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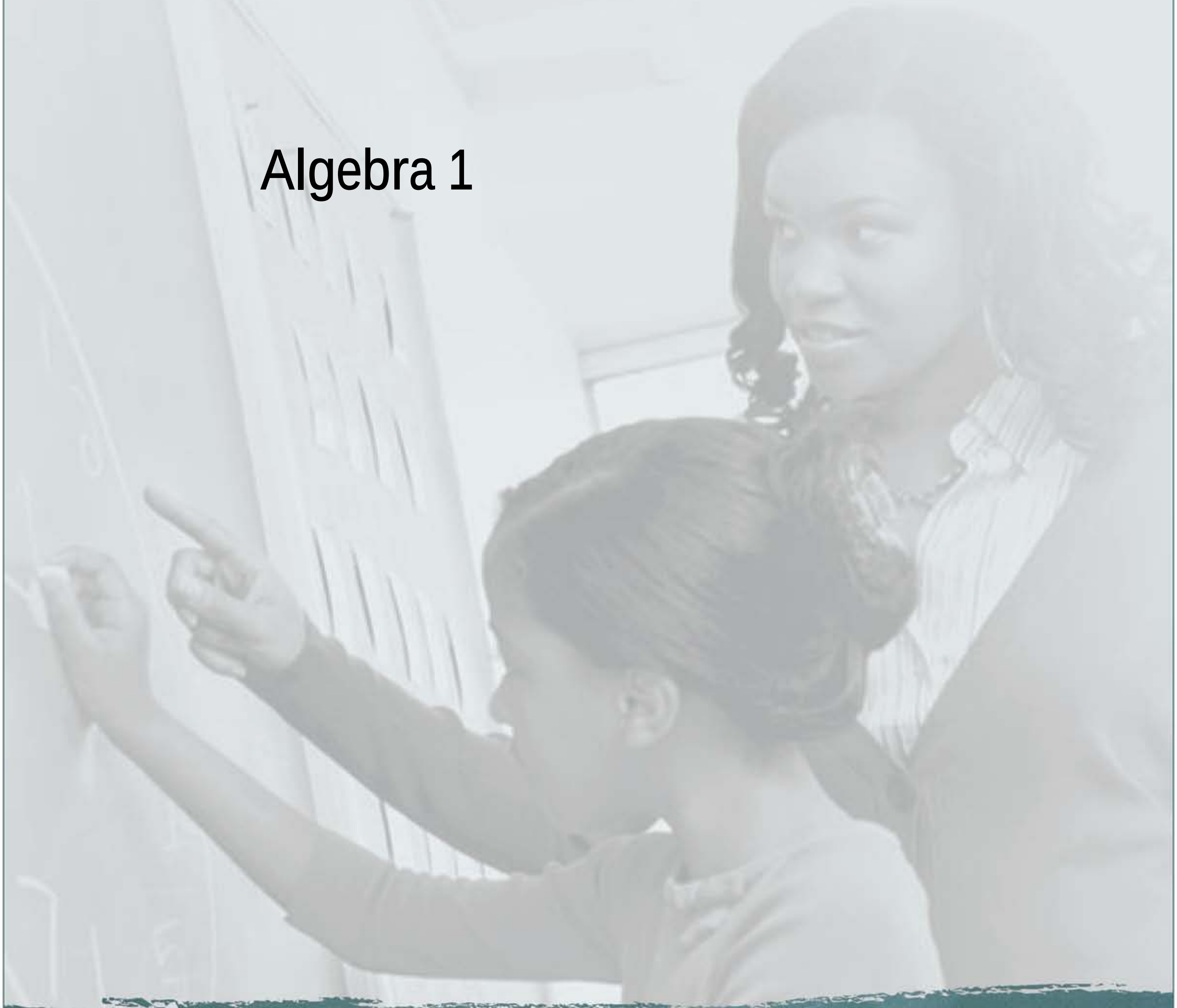
GLE Grade-Level Expectations

COMMON CORE STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

Algebra 1



Transitional Curriculum

REVISED 2012

BLACKLINE MASTERS

LOUISIANA DEPARTMENT OF EDUCATION

Identifying and Classifying Numbers

1. Explain the difference between a rational and an irrational number.

Classify the following numbers as rational or irrational.

2. ½ 3. 8 4. $\sqrt{6}$ 5. $\sqrt{16}$ 6. π

7. List the set of all natural numbers.

8. List the set of whole numbers less than 4.

9. List the set of integers such that –3 < x < 5.

Classify the following numbers as rational, irrational, natural, whole and/or integer. (A number may belong to more than one set)

10. –3 12. $4\frac{2}{3}$ 13. $\sqrt{3}$ 14. 0

15. Using the following set of numbers:
$A = \left\{ \sqrt{3.6},\ 0.36,\ -\frac{3}{6},\ 0.3\overline{6},\ 0,\ 3^6,\ -3,\ \sqrt{36},\ 3.63363336\ldots \right\}$, place each element in the appropriate subset. (Numbers may belong to more than one subset)

rational numbers________________________ irrational numbers______________________

natural numbers________________________ whole numbers________________________

integers________________________

True or False?

16. All whole numbers are rational numbers.

17. All integers are irrational numbers.

18. All natural numbers are integers.

Unit 1, Activity 1, Identifying and Classifying Numbers with Answers

Identifying and Classifying Numbers

1. Explain the difference between a rational and an irrational number.
   A rational number can be expressed as the ratio of two integers. An irrational number is any real number that is not rational

Classify the following numbers as rational or irrational.

2. ½ *rational*   3. 8 *rational*   4. $\sqrt{6}$ *irrational*   5. $\sqrt{16}$ *rational*   6. π *irrational*

7. List the set of all natural numbers.
   {1, 2, 3…}

8. List the set of whole numbers less than 4.
   {0, 1, 2, 3}

9. List the set of integers such that –3 < x < 5.
   {-2, -1, 0, 1, 2, 3, 4}

Classify the following numbers as rational, irrational, natural, whole and/or integer. (A number may belong to more than one set)

10. –3 *rational integer*   12. $4\frac{2}{3}$ *rational*   13. $\sqrt{3}$ *irrational*   14. 0 *rational, integer whole number*

15. Using the following set of numbers:
$A=\left\{\sqrt{3.6},\ 0.36, -\frac{3}{6},\ 0.3\overline{6},\ 0,\ 3^6,\ -3,\ \sqrt{36},\ 3.63363336\ldots\right\}$, place each element in the appropriate subset. (Numbers may belong to more than one subset)

rational numbers $\left\{\sqrt{3.6},\ 0.36, -\frac{3}{6},\ 0.3\overline{6},\ 0,\ 3^6,\ -3,\ \sqrt{36}\right\}$ irrational numbers_*3.63363336*___

natural numbers__$\sqrt{36}, 3^6$______________   whole numbers____*0,* $\sqrt{36}, 3^6$_____________

integers___*-3, 0,* $\sqrt{36}, 3^6$_____________________

True or False?

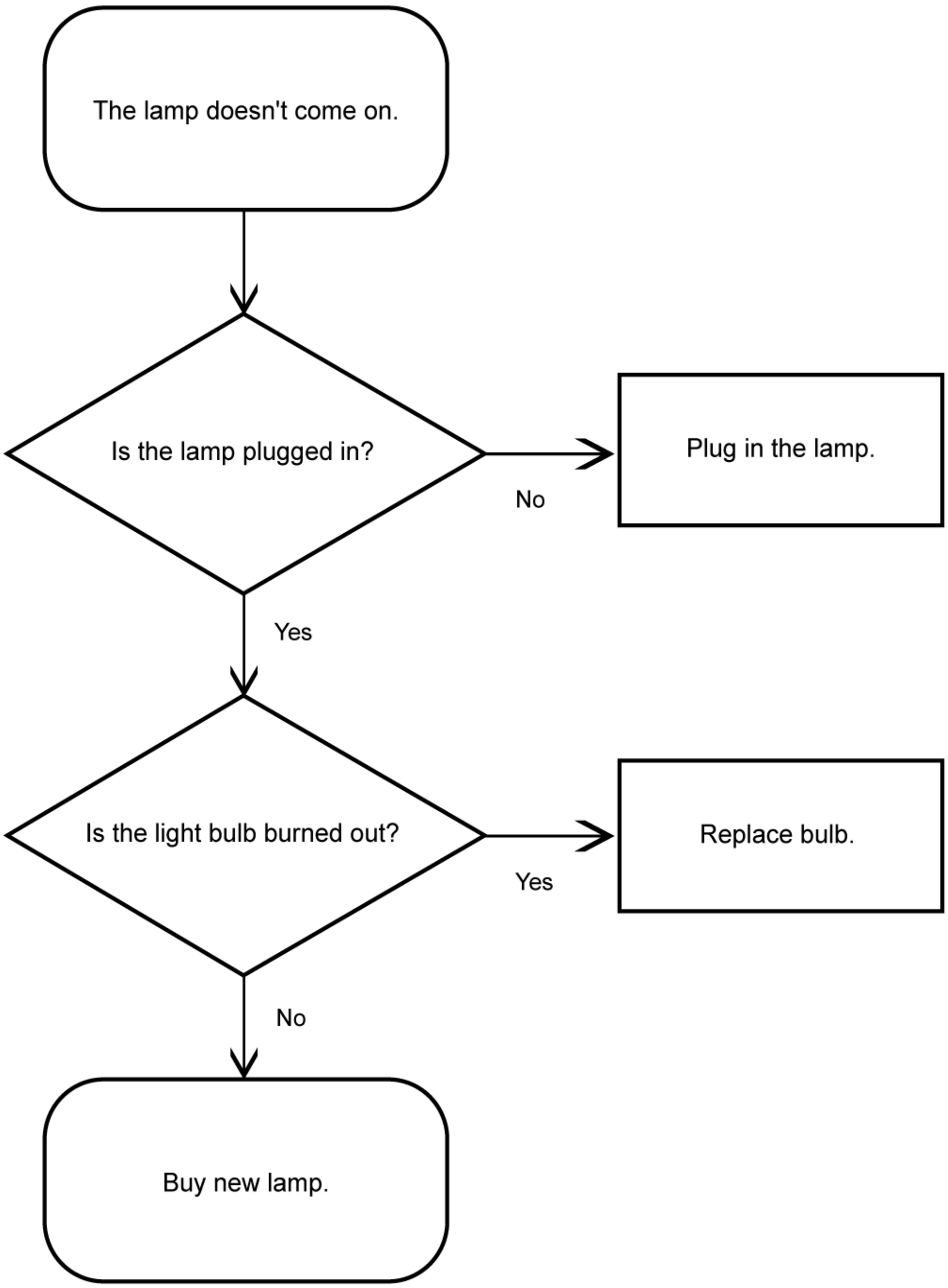
16. All whole numbers are rational numbers. *True*

17. All integers are irrational numbers. *False.*

18. All natural numbers are integers. *True*

Unit 1, Activity 2, Flowchart Example

Lamp Flowchart



What is a Flowchart?

Flowchart Definitions and Objectives:

Flowcharts are maps or graphical representations of a process. Steps in a process are shown with symbolic shapes, and the flow of the process is indicated with arrows connecting the symbols. Computer programmers popularized flowcharts in the 1960s, using them to map the logic of programs. In quality improvement work, flowcharts are particularly useful for displaying how a process currently functions or could ideally function. Flowcharts can help you see whether the steps of a process are logical, uncover problems or miscommunications, define the boundaries of a process, and develop a common base of knowledge about a process. Flowcharting a process often brings to light redundancies, delays, dead ends, and indirect paths that would otherwise remain unnoticed or ignored. But flowcharts don't work if they aren't accurate.

A flowchart (also spelled flow-chart and flow chart) is a schematic representation of a process. It is commonly used in business/economic presentations to help the audience visualize the content better, or to find flaws in the process.

The flowchart is one of the seven basic tools of quality control, which include the histogram, Pareto chart, check sheet, control chart, cause-and-effect diagram, flowchart, and scatter diagram. Examples include instructions for a bicycle's assembly, an attorney who is outlining a case's timeline, diagram of an automobile plant's work flow, or the decisions to make on a tax form.

Generally the start point, end points, inputs, outputs, possible paths and the decisions that lead to these possible paths are included.

Flow-charts can be created by hand or manually in most office software, but lately specialized diagram drawing software has emerged that can also be used for the intended purpose. See below for examples.

Flowchart History:

Flowcharts were used historically in electronic data processing to represent the conditional logic of computer programs. With the emergence of structured programming and structured design in the 1980s, visual formalisms like data flow diagrams and structure charts began to supplant the use of flowcharts in database programming. With the widespread adoption of such ALGOL-like computer languages as Pascal, textual models have been used more and more often to represent algorithms. In the 1990s Unified Modeling Language began to synthesize and codify these modeling techniques.

Today, flowcharts are one of the main tools of business analysts and others who seek to describe the logic of a process in a graphical format. Flowcharts and cross-functional flowcharts can commonly be found as a key part of project documentation or as a part of a business process document. Flowcharts are widely used in education, clinical settings, service industries and other areas where graphical, logical depiction of a process is helpful.

When should flowcharts be used?

At the beginning of your process improvement efforts, an "as-is" flowchart helps your team and others involved in the process to understand how it currently works. The team may find it helpful to compare this "as-is flowchart" with a diagram of the way the process is supposed to work. Later, the team will develop a flowchart of the modified process again, to record how it actually functions. At some point, your team may want to create an ideal flowchart to show how you would ultimately like the process to be performed.

Among the benefits of using flowcharts are that they:

- **Promote process understanding by explaining the steps pictorially.** People may have differing ideas about how a process works. A flowchart can help you gain agreement about the sequence of steps. Flowcharts promote understanding in a way that written procedures cannot. One good flowchart can replace pages of words.
- **Provide a tool for training employees.** Because of the way they visually lay out the sequence of steps in a process, flowcharts can be very helpful in training employees to perform the process according to standardized procedures.
- **Identify problem areas and opportunities for process improvement.** Once you break down the process steps and diagram them, problem areas become more visible. It is easy to spot opportunities for simplifying and refining your process by analyzing decision points, redundant steps, and rework loops.
- **Depict customer-supplier relationship,** helping the process workers understand who their customers are, and how they may sometimes act as suppliers, and sometimes as customers in relation to other people.

What symbols are used in flowcharts?

The symbols that are commonly used in flowcharts have specific meanings and are connected by arrows indicating the flow from one step to another.

