form system of equations.

Sample Problem:

A group of students takes their math teacher out for lunch because they did so well on their final exam. If the students order five steaks and four fried chicken salads, the bill will be \$106.50. If four have steaks and five have fried chicken salads, the bill will be \$102.75.

- Write the system of equations for this scenario.
- What is the price of a steak?
- What is the price of the fried chicken salad?

The teacher should model how to analyze and break apart the problem. This will help guide the students' ability to extract the information from the word problem and create the appropriate system of equations. Use the modeling process to break down the entire problem solving procedure.

Student Application – Students will return to their groups from Day 2. Each group will again select one of three guided worksheets containing a standard form system of equations word problem pertaining to spending money while on vacation. Use the same verbal/table/graph/algebraic equation graphic organizer from day two to assist students in organizing their work. Use the same rubric for evaluating students.

Embedded Assessment - Trade and grade for groups that have the same problem.

Reteaching/Extension– Each group will receive worksheets to complete for homework related to an alternate scenario.

Lesson 4

Preassessment – Teacher will place the homework example on the board to ensure accuracy. Ask questions to review all concepts taught relating to standard form systems of equations.

Launch - Lead a brief discussion on the similarities and differences between earning and spending on this vacation. Make sure to include the different forms of the equation.

Teacher Facilitation – Teacher will randomly select a group to begin presentations. There will be a total of six presentations, one from each scenario for earning and one

from each scenario from spending. Conduct a “trade and grade.” Each group will trade their project with another group that has a different scenario. Using the rubric from the HSA they will be responsible for grading the scenario. Then the teacher will make overheads of the graded scenarios to show the class and ask them if the grade given by the one group is appropriate and why. If not, what would the group deserve and why. This strategy really gives the students an idea of what goes into grading an ecr/bcr - what is acceptable what is not. It is an extremely powerful tool and the students are using their input to make these decisions.

Student Application – Teacher will facilitate the trade and grade. Students will explain their results and demonstrate an application of the skills.

Embedded Assessment – Teacher and students will conduct assessments using a rubric while students are presenting to each other.

Reteaching/Extension – Teacher will distribute for homework a set of word problems that are either slope-intercept form or general form systems of equations. Students will be required to identify the variables, label, set up the equations, identify what type of system (slope-intercept or general form) and include what the scenario is asking them to find in the context of the problem. This will provide closure that students can differentiate between the two forms of the equations and how the word problems are different.

Summative Assessment: The results from the rubric will serve as an assessment for this instruction.

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Selected Response Cards

A	A	A
B	B	B
C	C	C
D	D	D

Matching Systems Transparencies

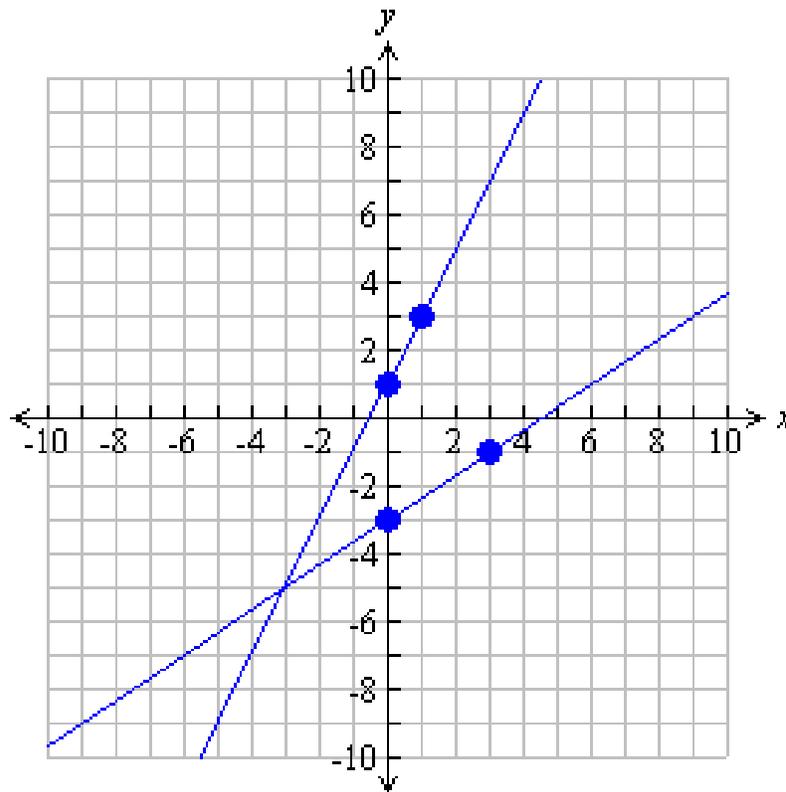
System # 1:

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

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

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

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



ANSWER: B

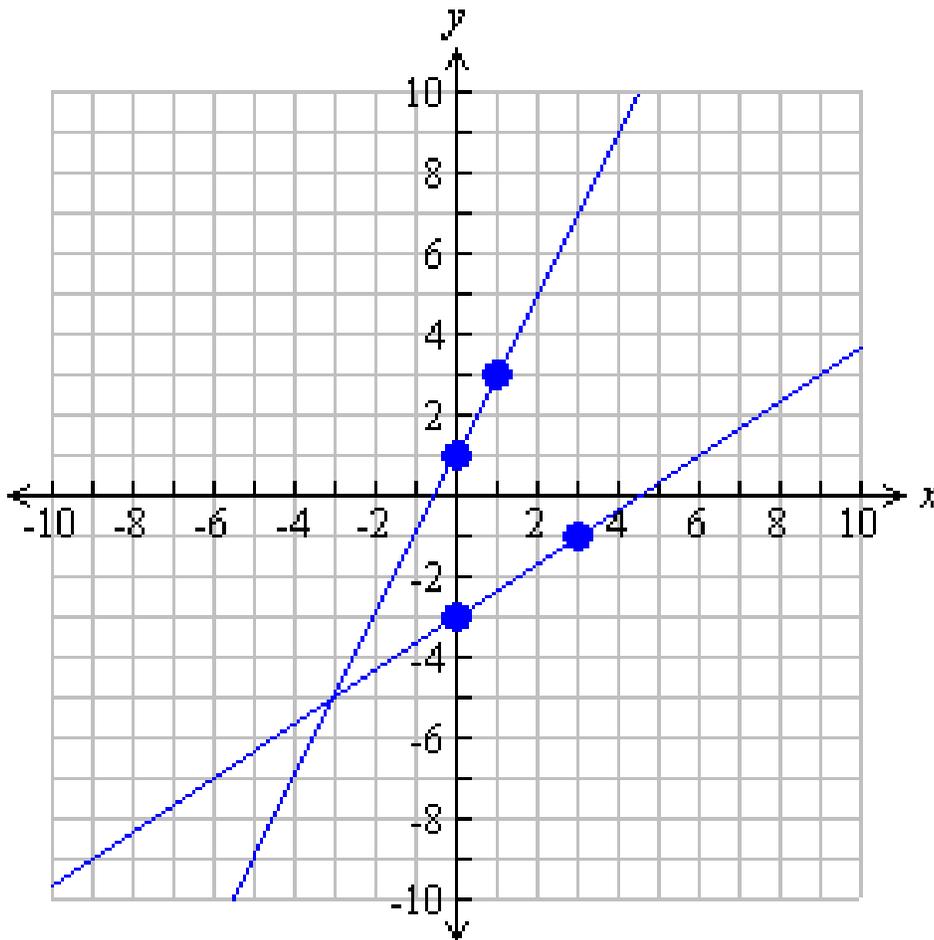
System # 2:

$$\text{A) } \begin{cases} y = 2x + 1 \\ -2x + 3y = -9 \end{cases}$$

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

$$\text{C) } \begin{cases} y = \frac{1}{2}x - 1 \\ y = 2x + 1 \end{cases}$$

$$\text{D) } \begin{cases} -2x + 3y = -9 \\ y = \frac{1}{2}x - 1 \end{cases}$$



ANSWER: A

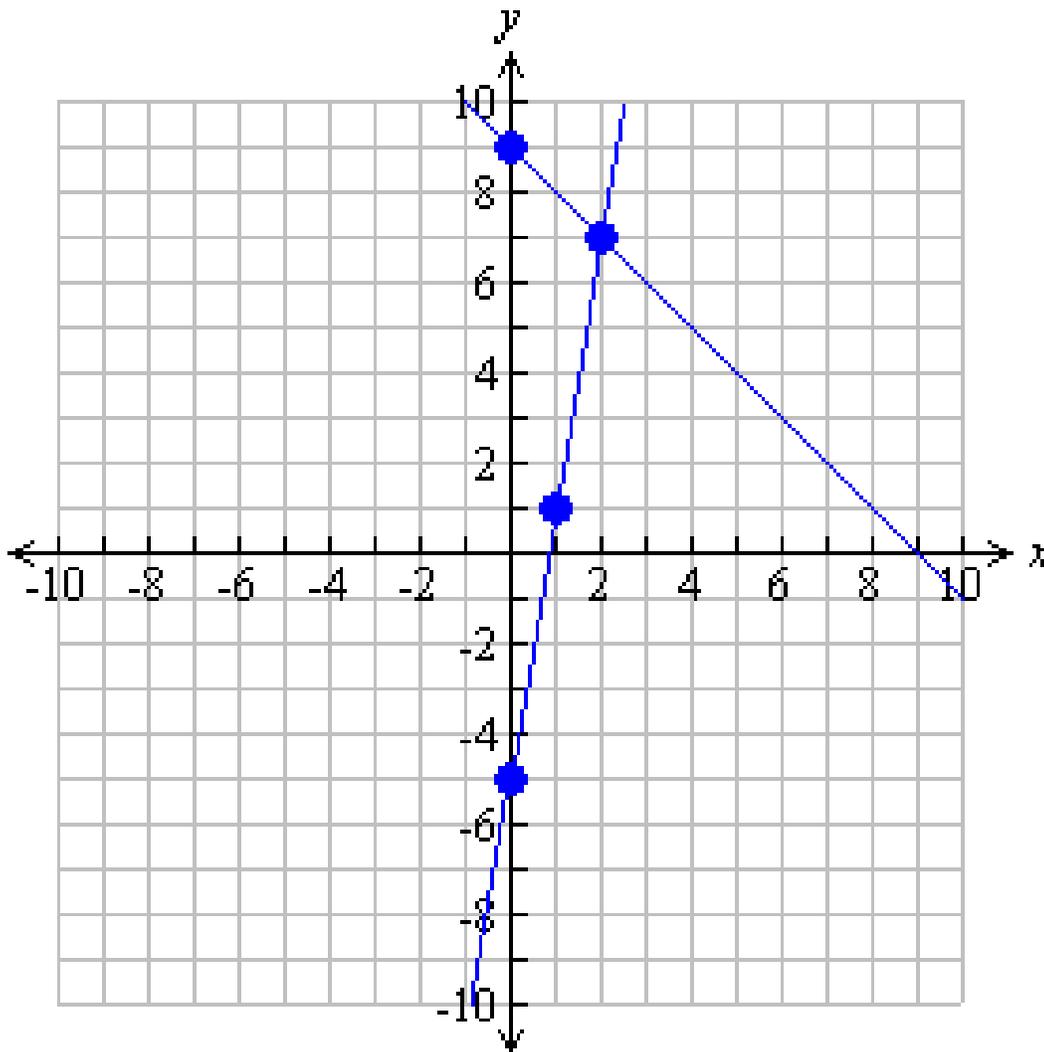
System # 3:

$$\text{A) } \begin{cases} x - y = 9 \\ 6x + y = -5 \end{cases}$$

$$\text{B) } \begin{cases} y = 6x - 5 \\ 6x + y = -5 \end{cases}$$

$$\text{C) } \begin{cases} 6x + y = -5 \\ y = x - 9 \end{cases}$$

$$\text{D) } \begin{cases} y = -x + 9 \\ y = 6x - 5 \end{cases}$$



ANSWER: D

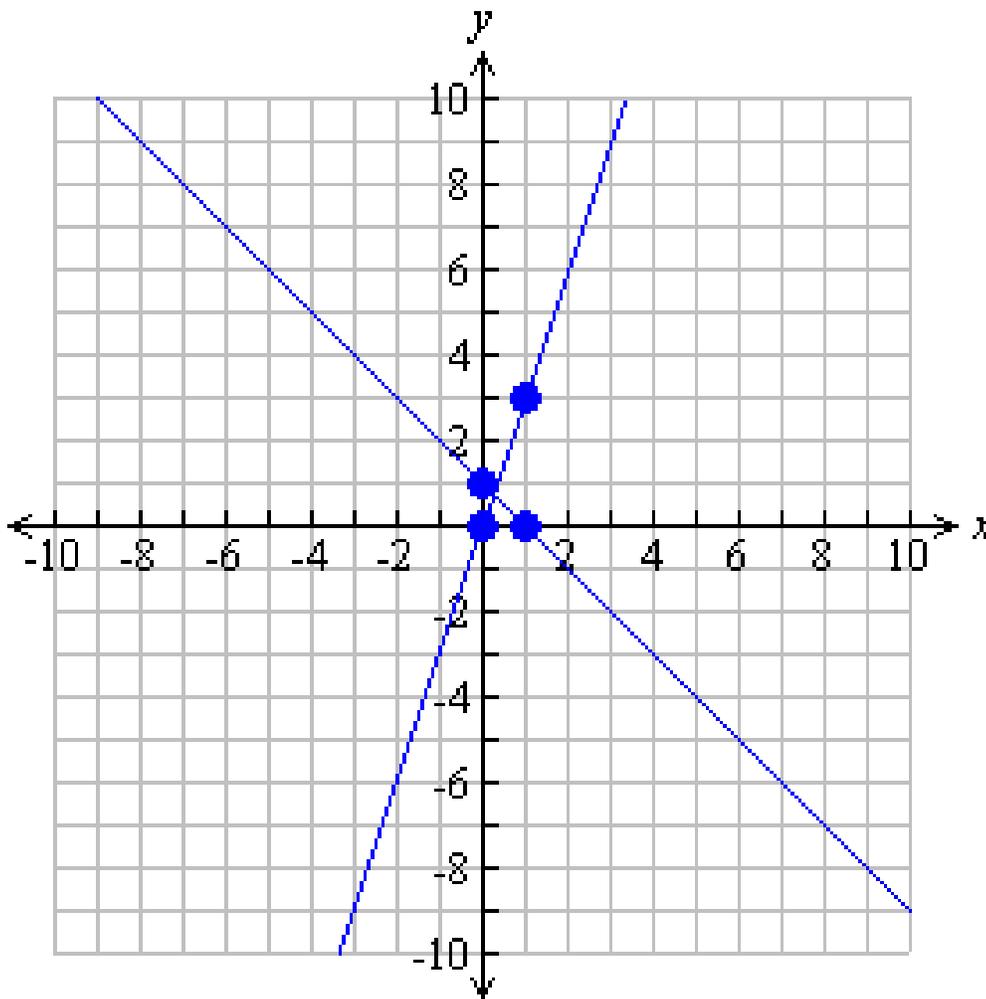
System # 4:

$$\text{A) } \begin{cases} y = x + 3 \\ y = -x + 1 \end{cases}$$

$$\text{B) } \begin{cases} x + y = 1 \\ y = 3x \end{cases}$$

$$\text{C) } \begin{cases} y = 3x \\ y = -x + 1 \end{cases}$$

$$\text{D) } \begin{cases} y = -x + 1 \\ y = \frac{1}{3}x \end{cases}$$



ANSWER: C

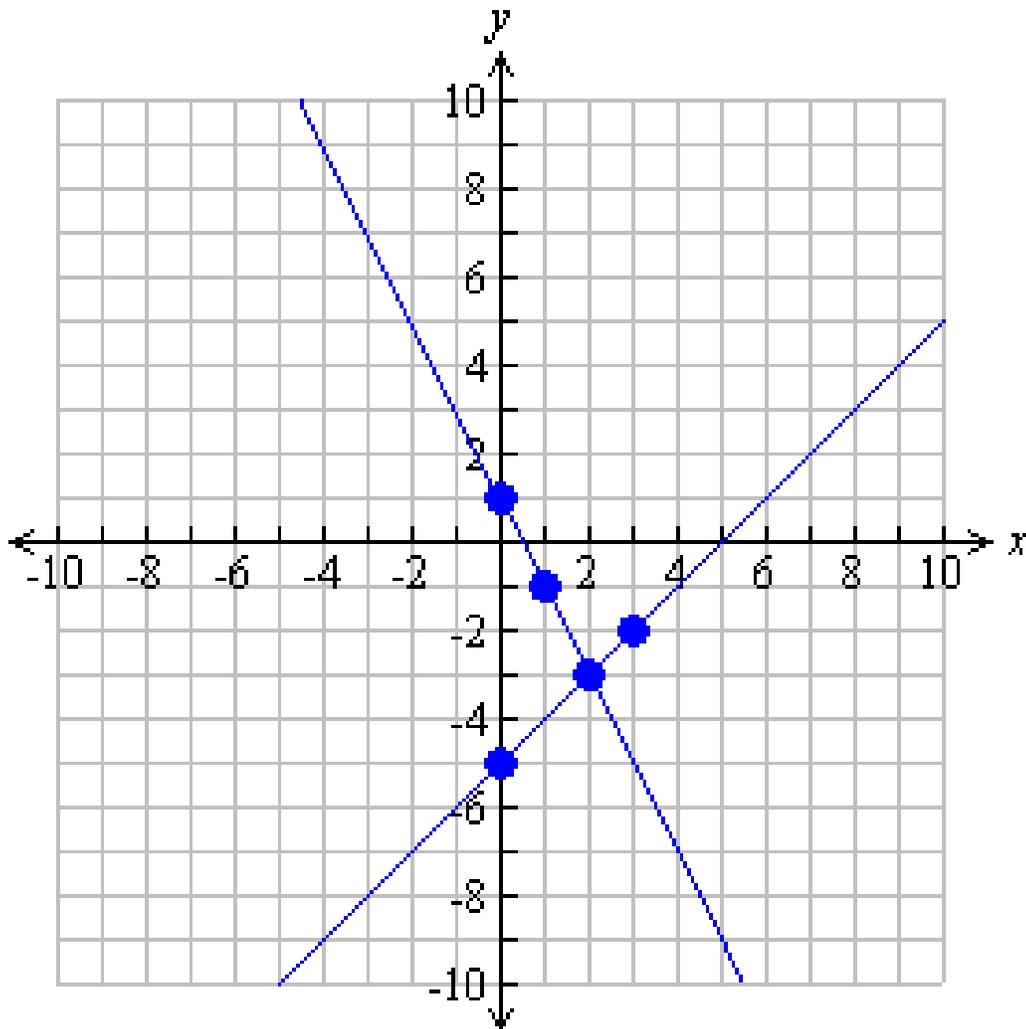
System # 5:

A) $\begin{cases} y = -2x + 1 \\ y = x - 5 \end{cases}$

B) $\begin{cases} y = 2x + 1 \\ y = x - 5 \end{cases}$

C) $\begin{cases} y = x - 5 \\ y = 5x \end{cases}$

D) $\begin{cases} y = 5x \\ y = -2x + 1 \end{cases}$



ANSWER: A

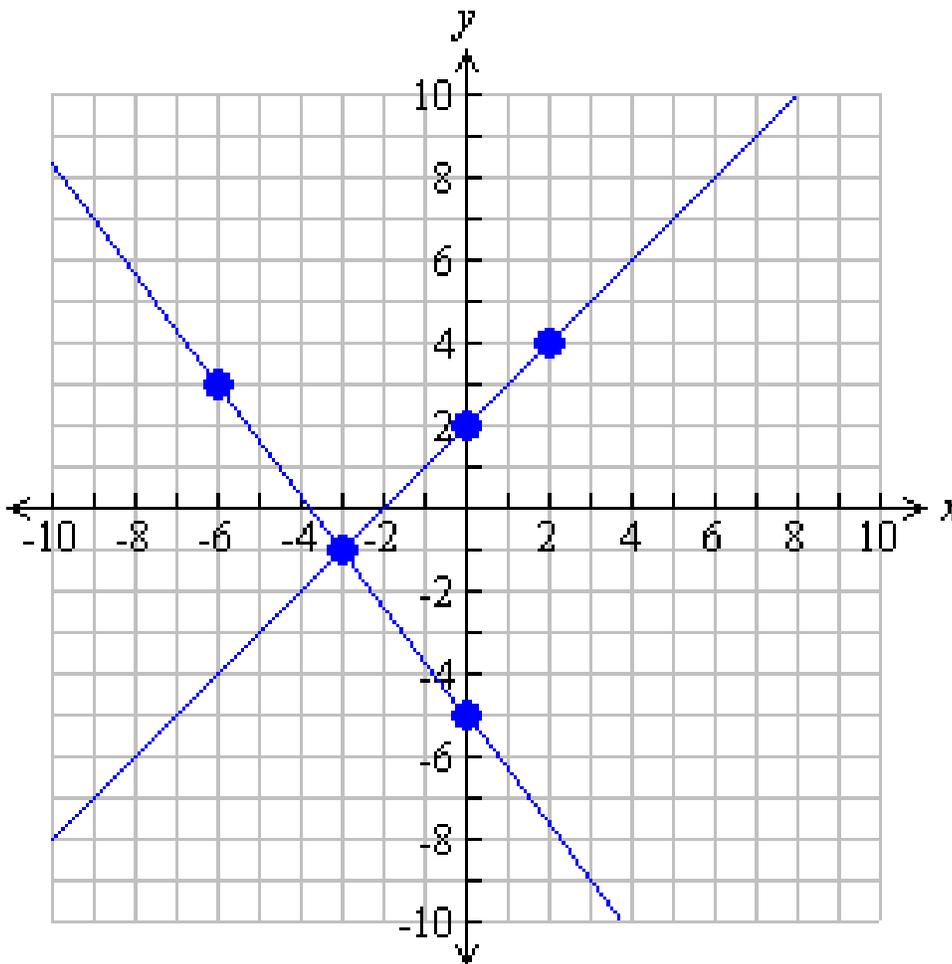
System # 6:

$$\text{A) } \begin{cases} y = 2x \\ y = \frac{-4}{3}x - 5 \end{cases}$$

$$\text{B) } \begin{cases} 4x + 3y = -5 \\ y = 2x \end{cases}$$

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

$$\text{D) } \begin{cases} 4x + 3y = -5 \\ y = \frac{-4}{3}x - 5 \end{cases}$$



ANSWER: C

Match Me an Equation!

Name: _____
Date: _____

Directions: Write the letter of each equation from Column B next to its corresponding equation in Column A.

Column A

A	$y = 3x + 2$
B	$3x + 2y = 6$
C	$y = \frac{2}{3}x - 2$
D	$2x - y = 6$
E	$y = -3x + 2$
F	$x + 2y = 2$
G	$2x - 3y = -6$

Column B

1.	$y = 2x - 6$
2.	$y = -\frac{1}{2}x + 1$
3.	$-3x + y = 2$
4.	$3x + y = 2$
5.	$y = -\frac{3}{2}x + 3$
6.	$y = \frac{2}{3}x + 2$
7.	$-2x + 3y = -6$

Match Me an Equation!

Name: ANSWER KEY

Date: _____

Directions: Write the letter of each equation from Column B next to its corresponding equation in Column A.

Column A		Column B	
A	$y = 3x + 2$	1.	$y = 2x - 6$
B	$3x + 2y = 6$	2.	$y = -\frac{1}{2}x + 1$
C	$y = \frac{2}{3}x - 2$	3.	$-3x + y = 2$
D	$2x - y = 6$	4.	$3x + y = 2$
E	$y = -3x + 2$	5.	$y = -\frac{3}{2}x + 3$
F	$x + 2y = 2$	6.	$y = \frac{2}{3}x + 2$
G	$2x - 3y = -6$	7.	$-2x + 3y = -6$

Vocabulary:

Term	Definition
Dependent variable	
Independent variable	
Rate	
Fixed rate	
Rate of change	
Base pay	
Signing bonus	

Example:

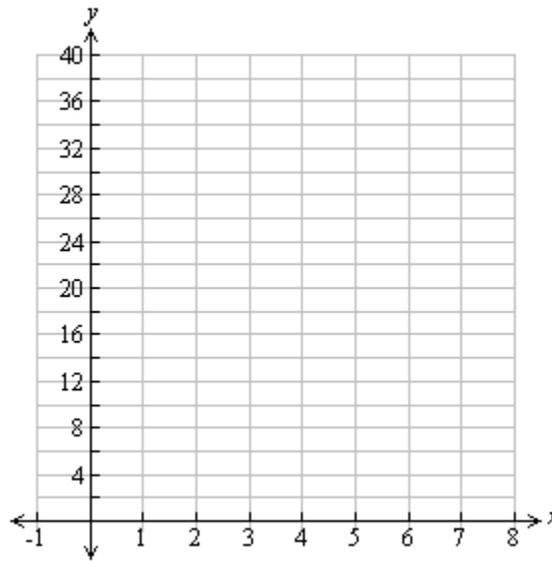
Terri is applying for summer jobs. She checks the Penny Saver and finds two different jobs.

Job A pays \$8 an hour

Job B pays \$5 an hour plus a signing bonus of \$12.

- Write an equation which represents the amount of money Terri will earn, y , for x hours on Job A.
- Write an equation which represents the amount of money Terri will earn, y , for x hours on Job B.
- Identify the rate of change in the equation for Job B. Explain what this rate of change means in the context of this situation.

- For how many hours will Terri earn the same amount of money at both jobs? Solve the system graphically. Circle the point of intersection.