- **Oval.** An oval indicates both the starting point and the ending point of the process.
- **Box.** A box represents an individual step or activity in the process.
- **Diamond.** A diamond shows a decision point, such as yes/no or go/no-go. Each path emerging from the diamond must be labeled with one of the possible answers.
- **Circle.** A circle indicates that a particular step is connected within the page. A numerical value is placed in the circle to indicate the sequence continuation.
- **Pentagon.** A pentagon indicates that a particular step of the process is connected to another page or part of the flowchart. A letter placed in the circle clarifies the continuation.
- **Flow line.** This indicates the direction flow of the process.

Excerpt taken from: http://www.edrawsoft.com/Flowchart-tutorial.php

DL-TA for (title)____

Prediction question(s):____
____
____

Using the title, your own background knowledge, and any other contextual clues, make your predictions.

Before reading:

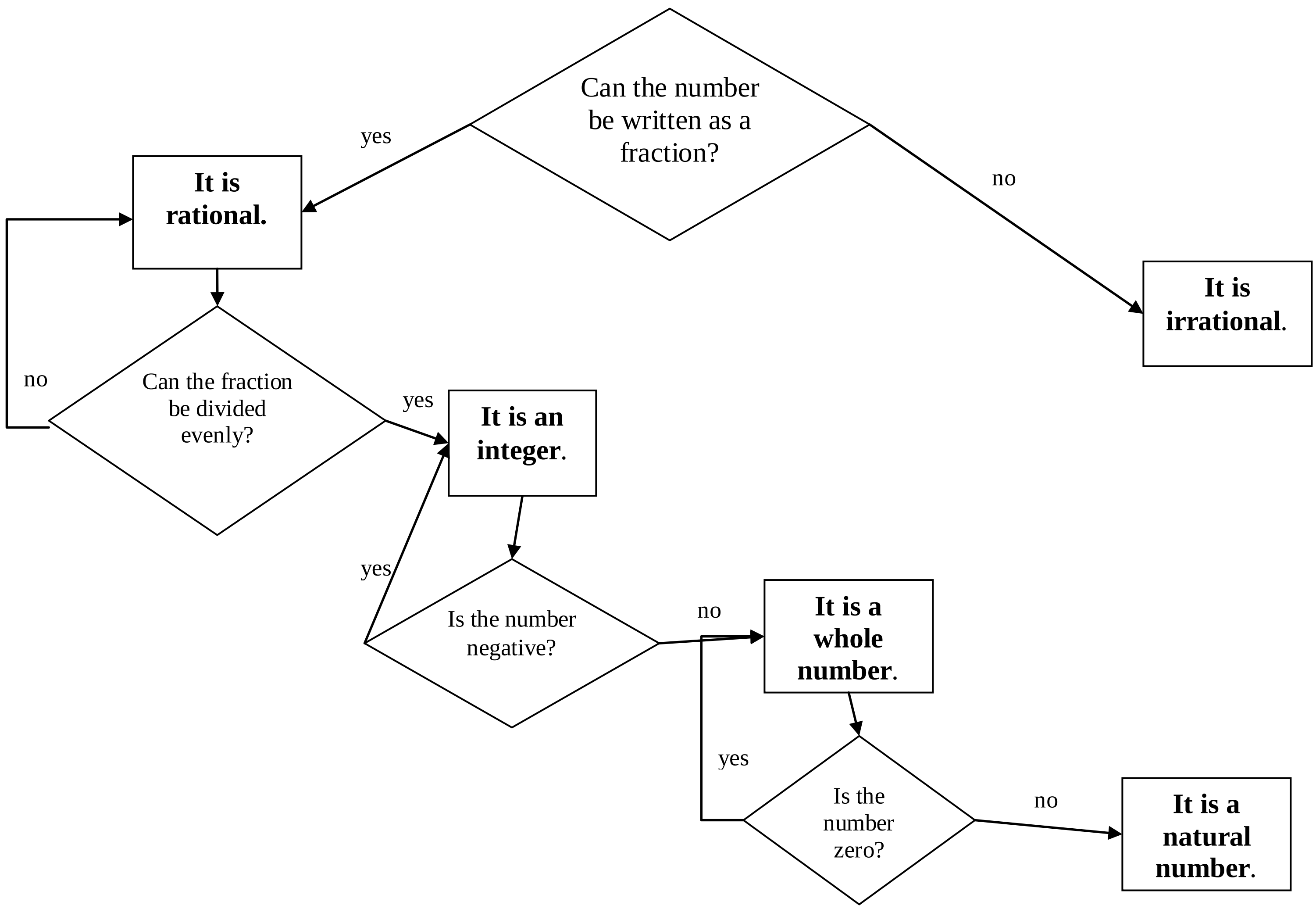
During reading:

During reading:

During reading:

After reading:

Sample Flow chart
Classifying Real Numbers



Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers

Part I: Classify the real numbers below in all possible ways.

Number	Irrational	Rational	Integer	Whole	Natural
Example: 2		*X*	*X*	*X*	*X*
A. -6					
B. $\frac{3\pi}{4}$					
C. 17.3					
D. $3\sqrt{2}$					
E. $\sqrt{16}$					
F. 8					
G. $\frac{3}{4}$					
H. 5.0					
I. -17.3					
J. $2\sqrt{2}$					

Part II. Perform the indicated operations. Classify each sum or product as rational or irrational by circling the appropriate classification.

Example: A + C -6 + 17.3 = 11.3 (rational) irrational

1) B x G rational irrational

2) G + A rational irrational

3) E x C rational irrational

4) I x D rational irrational

5) G + B rational irrational

6) E x F rational irrational

7) I + J rational irrational

8) E + A rational irrational

9) F + J rational irrational

10) G x A rational irrational

Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers

Part III: Using your answers from Part II, answer the following questions with complete sentences. Justify your classification using appropriate algebraic language.

A. What is the classification of the sum of two rational numbers?

B. What is the classification of the product of two rational numbers?

C. What is the classification of the sum of a rational and an irrational number?

D. What is the classification of the product of a rational and an irrational number?

E. When is it possible for the product of a rational and an irrational number to result in a rational value?

Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers with Answers

Part I: Classify the real numbers below in all possible ways.

Number	Irrational	Rational	Integer	Whole	Natural
Example: 2		*X*	*X*	*X*	*X*
A. -6		*X*	X		
B. $\frac{3\pi}{4}$	*X*				
C. 17.3		*X*			
D. $3\sqrt{2}$	*X*				
E. $\sqrt{16}$		*X*	*X*	*X*	*X*
F. 8		*X*	*X*	*X*	*X*
G. $\frac{3}{4}$		*X*			
H. 5.0		*X*	*X*	*X*	*X*
I. -17.3		*X*			
J. $2\sqrt{2}$	*X*				

Part II. Perform the indicated operations. Classify each sum or product as rational or irrational by circling the appropriate classification.

Example: A + C	-6 + 17.3 = 11.3	(rational)	irrational
1) B x G	$\frac{3\pi}{4} \times \frac{3}{4} = \frac{9\pi}{16}$	rational	*irrational*
2) G + A	$\frac{3}{4} + (-6) = -5\frac{1}{4}$	*rational*	irrational
3) E x C	$\sqrt{16} \times 17.3 = 69.2$	*rational*	irrational
4) I x D	$-17.3 \times 3\sqrt{2} = -51.9\sqrt{2}$	rational	*irrational*
5) G + B	$\frac{3}{4} + \frac{3\pi}{4} = \frac{3+3\pi}{4}$	rational	*irrational*
6) E x F	$\sqrt{16} \times 8 = 32$	*rational*	irrational
7) I + J	$-17.3 + 2\sqrt{2}$	rational	*irrational*
8) E + A	$\sqrt{16} + -6 = -2$	*rational*	irrational
9) F + J	$8 + 2\sqrt{2}$	rational	*irrational*
10) G x A	$\frac{3}{4} \times -6 = -\frac{9}{2}$	*rational*	irrational

Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers with Answers

Part III: Using your answers from Part II, answer the following questions with complete sentences. Justify your classification using appropriate algebraic language.

A. What is the classification of the sum of two rational numbers?
The sum of two rational numbers is rational because the sum can be written as a fraction.

B. What is the classification of the product of two rational numbers?
The product of two rational numbers is a rational number because the product can be written as a fraction.

C. What is the classification of the sum of a rational and an irrational number?
The sum of a rational and an irrational number is irrational since the sum cannot be written as a fraction in which the numerator and denominator are both integers.

D. What is the classification of the product of a rational and an irrational number?
The product of a rational and an irrational number is irrational because the product cannot be written as a fraction in which the numerator and denominator are both integers.

E.. When is it possible for the product of a rational and an irrational number to result in a rational value?
The product of rational and an irrational number can result in a rational value when one of the factors is the rational number 0.

Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers Homework

Homework Assignment: Classification of Sums and Products

1. Find each sum or product. Determine its classification as rational or irrational.

a. 1000 + (-288) = ____________________

b. 54.25 + $\sqrt{26}$ = _____________________

c. 0.7 x 17 = ___________________________

d. 4.1 x $\sqrt{49}$ = _________________________

e. -36 x $\sqrt{3}$ = ___________________________

.

2. Write an example for each condition.

a. The product of two rational numbers:

b. The sum of two rational numbers:

c. The product of a rational and an irrational number:

d. The sum of a rational and an irrational number.

Unit 1, Activity 4, Classifying Numbers: Sums and Products of Rational and Irrational Numbers Homework with Answers

1. Find each sum or product. Determine its classification as rational or irrational.

a. 1000 + (-288) = *712 rational*

b. 54.25 + $\sqrt{26}$ = *54.25 + $\sqrt{26}$ irrational*

c. 0.7 x 17 = *11.9 rational*

d. 4.1 x $\sqrt{49}$ = *28.7 rational*

e. -36 x $\sqrt{3}$ = *-36 $\sqrt{3}$ irrational*

2. Write an example for each condition.
   a. The product of two rational numbers:

   Answers will vary.

   b. The sum of two rational numbers:

   Answers will vary.

   c. The product of a rational and an irrational number:

   Answers will vary.

   d. The sum of a rational and an irrational number.

   Answers will vary.

An Activity Comparing Foot Length and Shoe Size

Student Worksheet

Using the standard measuring edge of your ruler, measure and record the length of the student’s foot, in centimeters, and the student’s shoe size. Record 10 sets of data for girls and 10 sets for boys.

GIRLS

Length of Foot	Shoe Size	Ratio of Foot Length to Shoe Size

BOYS

Length of Foot	Shoe Size	Ratio of Foot Length to Shoe Size

.

Answer these questions:

1. **Which is the independent and which is the dependent variable? How do you know?**

____

2. **Write ordered pairs on the line below, graph them, and look for a pattern.**

____

3. **Does the data appear to be linear? Explain your reasoning.**
   ____

4. **Using your calculator, find the average ratio of foot length to shoe size. This is the constant of variation. What does this value mean in the context of the data you have collected?**
   ____

   ____

5. **Write an equation that models the situation. _________________**

6. **List three other examples of positive relationships from real-life.**

Unit 1, Activity 5, Foot Length and Shoe Size

An Activity to Study Dimension of a Rectangle

Student Worksheet

Each group has 36 algebra unit tiles. Using all of the tiles you have been given, arrange the tiles in a rectangle and record the height and width. Continue to make rectangles until you think you have created all possible rectangles. Record the area for each rectangle.

Height (*h*)	**Width (*w*)**	**Area**

Answer these questions:

1. Does it matter which variable is independent and which variable is dependent? Explain. ____

2. Get together with other groups and decide which the entire class will use. Record the class decision below.

____

3. Using the table and the class decision about independent and dependent variables, write the ordered pairs below.

____

4. Graph these pairs on the paper provided and look for relationships in the graphed data.

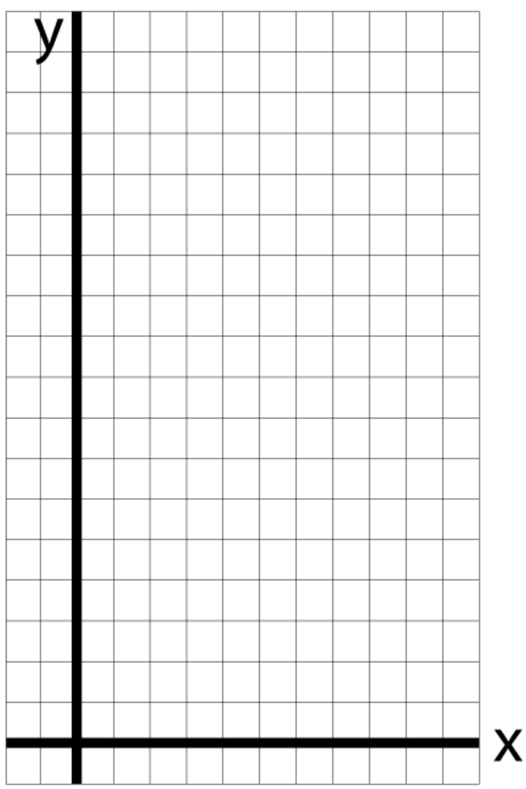
5. Write an equation to model this situation.______________________________

Exponential Growth and Decay

In this activity, fold a piece of computer paper in half as many times as possible. After each fold, stop to fill in a row of the table. Continue folding and recording until the table is filled.

NUMBER OF FOLDS	NUMBER OF REGIONS	AREA OF SMALLEST REGION
0		
1		
2		
3		
4		
5		
6		
7		
N		

Part I: Label the axes of the graph below before you plot your data. One axis is for Number of Folds and one axis is for Number of Regions. Think about the scale of your range and plan your markings before you begin.



Unit 1, Activity 6, Exponential Growth and Decay

Answer the following questions with the class:

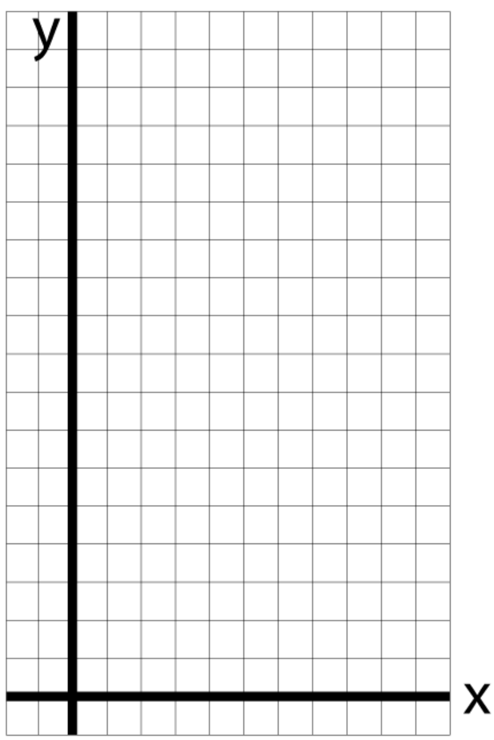
1. Identify the independent and the dependent variables.
   The independent variable is ______________________________________
   The dependent variable is ______________________________________

2. Is the graph linear? Explain your reasoning. ____
   ____

3. Describe the pattern that occurs in the data. ____
   ____

4. Write an equation to determine the number of regions if there are *n* folds.
   ____

Part II: Label the axes of the graph below before you plot your data. One axis is for Number of Folds and one axis is Area of Smallest Region. Think about the scale of your range and plan your markings before you begin.