- When does Job B pay more money than Job A?
- Which job would you prefer and why? Use mathematics to justify your answer.

Example 2: John has ideas for a school fundraiser.

Scenario A- Students will sell Hershey's chocolate bars at \$1 each. After writing a letter to the Hershey's company, the company agrees to give them \$25 for selling their product.

Scenario B- Students will sell Godiva chocolate bars at \$2 each.

- Write an equation which represents the amount of money John will earn, y , for x candy bars sold on Scenario A.
- Write an equation which represents the amount of money John will earn, y , for x candy bars on Scenario B.
- Identify the rate of change in the equation for Scenario A. Explain what this rate of change means in the context of this situation.
- For how many bars does John earn the same amount of money at both scenarios? Solve the system algebraically.
- When does Scenario B pay more money than Scenario A?
- Which job would you prefer and why? Use mathematics to justify your answer.

Example 3: Sarah's neighbors would like to hire her for babysitting.

Neighbor A- The Smith's will pay Sarah \$10 an hour plus a bonus of \$25.

Neighbor B- The Johnson's will pay Sarah \$15 an hour.

- Write an equation which represents the amount of money Sarah will earn, y , for x hours worked for Neighbor A.
- Write an equation which represents the amount of money Sarah will earn, y , for x hours worked for Neighbor B.
- Identify the rate of change in the equation for Neighbor B. Explain what this rate of change means in the context of this situation.
- For how many hours does Sarah earn the same amount of money at both scenarios? Solve the system using any method.
- When does Neighbor A pay more money than Neighbor B?
- Which job would you prefer and why? Use mathematics to justify your answer.

Vocabulary:

Term	Definition
Dependent variable	The variable that changes in response to the independent variable
Independent variable	The variable that is controlled and causes a change
Rate	Amount of a charge or payment per unit of time
Fixed rate	A rate that does not change
Rate of change	The degree to which a variable varies
Base pay	The starting salary with no rate involved
Signing bonus	Additional money that one earns, one time, at the beginning of a job

Example 1:

Terri is applying for summer jobs. She checks the Penny Saver and finds two different jobs.

Job A pays \$8 an hour

Job B pays \$5 an hour plus a signing bonus of \$12.

- Write an equation which represents the amount of money Terri will earn, y , for x hours on Job A.

$$y = 8x$$

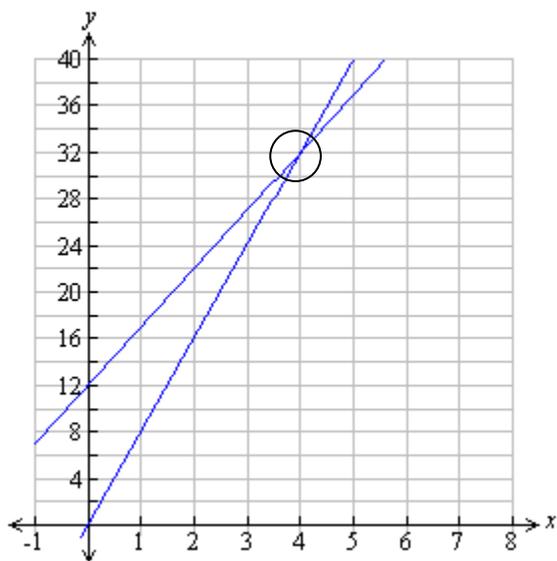
- Write an equation which represents the amount of money Terri will earn, y , for x hours on Job B.

$$y = 5x + 12$$

- Identify the rate of change in the equation for Job B. Explain what this rate of change means in the context of this situation.

The rate of change is 5. This is the amount of dollars Terri will earn per hour.

- For how many hours will Terri earn the same amount of money at both jobs? Solve the system graphically. Circle the point of intersection.



For four hours of work, both jobs will pay \$32.

- When does Job B pay more money than Job A?

Job B pays more if Terri works less than four hours.

- Which job would you prefer and why? Use mathematics to justify your answer.

Answers may vary. Sample answer: I would choose Job A because I would work for more than four hours.

Example 2: John has ideas for a school fundraiser.

Scenario A- Students will sell Hershey's chocolate bars at \$1 each. After writing a letter to the Hershey's company, the company agrees to give them \$25 for selling their product.

Scenario B- Students will sell Godiva chocolate bars at \$2 each.

- Write an equation which represents the amount of money John will earn, y , for x candy bars sold on Scenario A.

$$Y = x + 25$$

- Write an equation which represents the amount of money John will earn, y , for x candy bars on Scenario B.

$$Y = 2x$$

- Identify the rate of change in the equation for Scenario A. Explain what this rate of change means in the context of this situation.

The rate of change is 1 which means that for every bar that is sold, the profit increases by \$1.

- For how many bars does John earn the same amount of money at both scenarios? Solve the system algebraically.

Using substitution yields: $x + 25 = 2x$. Subtracting x from both sides gives $x = 25$.

When John sells 25 bars of either product he will have the same amount of money, \$50.

- When does Scenario B pay more money than Scenario A?

For more than 25 bars, Scenario B pays more money.

- Which job would you prefer and why? Use mathematics to justify your answer.

~~I would choose Scenario B because I think we will sell more than 25 bars. If we sold less than 25 bars, than Scenario A would yield a higher profit.~~

Example 3: Sarah's neighbors would like to hire her for babysitting.

Neighbor A- The Smith's will pay Sarah \$10 an hour plus a bonus of \$25.

Neighbor B- The Johnson's will pay Sarah \$15 an hour.

- Write an equation which represents the amount of money Sarah will earn, y , for x hours worked for Neighbor A.
 $Y = 10x + 25$
- Write an equation which represents the amount of money Sarah will earn, y , for x hours worked for Neighbor B.
 $Y = 15x$
- Identify the rate of change in the equation for Neighbor B. Explain what this rate of change means in the context of this situation.
The rate of change is 15, which means that for each hour Sarah babysits, her salary will increase by \$15.
- For how many hours does Sarah earn the same amount of money at both scenarios? Solve the system using any method.
Using substitution yields: $15x = 10x + 25$. Subtract $10x$ from both sides and then divide by 5. $X = 5$. When Sarah works for five hours, she earns the same amount at both sides.
- When does Neighbor A pay more money than Neighbor B?
Neighbor A pays more money up to five hours. After that, Neighbor B pays more.
- Which job would you prefer and why? Use mathematics to justify your answer. Answers may vary.

System of Equations
Exit Ticket

Name: _____
Date: _____

Devon's two favorite aunts send him money every year on his birthday. Devon's parents deposit the money into a savings account. Aunt Jeannie gives Devon \$50 for his first birthday and \$5.00 every birthday after that. Aunt Martha sends Devon \$10.00 for every birthday.



- Write an equation which models for the amount of money Aunt Jeannie gives Devon over x years.
- Write an equation which models for the amount of money Aunt Martha gives Devon over x years.
- What do each of the slopes represent in the context of the problem?
- Which gift from the Aunts has the steepest slope?
- On which birthday will Devon have received the same amount of money from both aunts?
- From which Aunt will he have received more money since birth through 5 years? Fifteen years?

Devon's two favorite aunts send him money every year on his birthday. Devon's parents deposit the money into a savings account. Aunt Jeannie gives Devon \$50 for his first birthday and \$5.00 every birthday after that. Aunt Martha sends Devon \$10.00 for every birthday.



- Write an equation which models for the amount of money Aunt Jeannie gives Devon over x years.
 $y = 5.00x + 50$
- Write an equation which models for the amount of money Aunt Martha gives Devon over x years.
 $y = 10.00x$
- What do each of the slopes represent in the context of the problem?
The slope represents how much money Devon will receive per year from his aunts on his birthday.
- Which gift from the Aunts has the steepest slope?
Aunt Martha's gift is steeper.
- On which birthday will Devon have received the same amount of money from both aunts? Use mathematics to justify your answer.
Jeannie's gift: $5(10) + 50 = 100$, Martha's gift: $10(10) = 100$
On his tenth birthday, he will have received \$100 from both Aunts.
- From which Aunt will he have received more money since birth through 5 years? Fifteen years?

0-5 years: Aunt Jeannie $y = 5(5) + 50 = 75$
 Aunt Martha $y = 10(5) = 50$

On his fifth birthday, Devon will have received more money from Aunt Jeannie by \$25.

15 years: Aunt Jeannie $y = 5(15) + 50 = 125$
 Aunt Martha $y = 10(15) = 150$

On his fifteenth birthday, Devon will have received more money from Aunt Martha by \$25.

System of Equations
Homework Day 1

Name: _____
Date: _____

1. Jasmine earns \$5.50 per hour for yard work. She also charges a \$2.00 fee for supplies for each job. Johnny charges \$4.25 per hour for yard work and a \$5.00 charge for supplies. Write two equations for E , for both students earnings on one job if they work h hours. How many hours will they need to work to charge the same amount? If they work 5 hours who will have the better deal? One hour?
2. Susie just got her pilot's license and wants to rent a plane. The Platinum Plane company charges \$180 plus \$92 per hour to rent a plane. The Plastic Plane Company charges \$250 plus \$78 per hour.
 - a. For what number of hours would the companies charge the same amount?
 - b. What would the charge be for that number of hours?
3. Trendy T-Shirts has decided to manufacture a new design. It will cost \$400 plus \$7 per shirt to produce them, and Trendy plans to spend \$5000 on advertising. The shirts will sell for \$12 each.
 - a. How many shirts must be sold to break even (total cost equals income from sales)?
 - b. What is Trendy's income (or total cost) for that many shirts?
4. Romeo and Juliet first saw each other when they were 270 feet apart. Romeo began running toward Juliet at a rate of 16ft/s. At the same moment, Juliet began running toward Romeo at a rate of 14ft/s.
 - a. How many seconds after they started running will they meet?
 - b. How far will Romeo have run then?
5. The launch site for Trigon Balloon CO. is 250 ft. above sea level. A hot-air balloon is launched from the site and begins to rise at a rate of 110ft/min. At the same time, another balloon 2200 ft above sea level begins to descend at a rate of 150ft/min.
 - a. How long will it be until the balloons are at the same elevation?
 - b. What will their elevation be then?

System of Equations MODIFIED
Homework Day 1

Name: _____
Date: _____

1. Jasmine earns \$5.50 per hour for yard work. She also charges a \$2.00 fee for supplies for each job. Johnny charges \$4.25 per hour for yard work and a \$5.00 charge for supplies. Write two equations for E , for both students earnings on one job if they work h hours. How many hours will they need to work to charge the same amount? If they work 5 hours who will have the better deal? One hour?

Jasmine: $E = \underline{\hspace{2cm}}$ (per hour) $h + \underline{\hspace{2cm}}$ fee for supplies
Johnny: $E = \underline{\hspace{2cm}}$ (per hour) $h + \underline{\hspace{2cm}}$ fee for supplies

Remember: To answer questions substitute in 5 hours for h on both equations. Do the same for 1 hour

2. Susie just got her pilot's license and wants to rent a plane. The Platinum Plane company charges \$180 plus \$92 per hour to rent a plane. The Plastic Plane Company charges \$250 plus \$78 per hour.

- a. For what number of hours would the companies charge the same amount?
Platinum = $\underline{\hspace{2cm}}$ per hour + $\underline{\hspace{2cm}}$ fee
Plastic = $\underline{\hspace{2cm}}$ per hour + $\underline{\hspace{2cm}}$ fee

Remember : find point of intersection using calculator or set the equations equal to each other to find when they will cost the same.

- b. What would the charge be for that number of hours?

3. Trendy T-Shirts has decided to manufacture a new design. It will cost \$400 plus \$7 per shirt to produce them, and Trendy plans to spend \$5000 on advertising. The shirts will sell for \$12 each.

- a. How many shirts must be sold to break even (total cost equals income from sales)? Trendy = $\underline{\hspace{2cm}}$ per shirt + 400 set up
Trendy = $\underline{\hspace{2cm}}$ selling price per shirt
b. What is Trendy's income (or total cost) for that many shirts?

Remember: Refer to definition of break even point to answer this question.

4. Romeo and Juliet first saw each other when they were 270 feet apart. Romeo began running toward Juliet at a rate of 16ft/s. At the same moment, Juliet began running toward Romeo at a rate of 14ft/s.
- How many seconds after they started running will they meet?
(Hint: one can be running and reducing the distance of 270 ft and the other can be just running towards the other person)
- Romeo (underline information in that sentence to help get that equation)
Juliet (underline information in that sentence to help get that information).
Find point of intersection.
- How far will Romeo have run then?
5. The launch site for Trigon Balloon CO. is 250 ft. above sea level. A hot-air balloon is launched from the site and begins to rise at a rate of 110ft/min. At the same time, another balloon 2200 ft above sea level begins to descend at a rate of 150ft/min.
- How long will it be until the balloons are at the same elevation?
 - What will their elevation be then?

Remember: underline information in a sentence that relates to each balloon.
Set up equations. Find the point of intersection using your calculator or set the equations equal to each other to solve.

1. Jasmine earns \$5.50 per hour for yard work. She also charges a \$2.00 fee for supplies for each job. Johnny charges \$4.25 per hour for yard work and a \$5.00 charge for supplies. Write two equations for E, for both students earnings on one job if they work h hours. How many hours will they need to work to charge the same amount? If they work 5 hours who will have the better deal? One hour?



Jasmine: $E = \underline{5.50}(\text{per hour})h + \underline{2}$ fee for supplies
Johnny: $E = \underline{4.25}(\text{per hour})h + \underline{5}$ fee for supplies

Remember: To answer questions substitute in 5 hours for h on both equations.
Do the same for 1 hour

5 hours Jasmine \$29.50
Johnny \$26.25
1 hour Jasmine \$7.50
Johnny \$9.25

2. Susie just got her pilot's license and wants to rent a plane. The Platinum Plane company charges \$180 plus \$92 per hour to rent a plane. The Plastic Plane Company charges \$250 plus \$78 per hour.
- a. For what number of hours would the companies charge the same amount?
Platinum = 92 per hour + 180 fee
Plastic = 78 per hour + 250 fee
At 5 hours the cost would be the same
Remember : find point of intersection using calculator or set the equations equal to each other to find when they will cost the same.
- b. What would the charge be for that number of hours?

The cost at 5 hours would be \$640

3. Trendy T-Shirts has decided to manufacture a new design. It will cost \$400 plus \$7 per shirt to produce them, and Trendy plans to spend \$5000 on advertising. The shirts will sell for \$12 each.
- a. How many shirts must be sold to break even (total cost equals income from sales)? Trendy = 7 per shirt + 400 set up

Trendy= 12 selling price per shirt
You will need 80 shirts for the cost to be the same

- b. What is Trendy's income (or total cost) for that many shirts?

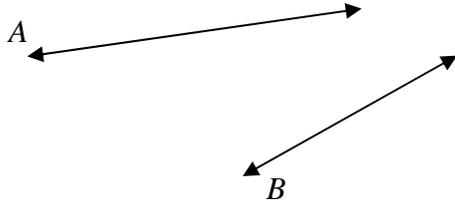
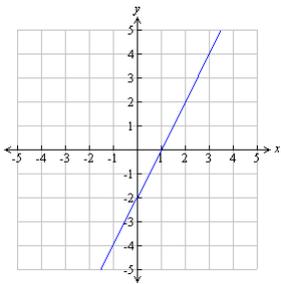
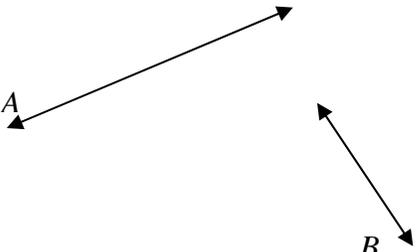
The break even point of 960-960 will equal zero.

Remember: Refer to definition of break even point to answer this question.

4. Romeo and Juliet first saw each other when they were 270 feet apart. Romeo began running toward Juliet at a rate of 16ft/s. At the same moment, Juliet began running toward Romeo at a rate of 14ft/s.
- a. How many seconds after they started running will they meet?
(Hint: one can be running and reducing the distance of 270 ft and the other can be just running towards the other person)
It will take 9 seconds for them to meet
Romeo (underline information in that sentence to help get that equation)
 $270-16f$
Juliet (underline information in that sentence to help get that information).
Find point of intersection. $14f$
- b. How far will Romeo have run then?
 $270-16(9) = 144$ ft high
5. The launch site for Trigon Balloon CO. is 250 ft. above sea level. A hot-air balloon is launched from the site and begins to rise at a rate of 110ft/min. At the same time, another balloon 2200 ft above sea level begins to descend at a rate of 150ft/min.
- a. How long will it be until the balloons are at the same elevation?
 $B1= 110f +250$ $B2=2200-150f$ set them equal and they will be at 1075 feet high when they have traveled 7.5 minutes
- b. What will their elevation be then?

Remember: underline information in a sentence that relates to each balloon.
Set up equations. Find the point of intersection using your calculator or set the equations equal to each other to solve.