Unit 1, Activity 6, Exponential Growth and Decay

Answer the following questions with the class:

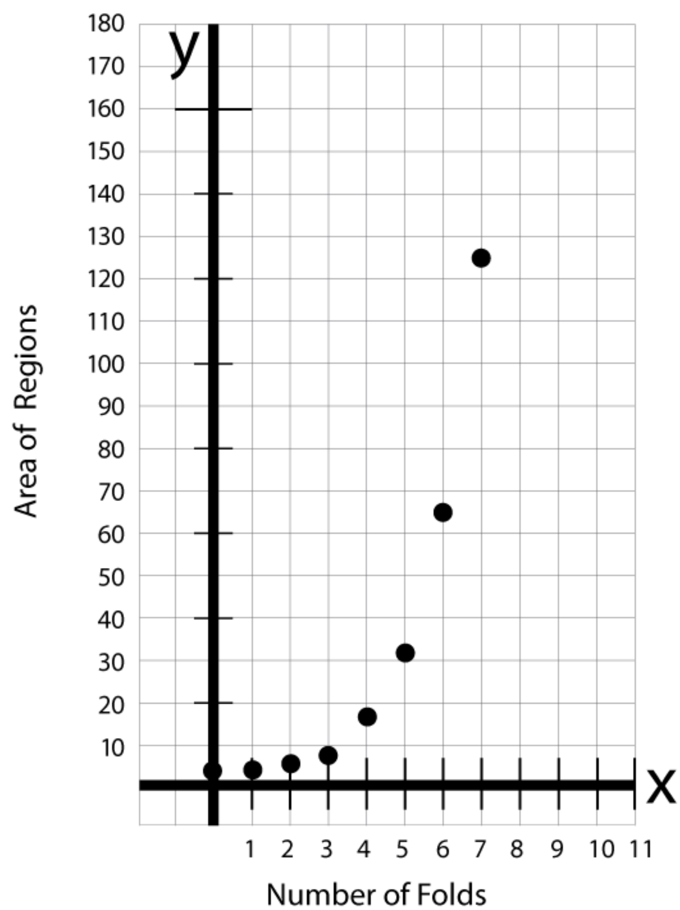
1. Identify the independent and the dependent variables.
   The independent variable is ____
   The dependent variable is ____
2. Is the graph linear? Explain your reasoning. ____
   ____
3. Describe the pattern that occurs in the data. ____
   ____
4. Write an equation to determine the number of regions if there are *n* folds.
   ____

Exponential Growth and Decay

In this activity, fold a piece of computer paper in half as many times as possible. After each fold, stop to fill in a row of the table. Continue folding and recording until the table is filled

NUMBER OF FOLDS	NUMBER OF REGIONS	AREA OF SMALLEST REGION
0	1	1
1	2	$\frac{1}{2}$ or 2^{-1}
2	4	$\frac{1}{4}$ or 2^{-2}
3	8	$\frac{1}{8}$ or 2^{-3}
4	16	$\frac{1}{16}$ or 2^{-4}
5	32	$\frac{1}{32}$ or 2^{-5}
6	64	$\frac{1}{64}$ or 2^{-6}
7	128	$\frac{1}{128}$ or 2^{-7}
N	2^n	$\frac{1}{2^n}$ or 2^{-n}

Part I: Label the axes of the graph below before you plot your data. One axis is for Number of Folds and one axis is for Number of Regions. Think about the scale of your range and plan your markings before you begin.



Unit 1, Activity 6, Exponential Growth and Decay with Answers

Answer the following questions with the class:

1. Identify the independent and the dependent variables.
   The independent variable is ________*number of folds*____________________________
   The dependent variable is ________*number of regions*____________________________

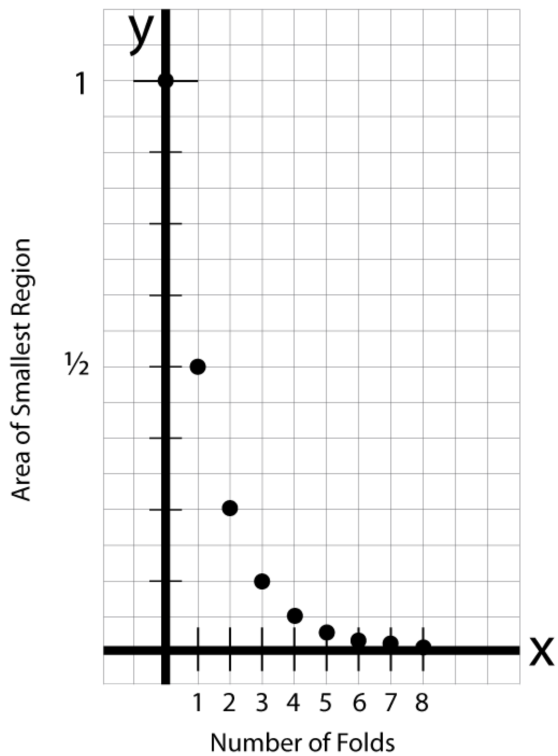
2. Is the graph linear? Explain your reasoning. *The graph is not linear because the data points do not seem to form a line; there is not a constant rate of change.*

3. Describe the pattern that occurs in the data. *The number of regions increases by a power of two. The power is equal to the number of folds.*

4. Write an equation to determine the number of regions if there are *n* folds.

   $r = 2^n$

Part II: Label the axes of the graph below before you plot your data. One axis is for Number of Folds and one axis is Area of Smallest Region. Think about the scale of your range and plan your markings before you begin.



Answer the following questions with the class:

1. Identify the independent and the dependent variables.
   The independent variable is ___*number of folds*___________________________________
   The dependent variable is ________*area of smallest region*________________________

2. Is the graph linear? Explain your reasoning. *The graph is not linear because the data points do not seem to form a line; there is not a constant rate of change.*

3. Describe the pattern that occurs in the data. *The area of the smallest region decreases by a negative power of two (or a power of ½). The power is equal to the number of folds.*

4. Write an equation to determine the number of regions if there are *n* folds. $r = 2^{-n}$

Pay Day!

In your math log, respond to the following question.

Part I:
Which of the following jobs would you choose? Give reasons to support your answer.
Job A: Salary of $1 for the first year, $2 for the second year, $4 for the third year, continuing for 25 years.
Job B: Salary of $1 Million a year for 25 years

Part II:
At the end of 25 years, which job would produce the largest amount in total salary?

NUMBER OF YEARS WORKED	YEARLY SALARY JOB A	TOTAL SALARY JOB A	YEARLY SALARY JOB B	TOTAL SALARY JOB B
1	$1	$1	$1,000,000	$1,000,000
2				
3				
4				
5				
6				
N				

1. Predict when the salaries will be equal. Explain your reasoning.
2. Does Job A represent linear or exponential growth? Explain your reasoning.
3. Does Job B represent linear or exponential growth? Explain your reasoning.
4. Write an equation to represent the salary for each job option.

Pay Day!

In your math log, respond to the following question.

Which of the following jobs would you choose?
Job A: Salary of $1 for the first year, $2 for the second year, $4 for the third year, continuing for 25 years.
Job B: Salary of $1 Million a year for 25 years
Give reasons to support your answer.

At the end of 25 years, which job would produce the largest amount in total salary?

NUMBER OF YEARS WORKED	YEARLY SALARY JOB A	TOTAL SALARY JOB A	YEARLY SALARY JOB B	TOTAL SALARY JOB B
1	*$1*	*$1*	*$1,000,000*	*$1,000,000*
2	*$2*	*$3*	*$1,000,000*	*$2,000,000*
3	*$4*	*$7*	*$1,000,000*	*$3,000,000*
4	*$8*	*$15*	*$1,000,000*	*$4,000,000*
5	*$16*	*$31*	*$1,000,000*	*$5,000,000*
6	*$32*	*$63*	*$1,000,000*	*$6,000,000*
N	2^{n-1}	*This cell would remain empty*	*$1,000,000*	*$1,000,000N*

1. Predict when the salaries will be equal. Explain your reasoning. *In about 20 years; Explanations will vary*
2. Does Job A represent linear or exponential growth? Explain your reasoning. *Exponential; the salary is equal to some power of 2 with the power equal to the number of years.*
3. Does Job B represent linear or exponential growth? Explain your reasoning. *Linear; the rate of change is constant*
4. Write an equation to represent the salary for each job option. *Job A:* $s = 2^{N-1}$
Job B: $s = 1,000,000N$

Linear or Non-Linear?

In this activity, you will construct a scatter plot using the data set you were given and determine if the data represents a linear or non-linear relationship.

1. Identify the independent and dependent variables and write them on the top left corner of the poster.

2. Construct the scatter plot on your poster board.

3. Describe the relationship between the two variables on the top right corner of the poster, including a decision about whether your data is linear or non-linear.

4. Present your findings to the class. Include in your presentation three informative points about your data and a discussion about why the data is linear or non-linear.

Unit 1, Activity 8, Sample Data

Household with Television Sets (in millions)	
Year	**Television Sets**
1986	158
1987	163
1988	168
1989	176
1990	193
1991	193
1992	192
1993	201

Median House Prices	
Year	**Price**
1990	85000
1991	88000
1992	92000
1993	100000
1994	106000
1995	115500
1996	125000
1997	135000
1998	151000
1999	160000

Average Temperature	
Month	**Temp**
1. Jan	50
2 Feb	54
3 Mar	60
4 Apr	67
5 May	74
6 June	80
7 July	82
8 Aug	81
9 Sept	78
10 Oct	68
11 Nov	59

Old Faithful geyser eruption	
Length of eruption (minutes)	**Minutes between eruptions**
2	57
2.5	62
3	68
3.5	75
4	83
4.5	89
5	92

Length and Weight of Whales	
Length	**Weight**
(feet)	**(long tons)**
40	25
42	29
45	34
46	35
50	43
52	45
55	51

Wind Chill	
Wind Speed	**Wind Chill**
(mph)	**Fahrenheit**
0	35
5	32
10	22
15	16
20	11
25	8
30	6
35	4

World Oil Production	
Year	**Barrels**
	(millions)
1900	149
1910	328
1920	689
1930	1412
1940	2150
1950	3803
1960	7674
1970	16690
1980	21722

Presidential Physical Fitness Awards	
Mile – Run	
Age	**Time (seconds)**
9	511
10	477
11	452
12	431
13	410
14	386

RUBRIC
Graphing: Linear or Non-linear?

Student Name: ____

CATEGORY	4	3	2	1
GRAPH				
Labeling of X axis	The X axis has a clear, neat label that describes the units used for the independent variable (e.g, days, months, participants' names).	The X axis has a clear label that describes the units used for the independent variable.	The X axis has a label.	The X axis is not labeled.
Labeling of Y axis	The Y axis has a clear, neat label that describes the units and the dependent variable (e.g, % of dog food eaten; degree of satisfaction).	The Y axis has a clear label that describes the units and the dependent variable (e.g, % of dog food eaten; degree of satisfaction).	The Y axis has a label.	The Y axis is not labeled.
Title	Title is creative and clearly relates to the problem being graphed (includes dependent and independent variable). It is printed at the top of the graph.	Title clearly relates to the problem being graphed (includes dependent and independent variable) and is printed at the top of the graph.	A title is present at the top of the graph.	A title is not present.
Accuracy of Plot	All points are plotted correctly and are easy to see. A ruler is used to neatly connect the points or make the bars, if not using a computerized graphing program.	All points are plotted correctly and are easy to see.	All points are plotted correctly.	Points are not plotted correctly OR extra points were included.
Linear or Non-linear?	Graph fits the data well and makes it easy to interpret.	Graph is adequate and does not distort the data, but interpretation of the data is somewhat difficult.	Graph distorts the data somewhat and interpretation of the data is somewhat difficult.	Graph seriously distorts the data making interpretation almost impossible.

Unit 1, Activity 8, Linear or Non-Linear Rubric

PRESENTATION	4	3	2	1
Clarity of presentation	Explanations of the project are presented in clear and detailed manner	Explanations of the project are presented in a clear manner	Explanation is a little difficult to understand, but includes critical components	Explanation is difficult to understand and includes little critical components
Accuracy of Information	All mathematical facts are reported accurately	Almost all mathematical facts are reported accurately	One fact is reported accurately	No facts were reported accurately or no facts were reported
POSTER	Exceptionally well designed, neat, and attractive. Colors that go well together are used to make the graph more readable. A ruler and graph paper (or graphing computer program) are used.	Neat and relatively attractive. A ruler and graph paper (or graphing computer program) are used to make the graph more readable.	Lines are neatly drawn, but the graph appears quite plain.	Appears messy and "thrown together" in a hurry. Lines are visibly crooked.

Creating a scatter plot with the TI-83 graphing calculator:

1) Enter data into lists:
   STAT EDIT
   Clear lists by highlighting L1 then pressing Clear, Enter
   Highlight L2 press clear, enter
   Enter independent variable (x) in L1
   Enter dependent variable (y) in L2

2) Turn on scatter plot:
   2^{nd} y=

   Enter 1: On Type: scatter plot Xlist: L_1 Ylist: L_2 Mark: (any)

3) Set window to fit your data:
   WINDOW
   Xmin and Xmax should be set to fit the data in L1
   Ymin and Ymax should be set to fit the data in L2
   All other entries can be set at whatever you wish

4) Look at Graph
   GRAPH

Understanding Data

The table below gives the box score for game three of the 2003 NBA Championship series.