Concentric Circles Game

FRONT	BACK
$y = 2x + 4$ $3x + 2y = 8$ $x - y = 5$ $y = 2x$	<p>Question: Is the equation in standard form or slope-intercept form?</p> <p>Answer: Slope-intercept Standard Standard Slope-intercept</p>
$y = 4x + 8$ $y = x - 5$	<p>Question; Convert each equation into standard form.</p> <p>Answer: $-4x + y = 8$</p> $x - y = 5$
	<p>Question: Which line has a steeper slope?</p> <p>Answer: Line B</p>
	<p>Question: What is the slope of the line? What is the y-intercept of the line?</p> <p>Answer: Slope: $\frac{6}{3} = 2$</p> <p>y - Intercept: -2</p>
	<p>Question: Which line has a negative slope?</p> <p>Answer: Line B</p>

$y = 4x$	<p>Question: What is the y-intercept?</p> <p>Answer: Origin</p>
$y = 3x + 5$ $y = 3x - 7$	<p>Question: What would the graph of this system look like?</p> <p>Answer: Two Parallel Lines</p>
$y = 4x - 8$ $y = \frac{1}{4}x - 8$	<p>Question: Do these two lines intersect?</p> <p>Answer: Yes (Different slopes)</p>
$-2x + y = 5$ $-2x + 3y = -15$	<p>Question: Convert the equations to slope-intercept form.</p> <p>Answer: $y = 2x + 5$</p> $y = \frac{2}{3}x - 5$
$3x + 2y = 6$ $6x + 4y = 12$	<p>Question: What is the solution to the system?</p> <p>Answer: Infinitely many solutions (Same Line)</p>

Earning Money for Your Graduation Trip: #1

Jamie and Derek earn money in different ways.



Jamie

Every week his parents give him an allowance of \$8.

(Hint: Remember to make this unit match Derek)

Derek

Every month his neighbors will pay him \$40 to mow their lawn

- Write a system of equations to compare each plan of earning money.
- After 3 months, how much money will Derek have?
- When Derek earns \$200, how much money will Jamie earn?
- Will Jamie be able to earn more money than Derek?

Earning Money for Your Graduation Trip: #2



Your class wants to conduct a fundraiser by selling soda at school.

Plan A

For each case of CocaCola you sell, you will make a profit of \$5. In addition, CocaCola will donate \$150 to your trip.

Plan B

For each case of Pepsi that you sell, you will make a profit of \$6. In addition, Pepsi will donate \$100 to your trip.

- Write a system of equations to compare each plan of earning money.
- What does the slope represent in the context of the problem?
- What will happen to your earnings after 2 cases of Pepsi are sold? CocaCola?
- At what point will your earnings be the same?
- Which plan would you choose and why? (Justify your reasoning using mathematics)

Earning Money for Your Graduation Trip: #3

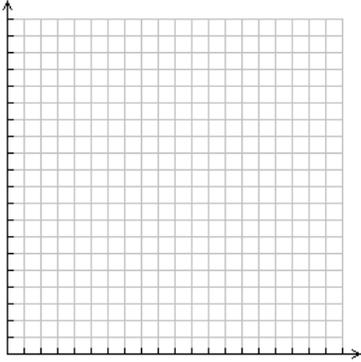


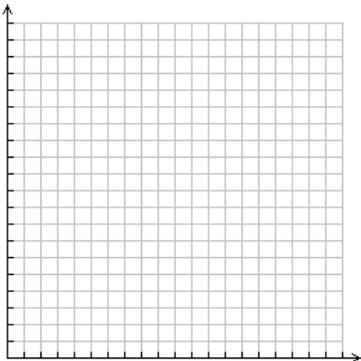
You have two options for earning money for your trip.

You can take a job at the local grocery store on the weekends where the pay rate is \$6.25 an hour. If you do, your grandparents will give you \$60 to help pay for the trip. Or, you can babysit your neighbor's kids during the week in the evenings at a rate of \$10 an hour.

- Write a system of equations to compare each plan of earning money.
- How long will you have to work to earn the same amount at both jobs?
- If you anticipate that you will need \$600 for your trip, how many hours at each job must you work?
- Which plan would you select and why? (Use mathematics to justify your reasoning.)

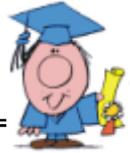
Use the guided worksheet to show your work:

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Algebraic Model or Equation:																							

Earning Money for Your Graduation Trip #1

ANSWER KEY



Jamie and Derek earn money in different ways.

Jamie

Every week his parents give him an allowance of \$8.

(Hint: Remember to make this unit match Derek)

Derek

Every month his neighbors will pay him \$40 to mow their lawn

Write a system of equations to compare each plan of earning money.

$$Y = 32x$$

$$Y = 40x$$

After 3 months, how much money will Derek have?

$$Y = 40x$$

$$Y = 40(3)$$

$$Y = 120$$

After 3 months Derek will have earned \$120.

When Derek earns \$200, how much money will Jamie earn?

When Derek earns \$200 Jamie will only have earned \$160. We put both equations into the calculator and looked at the table to see that when Derek had earned \$200 Jamie will have earned \$160. That will have taken five months.

Will Jamie be able to earn more money than Derek?

Jamie will not be able to earn more money than Derek. If you look at the two lines their y-intercepts are the same. They both start at the origin so that is where they intersect.



Your class wants to conduct a fundraiser by selling soda at school.

Plan A

For each case of CocaCola you sell, you will make a profit of \$5. In addition, CocaCola will donate \$150 to your trip.

Plan B

For each case of Pepsi that you sell, you will make a profit of \$6. In addition, Pepsi will donate \$100 to your trip.

- Write a system of equations to compare each plan of earning money.

Plan A: $y = 5x + 150$

Plan B: $y = 6x + 100$

- What does the slope represent in the context of the problem?

The slope in the context of this problem represents the amount of profit for every case of soda you sell.

- What will happen to your earnings after 2 cases of Pepsi are sold? CocaCola?

Coca Cola	Pepsi
$y = 5(2) + 150$	$y = 6(2) + 100$
$y = 10 + 150$	$y = 12 + 100$
$y = \$160$	$y = \$112$

After 2 cases you will earn more of a profit by selling \$160.

- At what point will your earnings be the same?

$$\begin{array}{r}
 5x + 150 = 6x + 100 \\
 -5x \qquad \qquad -5x \\
 \hline
 150 = x + 100 \\
 -100 \qquad \qquad -100 \\
 \hline
 50 = x
 \end{array}$$

After 50 cases the profit from selling either soda will be the same. At 50 cases both brands will have a profit of \$400.

- Which plan would you choose and why? (Justify your reasoning using mathematics.)

I would choose Pepsi if I was going to be able to sell more than 50 cases. I would make more of a profit. If I knew I was going to sell less than 50 cases I would choose CocaCola.



You have two options for earning money for your trip.

You can take a job at the local grocery store on the weekends where the pay rate is \$6.25 an hour. If you do, your grandparents will give you \$60 to help pay for the trip. Or you can baby sit your neighbor's kids during the weekend in the evenings at a rate of \$10 an hour.

- Write a system of equations to compare each plan of earning money.
 Grocery store: $y = 6.25x + 60$ Baby Sitting: $y = 10x$
- How long will you have to work to earn the same amount at both jobs?

$$\begin{array}{r}
 6.25x + 60 = 10x \\
 -6.25x \qquad \qquad -6.25x \\
 \hline
 \qquad 60 = 3.75x \\
 \qquad 3.75 \qquad 3.75 \\
 \qquad 16 = x
 \end{array}$$

You will have to work 16 hours on the weekend for both jobs to pay you the same amount of \$160.

- If you anticipate that you will need \$600 for your trip, how many hours at each job must you work?

$$\begin{array}{r}
 \text{Local Grocery Store} \\
 6.25x + 60 = 600 \\
 \qquad - 60 \qquad - 60 \\
 \hline
 6.25x \qquad \qquad = 540 \\
 \qquad x = 86.4
 \end{array}$$

$$\begin{array}{r}
 \text{Babysitting} \\
 10x = 600 \\
 \hline
 10 \qquad 10 \\
 x = 60
 \end{array}$$

- Which plan would you select and why? (Use mathematics to justify your reasoning.)

I would select babysitting because after 16 weeks when both gave you the same earnings I could earn more money. The initial donation from grandparents helped at the beginning but after 16 weeks it did not benefit us.

RUBRIC

Criteria	YES	NO
All members of the group participated		
The scenario was presented		
The group identified what the question was asking		
Everyone in the group was able to answer and support other members of the group		
Variables were identified and labeled correctly		
Equations were written and set up correctly		
All group members were able to compute the correct response		
The answers were stated in the context of the problem		

Score	Points Awarded
5	100
4	80
3	60
2	40
1	20

Total Points:

MATHEMATICS BRIEF CONSTRUCTED RESPONSE RUBRIC

3 The response indicates application of a reasonable strategy that leads to a correct solution in the context of the problem. The representations are essentially correct. The explanation and/or justification is logically sound, clearly presented, fully developed, supports the solution, and does not contain significant mathematical errors. The response demonstrates a complete understanding and analysis of the problem.