SAN ANTONIO SPURS						REBOUNDS					
PLAYER	POS	MIN	FGM-A	3GM-A	FTM-A	OFF	DEF	TOT	AST	PF	PTS
TONY PARKER	G	43	9-21	4-6	4-8	1	2	3	6	0	26
STEPHEN JACKSON	G	36	2-7	1-2	2-4	0	6	6	2	3	7
TIM DUNCAN	F	45	6-13	0-0	9-12	3	13	16	7	3	21
BRUCE BOWEN	F	32	0-5	0-2	0-0	1	3	4	0	3	0
DAVID ROBINSON	C	26	1-5	0-0	6-8	1	2	3	0	2	8
Emanuel Ginobili		28	3-6	0-0	2-3	2	0	2	4	2	8
Malik Rose		22	4-7	0-0	0-0	0	2	2	0	2	8
Speedy Claxton		5	2-2	0-0	0-0	0	1	1	0	1	4
Kevin Willis		3	1-1	0-0	0-0	1	0	1	0	1	2
Steve Kerr											
Danny Ferry											
Steve Smith											
TOTAL		240	28-67	5-10	23-35	9	29	38	19	17	84
			41.8%	50.0%	65.7%	Team Rebs: 15					

NEW JERSEY NETS						REBOUNDS					
PLAYER	POS	MIN	FGM-A	3GM-A	FTM-A	OFF	DEF	TOT	AST	PF	PTS
JASON KIDD	G	42	6-19	0-5	0-0	2	1	3	11	3	12
KERRY KITTLES	G	43	8-16	3-5	2-3	1	3	4	1	2	21
KENYON MARTIN	F	42	8-18	0-1	7-8	2	9	11	0	5	23
RICHARD JEFFERSON	F	36	3-11	0-0	0-0	2	7	9	0	2	6
JASON COLLINS	C	25	0-3	0-0	0-0	4	1	5	1	6	0
Lucious Harris		22	1-6	1-2	4-4	1	0	1	3	2	7
Dikembe Mutombo		18	1-1	0-0	0-0	1	2	3	0	3	2
Rodney Rogers		11	0-3	0-0	2-2	0	2	2	0	2	2
Anthony Johnson		6	2-2	0-0	0-0	0	1	1	0	0	4
Aaron Williams		4	1-2	0-0	0-0	1	1	2	1	1	2
Tamar Slay											
Brian Scalabrine											
TOTAL		240	30-81	4-13	15-17	14	27	41	17	26	79
			37.0%	30.8%	88.2%	Team Rebs: 10					

Source: www.nba.com

Key for Table			
Pos	**Position**	**3GM-A**	**3 point goals made – 3 point goals attempted**
Min.	**Minutes Played**	**AST**	**Assists**
FGM–A	**Field goals made–field goals attempted**	**PF**	**Personal Fouls**
FTM–A	**Free throws made–free throws attempted**	**PTS**	**Total Points Scored**
R	**Rebounds**		

Use the table above to answer the following questions.

1. Which player played the most minutes of the game? ______________________

2. Who had the most assists? ________________________________

3. Which team made a larger percentage of free throws? ____________________

Unit 1, Activity 9, Understanding Data

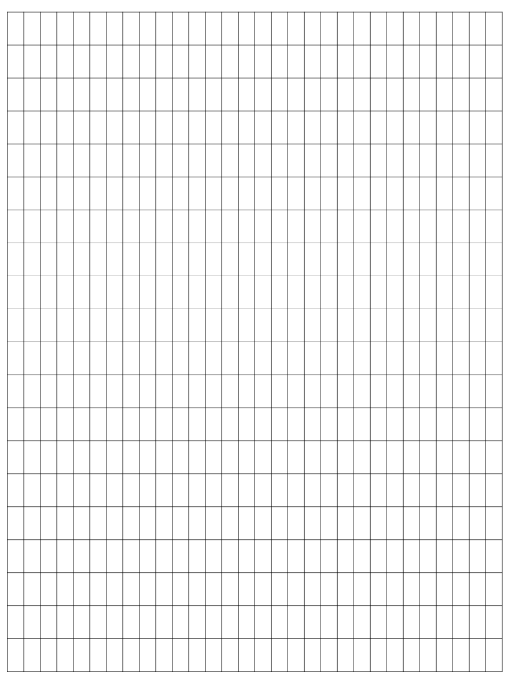
	FGM/FGA	FTM/FTA
JASON KIDD		
KERRY KITTLES		
KENYON MARTIN		
RICHARD JEFFERSON		
JASON COLLINS		
Lucious Harris		
Dikembe Mutombo		
Rodney Rogers		
Anthony Johnson		
Aaron Williams		
TONY PARKER		
STEPHEN JACKSON		
TIM DUNCAN		
BRUCE BOWEN		
DAVID ROBINSON		
Emanuel Ginobili		
Malik Rose		
Speedy Claxton		
Kevin Willis		

4. Calculate the percentage of free throws made/free throws attempted and field goals made/field goals attempted for each player. (Use the chart above to write your answers)

5. Which player(s) have/has the highest percentage? ____________________
Why do you think this is so?

6. Do you think that the players who attempt the most field goals are generally the players who make the most field goals? ________________

7. Make a scatter plot showing field goals made and field goals attempted.
Identify the independent and dependent variables.
Use different colors for the Spurs and Nets.



8. Does the scatter plot show a negative or positive correlation?

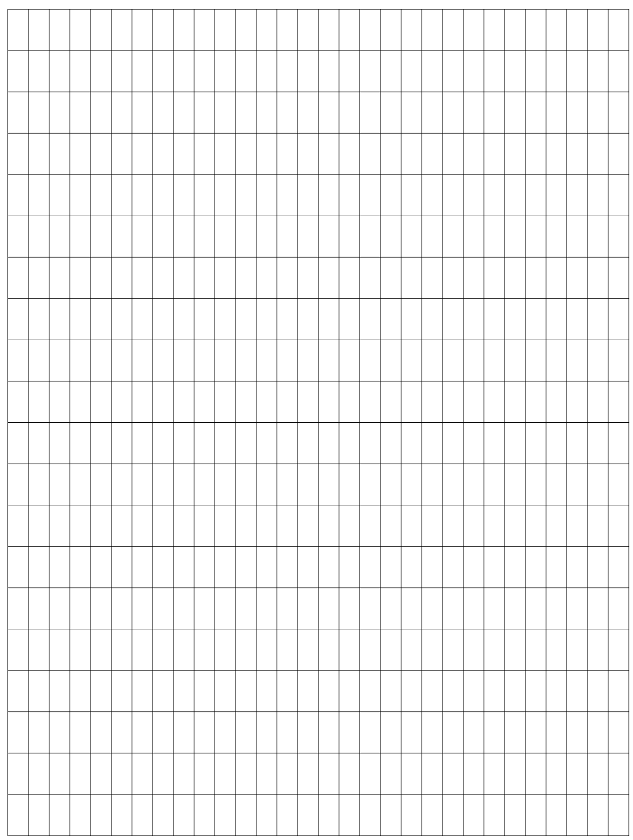
9. Who were the four perfect shooters in the game? Circle the points on the scatter plot that represent these perfect shooters.

10. The data on the graph seems to cluster in two sections. Can you explain where they cluster and why?

11. Give three interesting facts that you notice about the scatter plot.

12. Do you think that players who get a lot of rebounds also make a lot of assists (i.e., does the number of rebounds depend on the number of assists?)

13. Construct a scatter plot of rebounds and assists.



14. Is there a relationship between the two?

Understanding Data

The table below gives the box score for game three of the 2003 NBA Championship series.

SAN ANTONIO SPURS						REBOUNDS					
PLAYER	POS	MIN	FGM-A	3GM-A	FTM-A	OFF	DEF	TOT	AST	PF	PTS
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TIM DUNCAN	F	45	6-13	0-0	9-12	3	13	16	7	3	21
BRUCE BOWEN	F	32	0-5	0-2	0-0	1	3	4	0	3	0
DAVID ROBINSON	C	26	1-5	0-0	6-8	1	2	3	0	2	8
Emanuel Ginobili		28	3-6	0-0	2-3	2	0	2	4	2	8
Malik Rose		22	4-7	0-0	0-0	0	2	2	0	2	8
Speedy Claxton		5	2-2	0-0	0-0	0	1	1	0	1	4
Kevin Willis		3	1-1	0-0	0-0	1	0	1	0	1	2
Steve Kerr											
Danny Ferry											
Steve Smith											
TOTAL		240	28-67	5-10	23-35	9	29	38	19	17	84
			41.8%	50.0%	65.7%	Team Rebs: 15					

NEW JERSEY NETS						REBOUNDS					
PLAYER	POS	MIN	FGM-A	3GM-A	FTM-A	OFF	DEF	TOT	AST	PF	PTS
JASON KIDD	G	42	6-19	0-5	0-0	2	1	3	11	3	12
KERRY KITTLES	G	43	8-16	3-5	2-3	1	3	4	1	2	21
KENYON MARTIN	F	42	8-18	0-1	7-8	2	9	11	0	5	23
RICHARD JEFFERSON	F	36	3-11	0-0	0-0	2	7	9	0	2	6
JASON COLLINS	C	25	0-3	0-0	0-0	4	1	5	1	6	0
Lucious Harris		22	1-6	1-2	4-4	1	0	1	3	2	7
Dikembe Mutombo		18	1-1	0-0	0-0	1	2	3	0	3	2
Rodney Rogers		11	0-3	0-0	2-2	0	2	2	0	2	2
Anthony Johnson		6	2-2	0-0	0-0	0	1	1	0	0	4
Aaron Williams		4	1-2	0-0	0-0	1	1	2	1	1	2
Tamar Slay											
Brian Scalabrine											
TOTAL		240	30-81	4-13	15-17	14	27	41	17	26	79
			37.0%	30.8%	88.2%	Team Rebs: 10					

Source: www.nba.com

Key for Table			
Pos	**Position**	**3GM-A**	**3 point goals made – 3 point goals attempted**
Min.	**Minutes Played**	**AST**	**Assists**
FGM–A	**Field goals made–field goals attempted**	**PF**	**Personal Fouls**
FTM–A	**Free throws made–free throws attempted**	**PTS**	**Total Points Scored**
R	**Rebounds**		

Use the table above to answer the following questions.

1. Which player played the most minutes of the game? __*Tim Duncan*______________________

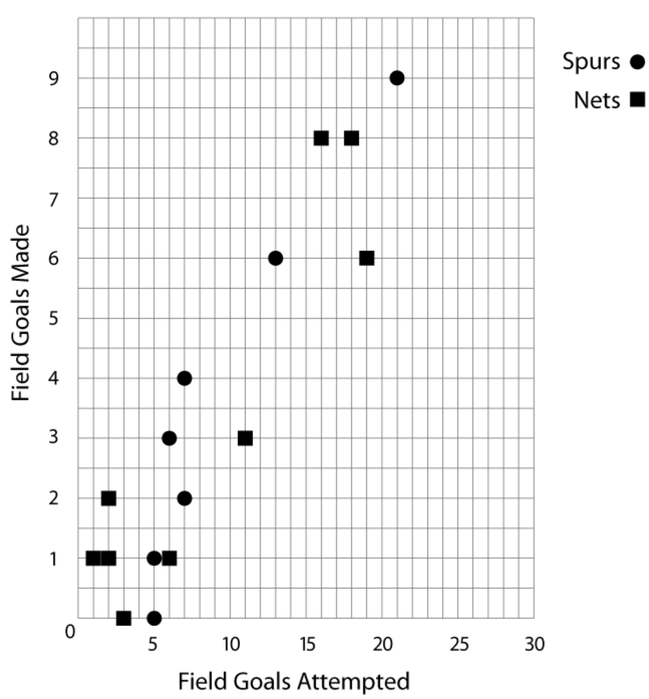
2. Who had the most assists? __*Jason Kidd*______________________________

3. Which team made a larger percentage of free throws? ____*Nets*_________________

	FGM/FGA	FTM/FTA
JASON KIDD	*32%*	--
KERRY KITTLES	*50%*	*67%*
KENYON MARTIN	*44%*	*88%*
RICHARD JEFFERSON	*27%*	--
JASON COLLINS	*0%*	--
Lucious Harris	*17%*	*100%*
Dikembe Mutombo	*100%*	--
Rodney Rogers	*0%*	*100%*
Anthony Johnson	*100%*	--
Aaron Williams	*50%*	--
TONY PARKER	*43%*	*50%*
STEPHEN JACKSON	*29%*	*50%*
TIM DUNCAN	*46%*	*75%*
BRUCE BOWEN	*0%*	--
DAVID ROBINSON	*20%*	*75%*
Emanuel Ginobili	*50%*	*67%*
Malik Rose	*57%*	--
Speedy Claxton	*100%*	--
Kevin Willis	*100%*	--

4. Calculate the percentage of free throws made/free throws attempted and field goals made/field goals attempted for each player. (Use the chart above to write your answers)
5. Which player(s) have/has the highest percentage of field goals made?__*Mutombo, A. Johnson, Claxton, Willis*_
Why do you think this is so? *They did not have as many attempts*
6. Do you think that the players who attempt the most field goals are generally the players who make the most field goals?__*You can't make goals if you don't attempt them.*_______________

7. Make a scatter plot showing field goals made and field goals attempted.
Identify the independent *(attempted)* and dependent variables.*(made)*
Use different colors for the Spurs and Nets.



8. Does the scatter plot show a negative or positive correlation? *positive*

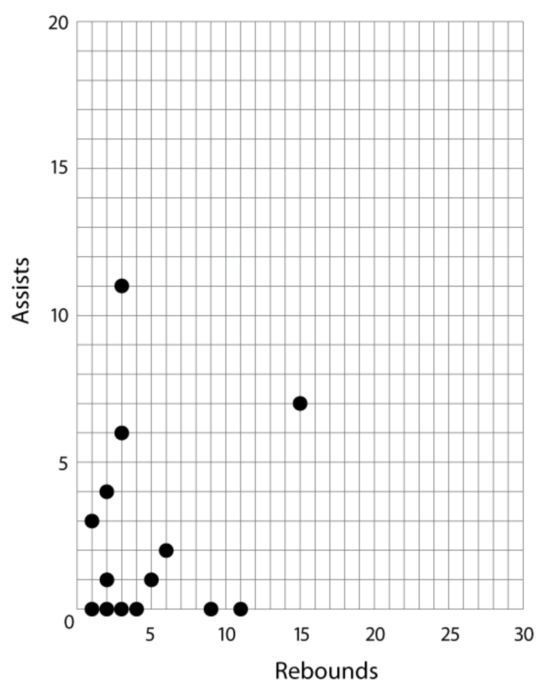
9. Who were the four perfect shooters in the game? Circle the points on the scatter plot that represent these perfect shooters. *Mutombo, A. Johnson, Claxton, Willis*

10. The data on the graph seems to cluster in two sections. Can you explain where they cluster and why?
The cluster at the highest point represents the players who played more minutes. The lower cluster is the group that played fewer minutes.