2 The response indicates application of a reasonable strategy that may be incomplete or undeveloped. It may or may not lead to a correct solution. The representations are fundamentally correct. The explanation and/or justification supports the solution and is plausible, although it may not be well developed or complete. The response demonstrates a conceptual understanding and analysis of the problem.

1 The response indicates little or no attempt to apply a reasonable strategy or applies an inappropriate strategy. It may or may not have the correct answer. The representations are incomplete or missing. The explanation and/or justification reveals serious flaws in reasoning. The explanation and/or justification may be incomplete or missing. The response demonstrates a minimal understanding and analysis of the problem.

0 The response is completely incorrect or irrelevant. There may be no response, or the response may state “I don’t know.”

MATHEMATICS EXTENDED CONSTRUCTED RESPONSE RUBRIC

4 The response indicates application of a reasonable strategy that leads to a correct solution in the context of the problem. The representations are correct. The explanation and/or justification is logically sound, clearly presented, fully developed, supports the solution, and does not contain significant mathematical errors. The response demonstrates a complete understanding and analysis of the problem.

3 The response indicates application of a reasonable strategy that may or may not lead to a correct solution. The representations are essentially correct. The explanation and/or justification is generally well developed, feasible, and supports the solution. The response demonstrates a clear understanding and analysis of the problem.

2 The response indicates an incomplete application of a reasonable strategy that may or may not lead to a correct solution. The representations are fundamentally correct. The explanation and/or justification supports the solution and is plausible, although it may not be well developed or complete. The response demonstrates a conceptual understanding and analysis of the problem.

1 The response indicates little or no application of a reasonable strategy. It may or may not have the correct answer. The representations are incomplete or missing. The explanation and/or justification reveals serious flaws in reasoning. The explanation and/or justification may be incomplete or missing. The response demonstrates a minimal

understanding and analysis of the problem.

0 The response is completely incorrect or irrelevant. There may be no response, or the response may state "I don't know."

Explanation refers to the student using the language of mathematics to communicate how the student arrived at the solution.

Justification refers to the student using mathematical principles to support the reasoning used to solve the problem or to demonstrate that the solution is correct. This could include the appropriate definitions, postulates, and theorems.

Essentially correct representations may contain a few minor errors such as missing labels, reversed axes, or scales that are not uniform.

Fundamentally correct representations may contain several minor errors such as missing labels, reversed axes, or scales that are not uniform. Revised August 2000

MATHEMATICS RUBRIC CUES FOR STUDENTS

Analysis

Consider what the question asks you to do.

What information is given in the problem?

What information do you need to solve the problem?

Think about what you would do to solve the problem.

Representation

Write an equation or inequality.

Define the variables. Let $x = \underline{\hspace{2cm}}$ and/or let $y = \underline{\hspace{2cm}}$.

Create a graph, chart, or table.

Include titles, axes, labels, and scales.

Create a drawing or construction.

Application

Solve the problem.

Write the answers in the context of the problem.

Be sure you answer what is asked for in the problem.

Check to see if the answer is reasonable.

*** Explanation**

Write or describe the steps you used to solve the problem.

*** Justification**

Use mathematics (definitions, theorems, reasoning, principles) to support your solution and/or process.

Write the mathematics concepts you used.

Tell why you solved the problem as you did.

Demonstrate that the solution is correct.

** Complete as appropriate and required by the problem.*

Revised September 2006

Cluck U Chicken charges \$8.75 per each dozen chicken wings and charges a flat rate of \$8.00 for a large soda and fries. Tyrone's charges \$6.50 for each chicken dinner and \$26.00 even for a complete second meal and a slice of pie and a drink for both meals, including tax.



- Write a system of equations that represents this scenario at both chicken restaurants.
- At what point will the amount charged at both restaurants be the same. Use mathematics, words, symbols or both to explain your answer.
- At what point is Cluck U Chicken a better deal? Explain how you came up with your answer.

Cluck U Chicken charges \$8.75 per each dozen chicken wings and charges a flat rate of \$8.00 for a large soda and fries. Tyrone's charges \$6.50 for each chicken dinner and \$26.00 even for an entire second meal plus a slice of pie and a drink for both dinners, including tax.



- Write a system of equations that represents this scenario at both chicken restaurants.

$$y = 8.75x + 11$$
$$y = 6.30x + 26$$

- At what point will the amount charged at both restaurants be the same. Use mathematics, words, symbols or both to explain your answer.

I put both equations into $y =$ and found the point of intersection (8,78)

- At what point is Cluck U Chicken a better deal? Explain how you came up with your answer.

Cluck U Chicken is a better deal prior to the 8 chicken meals when they are equal. They have a smaller flat rate which will make their cost cheaper until the point of intersection.

System of Equations in Slope-Intercept Form
Quiz

Name: _____
Date: _____

Scenario: Graduation vacation.

Gavin and Buddy are both going to Toronto on their graduation vacation. Gavin is driving with another friend who is charging him a flat fee of \$30 plus \$.50 per mile to cover the cost of driving expenses. Buddy is taking a bus and his trip will cost \$35 plus .25 per mile.

- Write the system of equations that models both boys' travel.
- After traveling how many hours will their cost be the same? Use mathematics to explain your answer.
- Will Gavin or Buddy have the better deal at six hours? At 12 hours?
- Explain in your own words what is happening to the slope in both equations. What does the y -intercept mean in the context of the problem?

System of Equations in Slope-Intercept Form
Quiz

Name: ANSWER KEY
Date: _____

Scenario: Graduation vacation.

Gavin and Buddy are both going to Toronto on their graduation vacation. Gavin is driving with another friend who is charging him a flat fee of \$30 plus \$.50 per mile to cover the cost of driving expenses. Buddy is taking a bus and his trip will cost \$35 plus .25 per mile.

- Write the system of equations that models both boys' travel.

$$y = .50x + 30$$

$$y = .25x + 35$$

- After traveling how many hours will their cost be the same? Use mathematics to explain your answer.

At 20 hours the cost for both boys will be the same \$40. We used the calculator to find this answer. We plugged both equations into $y=$ and found the intersection point. (2nd calc, #5, enter, enter, enter)

- Will Gavin or Buddy have the better deal at six hours? At 12 hours?

At six hours Gavin has the better deal. His ride will only cost \$33 while Buddy's will cost \$36.50. We looked at the table the calculator created once we input our equations.

- Explain in your own words what is happening to the slope in both equations. What does the y-intercept mean in the context of the problem?

The slope in this problem represents the cost per mile. Gavin is paying more per mile (.25 more). Eventually he will end up spending more money the farther the distance he must travel.

Spending Money for Your Graduation Trip #1

While on your vacation, you and your friends decide to go watch a Major League Soccer game. Some of your other friends went to the games at the beginning of the week and below is what they spent on food at the game.



Game 1

**3 nachos and 2 large sodas for
a total of \$13.50**

Game 2

**2 nachos and 2 sodas for a
total of \$11.00**

- Write a system of equations to compare each days spending on food at the game.

- At what point will Game 1 and Game 2 charge the same amount for nachos and sodas? Use mathematics to explain your answer. Show all your work or explain how you got your answer.

Spending Money for Your Graduation Trip #2

While traveling on your vacation you meet up with graduates from another school and decide to share some of the transportation costs with them. The van companies below list the amount of students that can be transported using their vehicles.



Safe Vans Company

We can use 6 vans and 2 cars and transport 44 students.

Van Fan

We can transport 56 students if we use 4 vans and 8 cars.

- Write a system of equations that will represent the given situations.
- How many students can be transported by each van? How many students can be transported by each car? Solve for the values of x and y , if x represents the number of students transported by each van and y represents the number of students transported by each car. Use words, symbols, or both in your explanation.

Spending Money for Your Graduation Trip #3

You decided that the majority of your savings needs to go to hotel and food/entertainment on your trip. You have saved a total of \$1,035 dollars and want to spend a total of \$120 dollars each night on hotel expenses and \$63 a day for food/entertainment. If you want to spend 11 days on vacation, in how many days will you reach your budget for hotel and food/entertainment?



- Write a system of equations.
Let x = the number of days you can spend in a hotel.
Let y = the number of days you will have funds for food/entertainment.

- Solve the system of equations to find x and y . Explain using mathematics, words, symbols or both what is happening in this scenario.