11. Give three interesting facts that you notice about the scatter plot.
Answers will vary

12. Do you think that players who get a lot of rebounds also make a lot of assists (i.e. does the number of rebounds depend on the number of assists)? *Students' opinions will vary*

13. Construct a scatter plot of rebounds and assists.

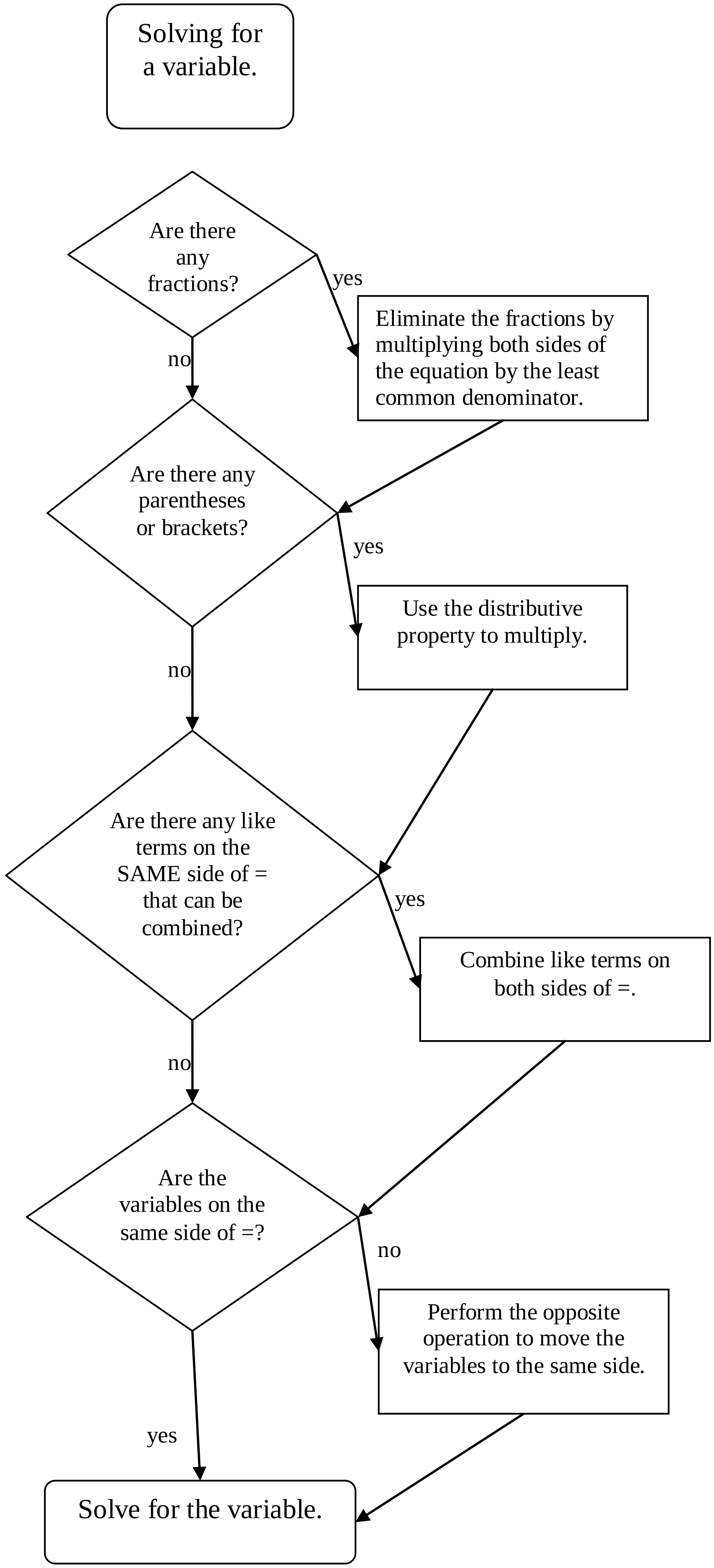


14. Is there a relationship between the two? *no*

Unit 2, Activity 2, Split-Page Notetaking Example

$2(m + 3) + 5 = 7(4 - m) - 5m$	Simplify both sides of the equation using order of operations.
$2m + 6 + 5 = 28 - 7m - 5m$	Cannot simplify inside parentheses, so multiply using the distributive property. Combine like terms.
$2m + 11 = 28 - 12m$ $+12m \qquad +12m$	Bring the variables to the same side of the equation – use the opposite operation (Add 12*m* or subtract 2*m*).
$14m + 11 = 28$ $-11 \quad -11$	Isolate the variable. Subtract 11 from both sides
$\frac{14m}{14} = \frac{17}{14}$	Divide both sides by 14.
$m = \frac{17}{14}$	Solution

Unit 2, Activity 3, Equation Graphic Organizer



Unit 2, Activity 4, Vocabulary Self-Awareness Chart

Word	+	☑	-	**Example**	**Definition**
Solution to an equation					
Variable					
Coefficient					
Constant term					
Addition Property of Equality					
Subtraction Property of Equality					
Multiplication Property of Equality					
Division Property of Equality					
Distributive Property					
Commutative Property					
Associative Property					
Equation					
Inequality					
Formula					

Procedure:
1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit you should have the entire chart completed. Because you will be revising this chart, write in pencil.

Proving Solution Methods

1. **Directions: Justify the statements in the solutions below. Use any of the properties that you have studied.**

Statements	Reasons
2(x + 1) + 1 = x - 5 - 2	**Original Problem**
2x + 2 +1 = x - 7	
2x + 3 = x - 7	
x + 3 = -7	
x = -10	

2. **Directions: Solve the equation and justify each step in the solution.**

Statements	Reasons
3(x + 2) + 4x = 4(x + 2) + 4	**Original Problem**

3. **Directions: Solve the equation and justify the solution. There is no value of x which will solve this equation.**

Statements	**Reasons**
2(x + 1) + 1 = (x - 5) + (x - 2)	**Original Problem**

4. **Directions: Solve the equation and justify each step of the solution. This equation is true for all values of the variable. It is called an identity.**

Statements	**Reasons**
3(x - 1) - 2 = 4(x - 4) -(x - 11)	**Original Equation**

5. **Explain how you would transform the equation 7x - 3y = 12 into each of the following equations as you isolate the variable *x*. Each part (a, b, or c) represents another step in the process to isolate the variable *x*.**

   a. $0 = 12 - 7x + 3y$ b. $7x = 3y + 12$ c. $x = \frac{3}{7}y + \frac{12}{7}$

6. **Explain how you would transform the equation 3x - 2y = 8 into each of the following equations as you isolate the variable *y*. Each part (a, b, or c) represents another step in the process to isolate the variable *y*.**

   a. $3x = 2y + 8$ b. $3x - 8 = 2y$ c. $\frac{3}{2}x - 4 = y$

Proving Solution Methods

1. **Directions: Justify the statements in the solutions below. Use any of the properties that you have studied.**

Statements	Reasons
2(x + 1) + 1 = x - 5 - 2	**Original Problem**
2x + 2 +1 = x - 7	*Distributive Property of Multiplication*
2x + 3 = x - 7	*Simplify; combine like terms*
x + 3 = -7	*Subtraction Property of Equality*
x = -10	*Subtraction Property of Equality*

2. **Directions: Solve the equation and justify each step in the solution.**

Statements	Reasons
3(x + 2) + 4x = 4(x + 2) + 4	**Original Problem**
3x +6 + 4x = 4x +8 +4	*Distributive Property of Multiplication*
7x + 6 = 4x + 12	*Simplify; combine like terms*
3x + 6 = 12	*Subtraction Property of Equality*
3x = 6	*Subtraction Property of Equality*
x = 2	*Division Property of Equality*

3. **Directions: Solve the equation and justify the solution. There is no value of x which will solve this equation.**

Statements	**Reasons**
2(x + 1) + 1 = (x - 5) + (x - 2)	**Original Problem**
2x +2 + 1 = 2x - 7	*Distributive Property of Multiplication; combine like terms*
2x + 3 = 2x - 7	*Simplify; combine like terms*
3 = -7	*Subtraction Property of Equality*

4. **Directions: Solve the equation and justify each step of the solution. This equation is true for all values of the variable. It is called an identity.**

Statements	**Reasons**
3(x - 1) - 2 = 4(x - 4) -(x - 11)	**Original Equation**
3x - 3 -2 = 4x - 16 - x + 11	*Distributive Property of Multiplication*
3x - 5 = 3x - 5	*Simplify; combine like terms*
-5 = -5	*Subtraction Property of Equality*
0 = 0	*Addition Property of Equality*
0 = 0	*Reflexive Property of Equality*

5. **Explain how you would transform the equation 7x - 3y = 12 into each of the following equations as you isolate the variable *x*. Each part (a, b, or c) represents another step in the process to isolate the variable *x*.**

   a. $0 = 12 - 7x + 3y$ b. $7x = 3y + 12$ c. $x = \frac{3}{7}y + \frac{12}{7}$

   a. Using the addition and subtraction properties of equality, subtract 7x from both sides of the equations and add 3y to both sides.

   b. Beginning from step a, using the addition property of equality, add 7x to both sides of the equation.

   c. Beginning from step b, using the division property of equality, divide both sides of the equation by 7.

6. **Explain how you would transform the equation 3x - 2y = 8 into each of the following equations.**

   a. $3x = 2y + 8$ b. $3x - 8 = 2y$ c. $\frac{3}{2}x - 4 = y$

   a. Using the addition property of equality, add 2y to both sides of the equation.

   b. Beginning from step a, using the subtraction property of equality, subtract 8 from both sides of the equation.

   c. Beginning from step b, using the division property of equality, divide both sides of the equation be 2 and simplify.

$2(m + 3) + 5 < 7(4 – m) – 5m$	Simplify both sides of the inequality using order of operations.
$2m + 6 + 5 < 28 – 7m – 5m$	Cannot simplify inside parentheses, so multiply using the distributive property Combine like terms
$2m + 11 < 28 – 12m$ $+12m \qquad +12m$	Bring the variables to the same side of the inequality – use the opposite operation (Add 12m or subtract 2m)
$14m + 11 < 28$ $-11 \quad -11$	Isolate the variable Subtract 11 from both sides
$\frac{14m}{14} < \frac{17}{14}$	Divide both sides by 14
$m < \frac{17}{14}$	Solution

Unit 2, Activity 6, Isolating Variables in Formulas

Isolating Variables in Formulas

Solve the equation or formula for the indicated variable.

1. $S = 5r^2t$, for t

2. $T = \frac{2U}{E}$, for U

3. $A = \frac{1}{2}bh$, for h

4. $P = 2l + 2w$, for l

5. $(y - y_1) = m(x - x_1)$, for m

6. $Ax + By = C$, for y

7. $C = \frac{5}{9}(F - 32)$, for F

8. $A = \frac{1}{2}(b_1 + b_2)$, for b_1

9. $4y + 3x = 7$, for x

10. $3y - 4x = 9$, for y

Solve the equation or formula for the indicated variable.

11. The formula for the time a traffic light remains yellow is $t = \frac{1}{8}s + 1$, where t is the time in seconds and s is the speed limit in miles per hour.
a. Solve the equation for s.
b. What is the speed limit at a traffic light that remains yellow for 4.5 seconds?

12. The length of a rectangle is 8 cm more than 3 times its width. The perimeter of the rectangle is 64 cm.
    a. Draw and label a diagram.

    b. What are the dimensions of the rectangle? Show your work.

    c. What is the area of the rectangle? Show your work

13. Air temperature drops approximately 5.5ºF for each 1,000-foot rise in altitude above Earth's surface (up to 30,000 ft).
    a. Write a formula that relates temperature *t* in degrees Fahrenheit at altitude *h* (in thousands of feet) and a ground temperature of 65ºF. State any restrictions on *h*.

    b. Find the temperature at 11,000 ft above Earth's surface.

Unit 2, Activity 6, Isolating Variables in Formulas with Answers

Isolating Variables in Formulas

Solve the equation or formula for the indicated variable.

1. $S = 5r^2t$, for *t* $\qquad t = \frac{S}{5r^2}$

2. $T = \frac{2U}{E}$, for *U* $\qquad U = \frac{TE}{2}$

3. $A = \frac{1}{2}bh$, for *h* $\qquad \frac{2A}{b} = h$

4. $P = 2l + 2w$, for *l* $\qquad \frac{P - 2w}{2} = l$

5. $(y - y_1) = m(x - x_1)$, for *m* $\qquad \frac{(y - y_1)}{(x - x_1)} = m$

6. $Ax + By = C$, for *y* $\qquad \frac{C - Ax}{B} = y$

7. $C = \frac{5}{9}(F - 32)$, for *F* $\qquad F = \frac{9}{5}C + 32$

8. $A = \frac{1}{2}(b_1 + b_2)$, for b_1 $\qquad b_1 = 2A - b_2$

9. $4y + 3x = 7$, for *x* $\qquad \frac{7 - 4y}{3} = x$

10. $3y - 4x = 9$, for *y* $\qquad y = \frac{9 + 4x}{3}$ or $y = 3 + \frac{4}{3}x$

Solve the equation or formula for the indicated variable.

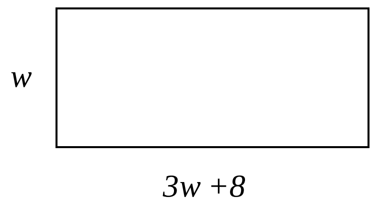
11. The formula for the time a traffic light remains yellow is $t = \frac{1}{8}s + 1$, where *t* is the time in seconds and *s* is the speed limit in miles per hour.

    a. Solve the equation for *s*. $\qquad s = 8(t - 1)$

    b. What is the speed limit at a traffic light that remains yellow for 4.5 seconds?

    s = 28 miles per hour

12. The length of a rectangle is 8 cm more than 3 times its width. The perimeter of the rectangle is 64 cm.
a. Draw and label a diagram.



w = width; 3w + 8 = length

b. What are the dimensions of the rectangle? Show your work.

$$P = 2w + 2l$$
$$64 = 2w + 2(3w + 8)$$
$$64 = 2w + 6w + 16$$
$$48 = 8w$$
$$6 \text{ cm} = w$$
$$26 \text{ cm} = \text{length}$$

c. What is the area of the rectangle? Show your work

$$A = lw$$
$$A = 6 \times 26$$
$$A = 156 \text{ cm}^2$$

13. Air temperature drops approximately 5.5ºF for each 1,000-foot rise in altitude above Earth's surface (up to 30,000 ft).

a. Write a formula that relates temperature *t* in degrees Fahrenheit at altitude *h* (in thousands of feet) and a ground temperature of 65ºF. State any restrictions on *h*.

t = temperature; h = height in number of thousands of feet

Formula: t = 65 – 5.5h

b. Find the temperature at 11,000 ft above Earth's surface.

t = 65 – 5.5(11); t = 4.5 degrees Celsius

Solving A Real World Application Problem Using A Formula

1. Directions: Read the problems below. Follow carefully the student problem solver's strategy as he solves the problems below using algebraic methods for transforming equations and formulas.

Have you ever wondered what happens to temperature as you go into a mine? Sometimes the temperature is very hot. In a Chilean coal mine, the temperature registers 90°F (32°Celsius) at a depth of 688 meters. Why would it matter how hot/cold the temperature in a mine is?
____

Scientists use formulas to determine the temperature at various depths inside mine. A typical formula indicates that temperature rises 10 degrees Celsius per kilometer travelled into the mine. Suppose the surface temperature of the mine is 22° Celsius, and the temperature at the bottom of the mine is 45° Celsius. What is the depth of the mine in kilometers?

What to think...	What to write...
Given: I must read the problem carefully to understand what information is given to me. I will write the information in an organized manner.	Surface Temperature = 22°C Bottom of Mine Temperature = 45°C Temperature increases 10 degrees for each kilometer that you go down.
Process: Since the temperature increases 10 degrees for every kilometer that I go down, I have to multiply 10 times the number of the kilometers to relate the depth and temperature. I will then have to add this value to the surface temperature.	s = Surface temp d = Depth b = Bottom temp $s + 10d = b$
I will develop the equation from the process. Since 22 is the surface temperature and 45 is the bottom temperature, I can use those values in the equation.	$22 + 10d = 45$
I need to solve the formula for *d*.	$22 + 10d = 45$ $-22 \quad\quad - 22$ $\frac{10}{10}d = \frac{23}{10}$ $d = 2.3$ km

At a depth of 2.3 km the temperature is 45° Celsius.

2. Now try this problem using this method of problem solving using a formula.

The temperature on a ski slope decreases 2.5° Fahrenheit for every 1000 feet you are above the base of the slope. If the temperature at the base is 28° and the temperature at the summit is 24° degrees. How many thousand feet is the summit above the base?

What to think...	What to write...
Given: I must read the problem carefully to understand what information is given to me. I will write the information in an organized manner.	
Process: Since the temperature ___________ degrees for every foot that I go ______, I have to _________ times the number of 1000s of feet to relate the height and temperature. I will then have to _______ this value from the _______ temperature.	
I will develop the equation from the process using the values I know from the problem.	
I need to solve the formula for x.	

At a height of _______ the temperature is ___________________.

3. Some problems involve geometric formulas. Suppose a rectangle has a perimeter of 96 centimeters. What is the formula for determining the perimeter of that shape? ____

The width of the rectangle is 2 less than its length. Determine the length and the width of the shape. Also, determine its area.

First, draw and label a diagram before you begin to solve the problem.

Wanted: l = length and w = width of the rectangle

What to think...	What to write...
Given:	

Unit 2, Activity 7, Solving Real World Application Problems Using a Formula

Process:	
I will develop the equation from the formula.	
I need to solve the formula for _____.	

If the perimeter of the rectangle is 96 centimeters, its length is ___________________________; its width is ____.

After you have found the dimensions of the rectangle, determine its area.
____

Unit 2, Activity 7, Solving Real world Application Problems Using a Formula with Answers

Solving A Real World Application Problem Using A Formula

1. Directions: Read the problems below. Follow carefully the student problem solver's strategy as he solves the problems below using algebraic methods for transforming equations and formulas.

Have you ever wondered what happens to temperature as you go into a mine? Sometimes the temperature is very hot. In a Chilean coal mine, the temperature registers 90°F (32°Celsius) at a depth of 688 meters. Why would it matter how hot/cold the temperature in a mine is?
Answers will vary.

Scientists use formulas to determine the temperature at various depths inside mine. A typical formula indicates that temperature rises 10 degrees Celsius per kilometer travelled into the mine. Suppose the surface temperature of the mine is 22° Celsius, and the temperature at the bottom of the mine is 45° Celsius. What is the depth of the mine in kilometers?

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I will develop the equation from the process. Since 22 is the surface temperature and 45 is the bottom temperature, I can use those values in the equation.	$22 + 10d = 45$
I need to solve the formula for d.	$22 + 10d = 45$ $-22 \quad\quad -22$ $\frac{10}{10}d = \frac{23}{10}$ $d = 2.3$ km

At a depth of 2.3 km the temperature is 45° Celsius.

2. Now try this problem using this method of problem solving using a formula.

The temperature on a ski slope decreases 2.5° Fahrenheit for every 1000 feet you are above the base of the slope. If the temperature at the base is 28° and the temperature at the summit is 24° degrees. How many thousand feet is the summit above the base?

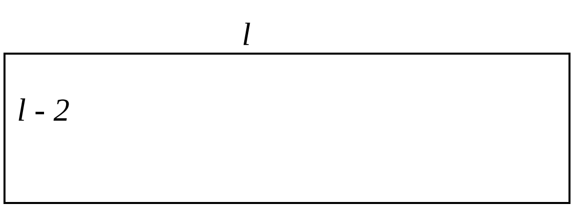
What to think...	What to write...
Given: I must read the problem carefully to understand what information is given to me. I will write the information in an organized manner.	*2.5: the amount the temperature drops for each 1000 kilometers* *28: the base temperature* *24: the summit temperature*
Process: Since the temperature *decreases 2.5* degrees for every foot that I go *up*, I have to *multiply 2.5* times the number of 1000s of feet to relate the height and temperature. I will then have to *subtract* this value from the *base* temperature.	*Base temperature = b* *Summit temperature = s* *Distance above base (in 1000's) = d* $b - 2.5d = s$
I will develop the equation from the process using the values I know from the problem.	$28 - 2.5d = 24$
I need to solve the formula for *d.*	*d = 1.6 thousand feet (or 1,600 feet)*

At a height of *1,600 feet* the temperature is *24 degrees.*

3. Some problems involve geometric formulas. Suppose a rectangle has a perimeter of 96 centimeters. What is the formula for determining the perimeter of that shape?
$P=2l + 2w$

The width of the rectangle is 2 less than its length. Determine the length and the width of the shape. Also, determine its area.

First, draw and label a diagram before you begin to solve the problem.



Wanted: l = length and w = width of the rectangle

Unit 2, Activity 7, Solving Real world Application Problems Using a Formula with Answers

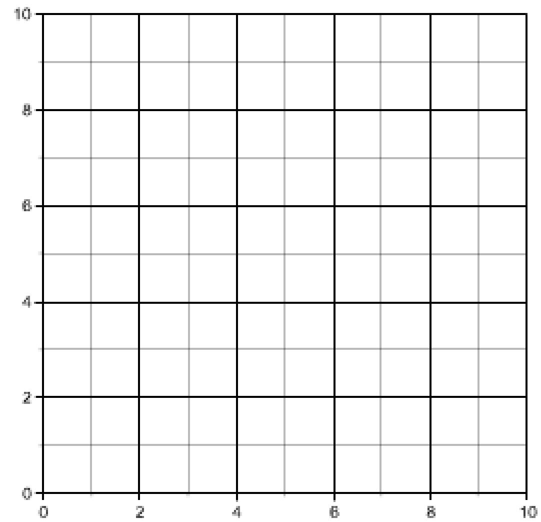
What to think...	What to write...
Given: *Perimeter is 96 cm*	$P = 2l + 2w$ $w = l - 2$ $P = 96$ *cm*
Process: *Multiply the length and width each by 2.. Then add to find the perimeter. To find the length and width solve the equation for l.*	$P = 2l + 2w$
I will develop the equation from the formula. *Substitute the expression for width into the perimeter formula*	$P = 2l + 2(l - 2)$
I need to solve the formula for *l.*	$l = 25$ *cm* $w = 23$ *cm*

If the perimeter of the rectangle is 96 centimeters, its length is *25 cm*; its width is *23 cm.*

After you have found the dimensions of the rectangle, determine its area. *Area: 575* cm^2

Unit 2, Activity 8, Linear Relationships

This is a chart of all of the hours worked, *h*, and the total pay, *p*, in your paycheck.



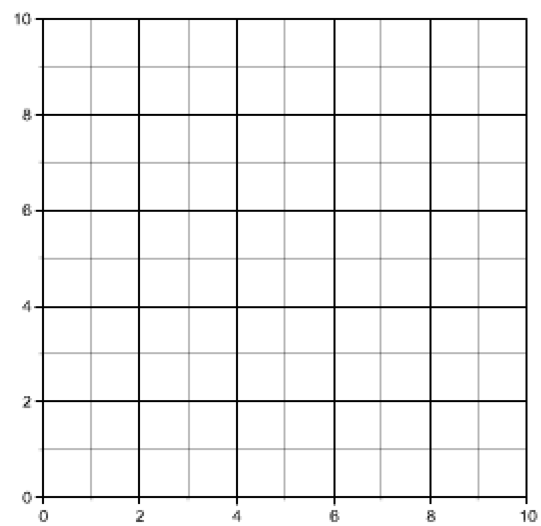
h	1	2	3	4	5	6
p	6.00	12.00	18.00	24.00	30.00	36.00

1. Please plot these points on the graph.
2. Is the graph linear? ___________________________
3. Does the line go through the origin? ______________
4. What is the rate of change? _______________
5. What is the real-life meaning of the rate of change of this linear relationship?

____

6. Write an equation to model this situation.__________
7. If you need to earn $60.00 to buy school supplies, how many hours will you need to work? _________

This is a chart of all of the gallons of gas bought, *g*, and the total price, *p*, of your purchase.



g	1	2	3	4	5	6
p	3.25	6.50	9.75	13.00	16.25	19.50

8. Please plot these points on the graph.
9. Is the graph linear? ___________________________
10. Does the line go through the origin? _____________
11. What is the rate of change? _______________
12. What is the real-life meaning of the rate of change of this linear relationship?

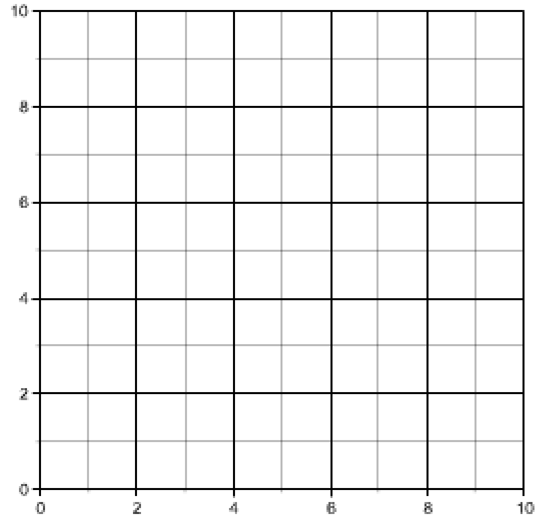
____

13. Write an equation to model this situation._________
14. If you have exactly $65.00 to spend on gas, how many gallons will you be able to buy? _______

Unit 2, Activity 8, Linear Relationships

This is a chart of minutes you talk on your cell phone, *m*, and the total charge, *c*, of your cell phone bill.

m	1	2	3	4	5	6
c	.10	.20	.30	.40	.50	.60



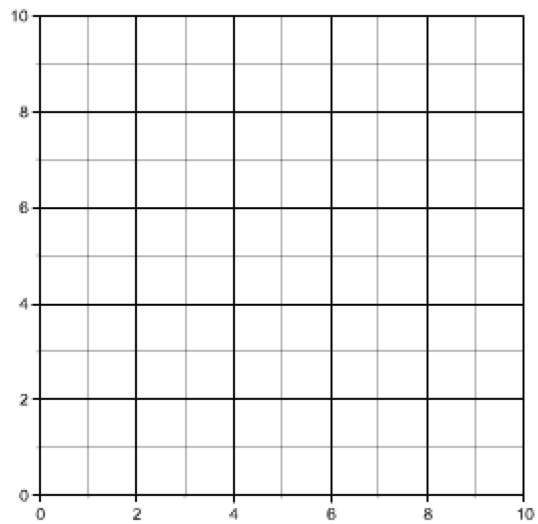
15. Please plot these points on the graph.
16. Is the graph linear? ____________________________
17. Does the line go through the origin? ______________
18. What is the rate of change? ________________
19. What is the real-life meaning of the rate of change of this linear relationship?

____

20. Write an equation to model this situation.__________
21. If your budget for cell phone use is $20.00, exactly how many minutes are you able to talk? ___________

This is a chart profit, *p*, you will make if you have a fundraiser selling t-shirts, *t*.

t	4	8	12	16	20	24
p	10.00	20.00	30.00	40.00	50.00	60.00



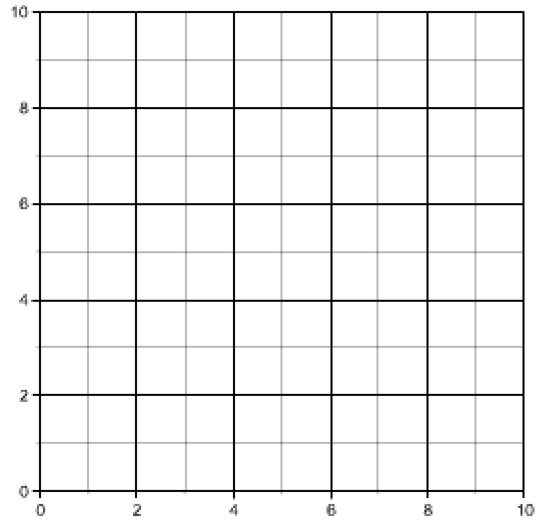
22. Please plot these points on the graph.
23. Is the graph linear? ____________________________
24. Does the line go through the origin? ______________
25. What is the rate of change? ________________
26. What is the real-life meaning of the rate of change of this linear relationship?

____

27. Write an equation to model this situation.__________
28. If your goal is to make a profit of $100.00 for your club, how many shirts must you sell? ________________

This is a chart of all of the hours worked, *h*, and the total pay, *p*, in your paycheck.