Spending Money for Your Graduation Trip #1 (KEY)

While on your vacation, you and your friends decide to go watch a Major League Soccer game. Some of your other friends went to the games at the beginning of the week and below is what they spent on food at the game.



<p style="text-align: center;">Game 1</p> <p>3 nachos and 2 large sodas for a total of \$13.50</p>

<p style="text-align: center;">Game 2</p> <p>2 nachos and 2 sodas for a total of \$11.00</p>

- Write a system of equations to compare each days spending on food at the game.

$$\begin{aligned}3x + 2y &= 13.50 \\2x + 2y &= 11.00\end{aligned}$$

- At what point, will game 1 and game 2 charge the same amount for nachos and sodas. Use mathematics to explain your answer. Show all your work or explain how you got your answer.

We used elimination and multiplied the 2nd equation by -1 to get rid of our y variables.

$$\begin{array}{r}3x + 2y = 13.50 \\-2x - 2y = -11.00 \\ \hline x = 2.50\end{array}$$

Check by substitution:

$$\begin{aligned}3(2.50) + 2y &= 13.50 \\7.50 + 2y &= 13.50 \\2y &= 6.00 \\y &= 3.00\end{aligned}$$

Spending Money for Your Graduation Trip #2 (KEY)

While traveling on your vacation you meet up with graduates from another school and decide to share some of the transportation costs with them. The van companies below list the amount of students that can be transported using their vehicles.



Safe Vans Company

We can use 6 vans and 2 cars and transport 44 students.

Van Fan

We can transport 56 students if we use 4 vans and 8 cars.

- Write a system of equations that will represent the given situations.
$$6x + 2y = 44$$
$$4x + 8y = 56$$
- How many students can be transported by each van? How many students can be transported by each car? Solve for the values of x and y if x represents the number of students transported by each van and y represents the number of students transported by each car. Use words, symbols, or both in your explanation.

Our group used the multiplication method with respect to subtraction. We multiplied the first equation by 4 to obtain $24x + 8y = 176$. Then we subtracted the second equation from the first equation to obtain $20x = 120$. After dividing by 20, we got $x = 6$. Six students can be transported by each van and 4 students can be transported by each car. Both systems need to be checked to make sure system works.

Spending Money for Your Graduation Trip #3 (KEY)

You decided that the majority of your savings needs to go to hotel and food/entertainment on your trip. You have saved a total of \$1,035 dollars and want to spend a total of \$120 dollars each night on hotel expenses and \$63 a day for food/entertainment. If you want to spend 11 days on vacation, in how many days will you reach your budget for hotel and food/entertainment?



- Write a system of equations.
Let x = the number of days you can spend in a hotel.
Let y = the number of days you will have funds for food/entertainment.
- Solve the system of equations to find x and y . Explain using mathematics, words, symbols or both what is happening in this scenario.

$$\begin{aligned}120x + 63y &= 1035 \\ x + y &= 11\end{aligned}$$

Group might use any method but for key show substitution.

$$\begin{aligned}120(11 - y) + 63y &= 1035 \\ 1320 - 120y + 63y &= 1035 \\ -57y &= -285 \\ y &= 5\end{aligned}$$

Substitute 5 for y in second equation and you get $x + 5 = 11$, therefore $x = 6$. Check other equation.

Homework Day 3

Name: _____

The cost of admission for a group of two adults and six students to Waterland Fun Park is \$78.00. The cost was \$90.00 for a group containing five adults and three children. What is the cost of admission to the park for each adult and each child?



- Write a system of equations to represent the situation. Let x = the cost of an adult's admission. Let y = the cost of a child's admission.

- Determine the cost of admission for one adult and one child to any event you want. Use mathematics to explain how you determined your answer. Make sure to write a sentence that puts the solution in the context of the problem. Show your work and justify your answer by checking the solution.

The cost of admission for a group of two adults and six students to Waterland Fun Park is \$78.00. The cost was \$90.00 for a group containing five adults and three children. What is the cost of admission to the park for each adult and each child?



- Write a system of equations to represent the situation. Let x = the cost of an adult's admission. Let y = the cost of a child's admission.

$$\begin{aligned}2x + 6y &= 78 \\5x + 3y &= 90\end{aligned}$$

- Determine the cost of admission for one adult and one child to any event you want. Use mathematics to explain how you determined your answer. Make sure to write a sentence that puts the solution in the context of the problem. Show your work and justify your answer by checking the solution.

I put both equations into y-intercept form so that I could enter them into the graphing calculator by $y=$. I used rref to find my answers.

The cost of an adult ticket is \$12.75.

The cost of a child's admission ticket is \$8.75.

Solve each word problem below by using a system of equations in either slope-intercept form or standard form.



1. The rocket coaster has 12 cars, some that hold 4 people and some that hold 8 people. There is room for 56 people altogether. How many 4-passenger cars are there? How many 8-passenger cars are there?

Equation #1 _____

Equation #2 _____

Solution:

2. The number of calories in a chocolate kiss is 20 less than the number of calories in a caramel cluster. Three kisses plus four clusters together have 360 calories. How many calories are in each ?

Equation #1 _____

Equation #2 _____

Solution:

3. Your teacher has asked you to determine which company is the better choice to buy mesh book bags from. Bags –R-Us charges \$4.50 per bag with a one time charge of \$10.00 for shipping. The Fabulous Bag Shop charges \$6.50 per bag with a one time charge of \$6.00 for shipping.

Equation #1 _____

Equation #2 _____

Solution:

4. Deanna went to the bank to cash a check for \$420. She wanted all \$10 and \$20 bills. She received 27 bills. How many of each kind did she receive?

Equation #1 _____

Equation #2 _____

Solution:

5. Burger Bing's restaurant chain charges a franchise fee of \$400 each month plus a \$1.75 per hamburger sold. Wendy's chain charges a fee of \$300 a month plus \$2.00 per each hamburger. At what point do Burger Bing and Wendy's charge the same?

Equation #1 _____

Equation #2 _____

Solution:

6. You are going to see your first Ravens' game at the Stadium. A parking garage down the street from the ballpark charges a flat fee of \$10.00 and \$.50 per hour for parking. A garage across the street charges \$2.50 per hour for parking. How many hours would the game need to be for both garages to charge the same?

Equation #1 _____

Equation #2 _____

Solution:

Solve each word problem below by using a system of equations in either slope-intercept form or standard form.



1. The rocket coaster has 12 cars, some that hold 4 people and some that hold 8 people. There is room for 56 people altogether. How many 4-passenger cars are there? How many 8-passenger cars are there?

$$\text{Equation \#1} \quad 4x + 8y = 56$$

$$\text{Equation \#2} \quad x + y = 12$$

Solution:

There are ten 4-passenger cars and two 8-passenger cars.

2. The number of calories in a chocolate kiss is 20 less than the number of calories in a caramel cluster. Three kisses plus four clusters together have 360 calories. How many calories are in each ?

$$\text{Equation \#1} \quad y = x - 20$$

$$\text{Equation \#2} \quad 4x + 3y = 360$$

Solution:

There are 47 calories in a caramel cluster and 27 calories in a chocolate kiss.

3. Your teacher has asked you to determine which company is the better choice to buy mesh book bags from. Bags –R-Us charges \$4.50 per bag with a one time charge of \$10.00 for shipping. The Fabulous Bag Shop charges \$6.50 per bag with a one time charge of \$6.00 for shipping.

$$\text{Equation \#1} \quad y = 4.50x + 10.00$$

$$\text{Equation \#2} \quad y = 6.50x + 6.00$$

Solution:

If you buy two bags, the prices are equal. If you buy less than two bags, then the Fabulous Bag Shop is less expensive. If you buy more than two bags, then Bags-R-Us is less expensive.

4. Deanna went to the bank to cash a check for \$420. She wanted all \$10 and \$20 bills. She received 27 bills. How many of each kind did she receive?

Equation #1 $10x + 20y = 420$

Equation #2 $x + y = 27$

Solution:

She received twelve \$10 bills and fifteen \$20 bills.

5. Burger Bing's restaurant chain charges a franchise fee of \$400 each month plus a \$1.75 per hamburger sold. Wendy's chain charges a fee of \$300 a month plus \$2.00 per each hamburger

Equation #1 $y = 1.75x + 400$

Equation #2 $y = 2.00x + 300$

Solution:

When 400 hamburgers are sold, both restaurants are at \$1100.

6. You are going to see your first Ravens' game at the Stadium. A parking garage down the street from the ballpark charges a flat fee of \$10.00 and \$.50 per hour for parking. A garage across the street charges \$2.50 per hour for parking. How many hours would the game need to be for both garages to charge the same?

Equation #1 $y = .50x + 10.00$

Equation #2 $y = 2.50x$

Solution:

At five hours, both garages would charge \$12.50.