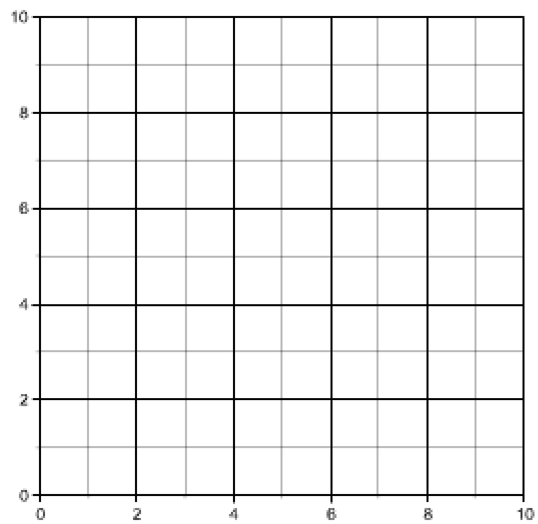
h	1	2	3	4	5	6
p	6.00	12.00	18.00	24.00	30.00	36.00



1. Please plot these points on the graph.
2. Is the graph linear? ______*yes*____________________
3. Does the line go through the origin? ____*yes*_______
4. What is the rate of change? _____*6.00*____
5. What is the real-life meaning of the rate of change of this linear relationship?
   For each hour worked, the pay increases $6.00
6. Write an equation to model this situation.__*p = 6h*__
7. If you need to earn $60.00 to buy school supplies, how many hours will you need to work? __*10 hours*

This is a chart of all of the gallons of gas bought, *g*, and the total price, *p*, of your purchase.

g	1	2	3	4	5	6
p	3.25	6.50	9.75	13.00	16.25	19.50

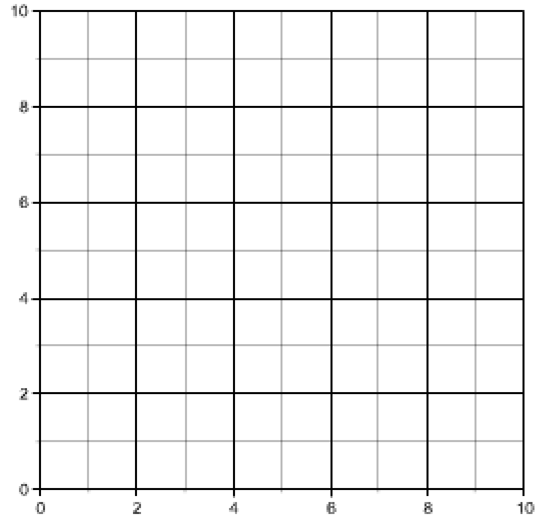


8. Please plot these points on the graph.
9. Is the graph linear? _________*yes*__________________
10. Does the line go through the origin? ____*yes*______
11. What is the rate of change? ______*3.25*_____
12. What is the real-life meaning of the rate of change of this linear relationship?
    Every gallon of gas costs $3.25
13. Write an equation to model this situation. __*p = 3.25g*
14. If you have exactly $65.00 to spend on gas, how many gallons will you be able to buy?
    20 gallons

Unit 2, Activity 8, Linear Relationships Keeping It Real with Answers

This is a chart of minutes you talk on your cell phone, *m*, and the total charge, *c*, of your cell phone bill.

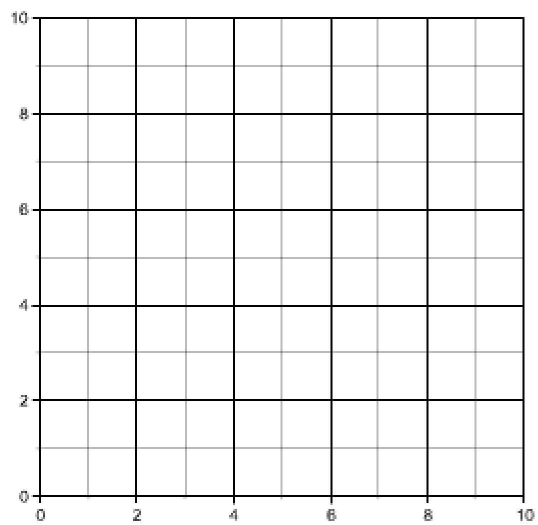
m	1	2	3	4	5	6
c	.10	.20	.30	.40	.50	.60



15. Please plot these points on the graph.
16. Is the graph linear? _______________*yes*__________
17. Does the line go through the origin? ______*yes*_____
18. What is the rate of change? _____*0.10*_____
19. What is the real-life meaning of the rate of change of this linear relationship?
    Each minute on the cell phone costs 10 cents
20. Write an equation to model this situation. *c = 0.10m*
21. If your budget for cell phone use is $20.00, exactly how many minutes are you able to talk? *200 minutes*

This is a chart profit, *p*, you will make if you have a fundraiser selling t-shirts, *t*.

T	4	8	12	16	20	24
P	10.00	20.00	30.00	40.00	50.00	60.00



22. Please plot these points on the graph.
23. Is the graph linear? __________*yes*_______________
24. Does the line go through the origin? ______*yes*______
25. What is the rate of change? ____*2.50*______
26. What is the real-life meaning of the rate of change of this linear relationship?
    The profit made on each t-shirt is $2.50
27. Write an equation to model this situation.__*p = 2.5t*_
28. If your goal is to make a profit of $100.00 for your club, how many shirts must you sell? _____*40 t-shirts*___

Unit Conversion

In this activity, you will use data about the heights of the ten tallest mountains in the world.

Mountain		Height		Location
1	Mount Everest	8,850m	29,035 ft	Nepal
2	Qogir (K2)	8,611m	28,250 ft	Pakistan
3	Kangchenjunga	8,586m	28,169 ft	Nepal
4	Lhotse	8,501m	27,920 ft	Nepal
5	Makalu I	8,462m	27,765 ft	Nepal
6	Cho Oyo	8,201m	26,906 ft	Nepal
7	Dhaulagiri	8,167m	26,794 ft	Nepal
8	Manaslu I	8,156m	26,758 ft	Nepal
9	Nanga Parbat	8,125m	26,658 ft	Pakistan
10	Annapurna I	8,091m	26,545 ft	Nepal

Use the graph below to create a scatter plot of the data. Use meters as your independent variable and feet as your dependent variable. Be sure to label both axes.

Does the data represent a linear or non-linear relationship?

What is the rate of change of the line?

What does the rate of change represent in real-life terms?

Write an equation for the linear relationship. Let x represent meters and y represent feet.

Use your equation to determine the length in meters of a football field.

The rate of change is the same as the ________________ of the line.

Use what you discovered about the equation for the relationship between meters and feet and write a direct variation equation for the relationship between miles and kilometers.

Use your equation to determine how many miles are in 10 kilometers?

Reflect on the following statement:

All unit conversions are linear relationships.

In your math log, write a paragraph explaining why you agree or disagree with the statement. Include examples to justify your position.

Unit 2, Activity 9 Unit Conversion with Answers

Unit Conversion

In this activity, you will use data about the heights of the ten tallest mountains in the world.

Mountain		Height		Location
1	Mount Everest	8,850m	29,035 ft	Nepal
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10	Annapurna I	8,091m	26,545 ft	Nepal

Use the graph below to create a scatter plot of the data. Use meters as your independent variable and feet as your dependent variable. Be sure to label both axes.

Does the data represent a linear or non-linear relationship?

Linear

What is the rate of change of the line?

3.28

What does the rate of change represent in real-life terms?

1 meter = 3.28 feet

Write an equation for the linear relationship. Let x represent meters and y represent feet.

$y = 3.28x$

Use your equation to determine the length in meters of a football field. *91.4 meters*

Unit 2, Activity 9 Unit Conversion with Answers

The rate of change is the same as the *slope*_____ of the line.

Use what you discovered about the equation for the relationship between meters and feet and write a direct variation equation for the relationship between miles and kilometers.

Let y = km and x = miles. $y = 1.6x$

Use your equation to determine how many miles are in 10 kilometers?

6.25 miles

Reflect on the following statement:

All unit conversions are linear relationships.

In your math log, write a paragraph explaining why you agree or disagree with the statement. Include examples to justify your position.

All unit conversions are linear relationship. Justifications will vary.

1. Rashaun has an overdue library book, and he is being charged $.25 for each day that it is overdue. Graph the total amount that he owes for his book as each day passes.

2. Jose is driving 65 miles per hour. Graph the distance that he has traveled as each hour passes.

3. Katherine wants to take her friends to a movie but only has a certain amount of money. Each movie ticket costs $6.50. Graph the total amount that she will spend on movie tickets if she takes *f* friends to a movie.

4. Courtney is renting a car to drive to another state. She is not sure how many days she will need the car. The cost of renting the car is $18 per day. Graph the total cost of renting the car as each day passes.

5. Drew is catering a party for his friends. He needs to buy grapes to use for his fruit tray. A pound of grapes cost $1.25 per pound. Graph the total cost for the grapes.

6. Ralph needs to give medicine to his pet hamster, Julian. The dosage says to administer 3 mgs each hour. Graph the total amount of medicine that Ralph gave to his hamster.

7. Jordan is piloting a hot air balloon that is rising at a rate of 500 feet per hour. Graph the height of the balloon.

8. One mile is the same as 1.6 kilometers. If John travels *m* miles, how many kilometers has he traveled?

Unit 3, Activity 1, Vocabulary Self-Awareness Chart

Vocabulary Self-Awareness Chart

Word	+	☑	-	**Example**	**Definition**
Relation					
Function					
Domain					
Range					
Graph					
Vertical line test					
F(x)					
input					
output					
independent					
dependent					
mapping					
1 to 1 correspondence					

Procedure:

1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit, you should have the entire chart completed. Because you will be revising this chart, write in pencil.

Unit 3, Activity 1, What is a Function?

What's a Function?

A relation is a set of ordered pairs.

A function is a special type of relation.

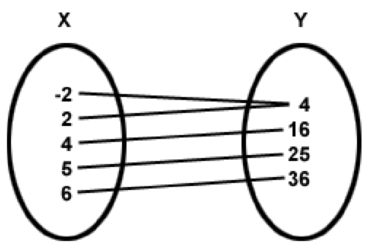
These relations are functions.

A) {(1, 2), (2, 3), (4, 8), (7, 5)}

B)

x	7	4	-3	5
y	4	6	3	4

C)



D) Time it takes to travel to the mall

Speed (mph)	50	55	60	65
Time (minutes)	36	33	30	28

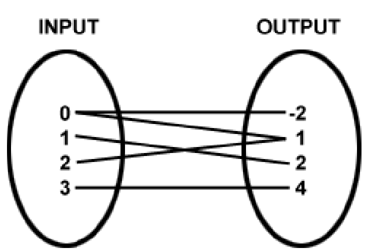
These relations are <u>not</u> functions.

A) {(4, 5), (7, 8), (4, 3), (2, 4)}

B)

x	7	4	5	5
y	4	6	3	4

C)



D) Does your age affect your GPA?

Age	14	15	16	16
GPA	3.6	3.3	3.0	2.8

What is a function?

Study the examples provided to determine the definition of a function. Discuss the possible answers with a partner. List the characteristics of each below.

Function

Not a function

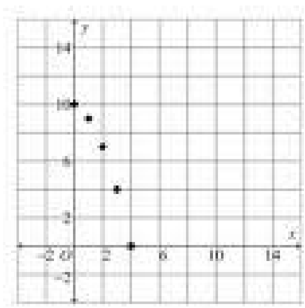
Unit 3, Activity 1, What is a Function?

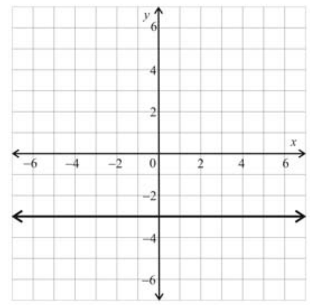
A function is a relation in which ____

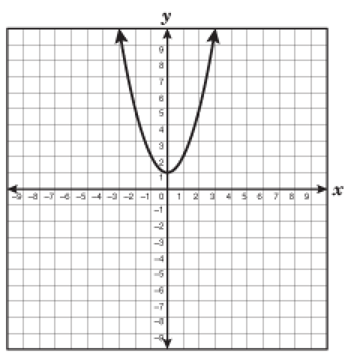
____

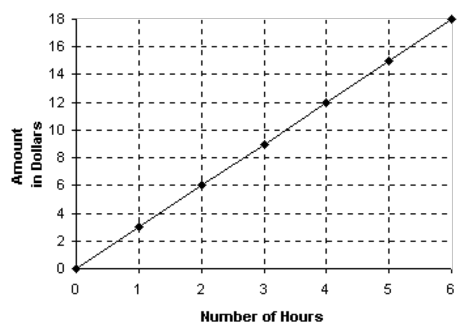
Since a graph is a set of ordered pairs, it is also a relation.

These relations are functions.

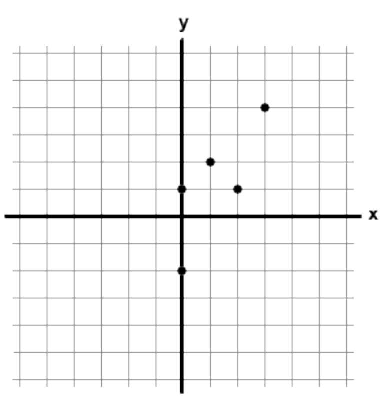


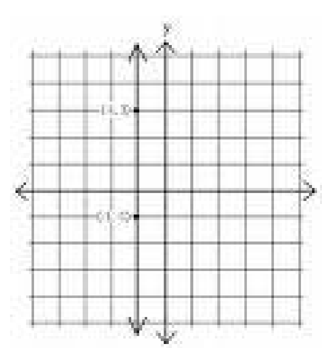




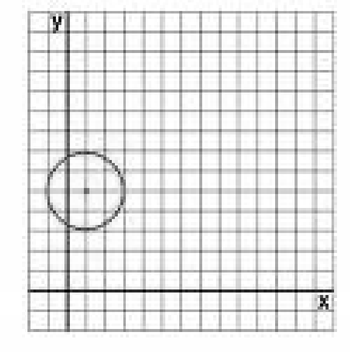


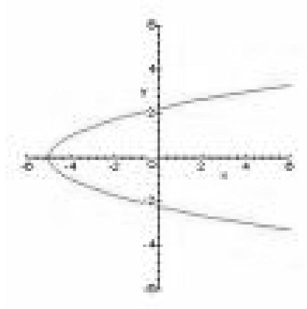
These relations are not functions.





Unit 3, Activity 1, What is a Function?





How can you determine if the graph of a relation is a function?

Vertical Line Test - ____

____

Domain and Range of a relation/function

Given the following function: {(1, 2), (2, 3), (4, 8), (7, 5)}

The domain of the function is: {1, 2, 4, 7}

The range of the function is: {2, 3, 8, 5}

Discuss with your partner what you believe is the definition of domain and range.

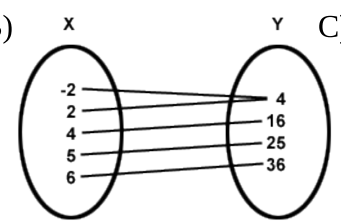
Domain - ____

Range - ____

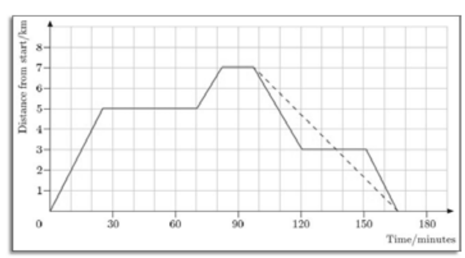
State the domain and range of each of the following functions.

A) {(1, 5), (2, 6), (3, 5)}

B)



C)



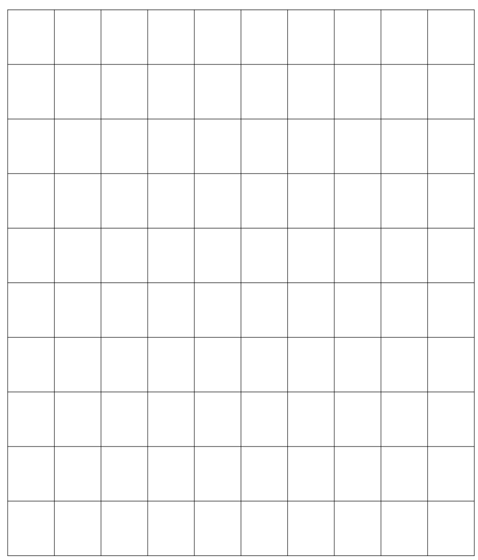
Unit 3, Activity 1, What is a Function?

Function notation - $f(x)$ *read "f of x"*

If $f(x) = 2x + 3$, find $f(-2)$, $f(-1)$, $f(0)$

Graph the function, $f(x) = 2x + 3$ by making a table of values.

x	y
-2	
-1	
0	



State the domain and range of the function.

Use the vertical line test to show that the graph is a function.

Unit 3, Activity 1, What is a Function? With Answers

What's a Function?

A relation is a set of ordered pairs.

A function is a special type of relation.

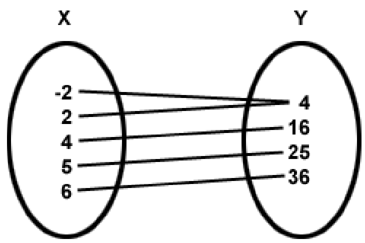
These relations are functions.

A) {(1, 2), (2, 3), (4, 8), (7, 5)}

B)

x	7	4	-3	5
y	4	6	3	4

C)



D) Time it takes to travel to the mall

Speed (mph)	50	55	60	65
Time (minutes)	36	33	30	28

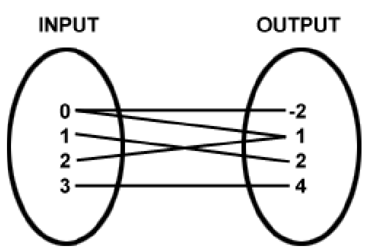
These relations are <u>not</u> functions.

A) {(4, 5), (7, 8), (4, 3), (2, 4)}

B)

x	7	4	5	5
y	4	6	3	4

C)



D) Does your age affect your GPA?

Age	14	15	16	16
GPA	3.6	3.3	3.0	2.8

What is a function?

Study the examples provided to determine the definition of a function. Discuss the possible answers with a partner. List the characteristics of each below.

Function
(Possible answers)
No inputs repeat
No inputs are paired with two different outputs

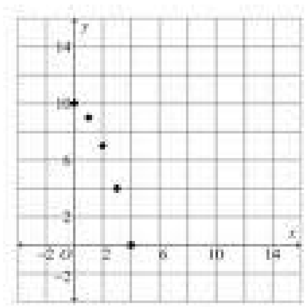
Not a function
(Possible answers)
Some of the inputs repeat
Same inputs have two different outputs

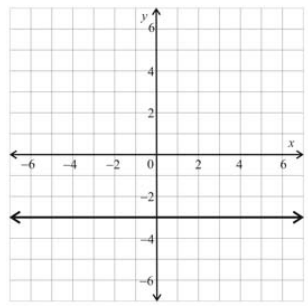
Unit 3, Activity 1, What is a Function? With Answers

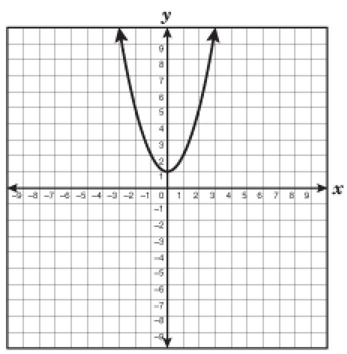
A function is a relation in which *every input has exactly one output*

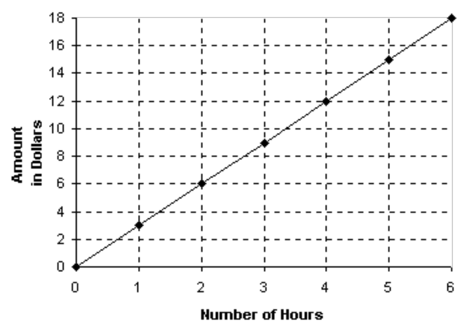
Since a graph is a set of ordered pairs, it is also a relation.

These relations are functions.

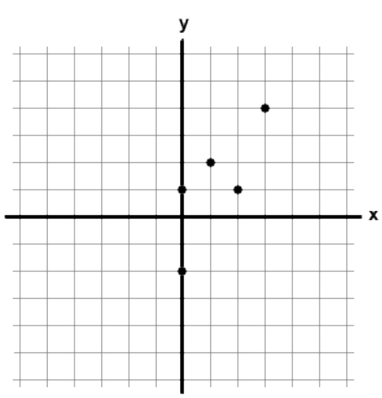


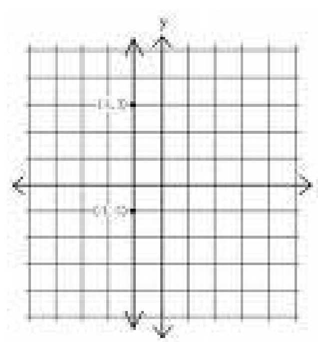




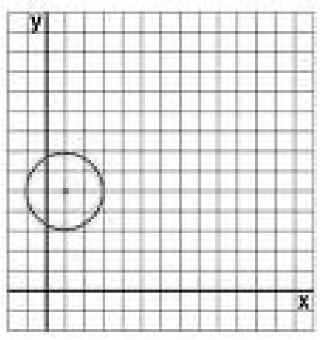


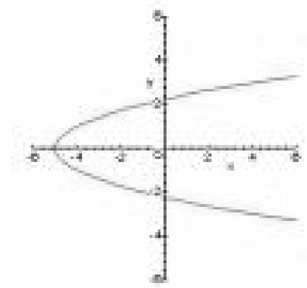
These relations are not functions.





Unit 3, Activity 1, What is a Function? With Answers





How can you determine if the graph of a relation is a function?

Vertical Line Test - __*If a vertical line drawn anywhere on a graph intersects the graph at more than one point, the graph is not a function.*____

Domain and Range of a relation/function

Given the following function: {(1, 2), (2, 3), (4, 8), (7, 5)}

The domain of the function is: {1, 2, 4, 7}

The range of the function is: {2, 3, 8, 5}

Discuss with your partner what you believe is the definition of domain and range.

Domain - __*the set of all inputs*____

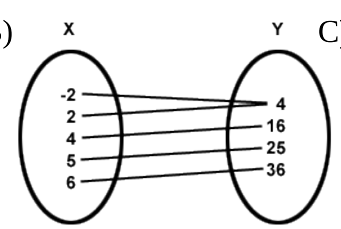
Range - __*the set of all outputs*____

State the domain and range of each of the following functions.

A) {(1, 5), (2, 6), (3, 5)}

D: {1, 2, 3}
R: {5, 6}

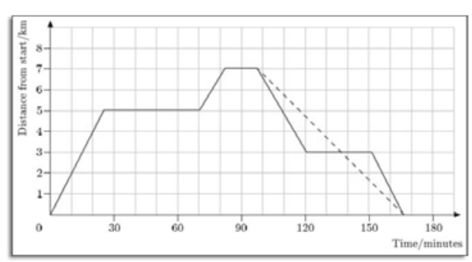
B)



D: {-2, 2, 4, 5, 6}

R: {4, 16, 25, 36}

C)



D: {0 through 165 minutes}
R: {0 through 7 miles}

Unit 3, Activity 1, What is a Function? With Answers

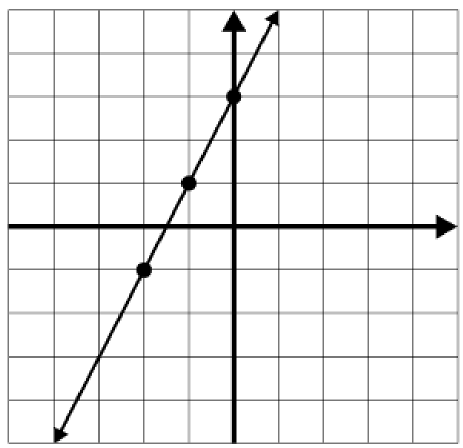
Function notation - $f(x)$ *read "f of x"*

If $f(x) = 2x + 3$, find *f*(-2), *f*(-1), *f*(0)

f(-2) = -1
f(-1) = 1
f(0) = 3

Graph the function, $f(x) = 2x + 3$ by making a table of values.

x	y
-2	*-1*
-1	*1*
0	*3*



State the domain and range of the function.

D: {all real numbers}
R: {all real numbers}

Use the vertical line test to show that the graph is a function.

Students should draw a few vertical lines on the graph to show that the function passes the vertical line test.

Identify Solution Sets for Equations Names ________________________

In this activity, you will use your handout with sets of ordered pairs and relation tables to fill in the spaces below. You can use the letter to save space. Work in groups.

$x + y = 5$	1.
$x + y = 10$	2.
$2x = y$	3.
$y = 4x$	4.
$y = x + 6$	5.
$x + y = -2$	6.
$y = 2x + 3$	7.
$8x + 4y = 24$	8.
$3x + y = 8$	9.
For your birthday each year, your grandmother gives you a choice of $20 for your gift or money equal to twice your age.	10.
Your health club charges $50 to sign up and $45 per month dues.	11.
You have borrowed $10,000 for college. Each month you spend $400.	12.
You are working to save money for a car. Your mother gave you $500 to start your account. You save $100 a month.	13.
A thriving business is doubling sales each year.	14.
A car is traveling at a rate of 50 mph.	15.
The cost to repair a car is $25 for the estimate and $25 per hour for repair work.	16.
$3y -3 (4x +2) = 2y +3$	17.
$9x – 10 = -3y + 2$	18.

19. One of the above problems is not a function. Which one is it? __________________________
20. One of the above functions is not linear. Which one is it? ______________________________
21. Rewrite #1-5 above in function notation. The first one is done for you.
    a. $x + y = 5$ $f(x) = -x + 5$

    b.

    c.

    d.

    e.

Unit 3, Activity 2, Identify

Ordered Pairs and Relation Tables

A.	(-2,-8) , (-1,-4) , (0,0) , (1,4) , (2,8)
B.	(0, 500), (1, 600), (2, 700), (3, 800), (4, 900)
C.	(-2,14) , (-1,11) , (0,8) , (1,5) , (2,2)
D.	(1 , 10000) , (2 , 20000) , (3 , 40000) , (4 , 80000)
E.	(-2,4) , (-1,5) , (0,6) , (1,7) , (2,8)
F.	(1,50) , (2,100) , (3,150) , (4,200) , (5,250)
G.	(-2,-15) , (-1,-3) , (0,9) , (1,21) , (2,33)
H.	(-2,7) , (-1,6) , (0,5) , (1,4) , (2,3)
I.	(0,25) , (1,50) , (2,75) , (3,100) , (4,125)

J.

input	output
-2	0
-1	-1
0	-2
1	-3
2	-4

K.

input	output
0	50
1	95
2	140
3	185
4	230

L.

input	output
1	5
2	7
3	9
4	11
5	13

M.

input	output
-2	12
-1	11
0	10
1	9
2	8

N.

input	output
1	9600
2	9200
3	8800
4	8400
5	8000

O.

input	output
-2	10
-1	7
0	4
1	1
2	-2

P.

Input	-2	-1	0	1	2	3
output	-4	-2	0	2	4	6

Q.

Input	0	1	2	3	4	5
Output	6	4	2	0	-2	-4

R.

Input	9	9	10	11	11	12
Output	20	18	20	20	22	20

Unit 3, Activity 2, Identify with Answers

Identify Solution Sets for Equations Names ______________________

In this activity, you will use your handout with sets of ordered pairs and relation tables to fill in the spaces below. You can use the letter to save space. Work in groups.

$x + y = 5$	*1. H*
$x + y = 10$	*2. M*
$2x = y$	*3. P*
$y = 4x$	*4. A*
$y = x + 6$	*5. E*
$x + y = -2$	*6. J*
$y = 2x + 3$	*7. L*
$8x + 4y = 24$	*8. Q*
$3x + y = 8$	*9. C*
For your birthday each year, your grandmother gives you a choice of $20 for your gift or money equal to twice your age.	*10. R*
Your health club charges $50 to sign up and $45 per month dues.	*11. K*
You have borrowed $10,000 for college. Each month you spend $400.	*12. N*
You are working to save money for a car. Your mother gave you $500 to start your account. You save $100 a month.	*13. B*
A thriving business is doubling sales each year.	*14. D*
A car is traveling at a rate of 50 mph.	*15. F*
The cost to repair a car is $25 for the estimate and $25 per hour for repair work.	*16. I*
$3y - 3(4x + 2) = 2y + 3$	*17. G*
$9x – 10 = -3y + 2$	*18. O*

19. One of the above problems is not a function. Which one is it?___*10) R*________________
20. One of the above functions is not linear. Which one is it? _____*14) D*___________________
21. Rewrite #1-5 above in function notation. The first one is done for you.
    a. $x + y = 5$ $f(x) = -x + 5$

    b. $x + y = 10$ $f(x) = -x + 10$

    c. $2x = y$ $f(x) = 2x$

    d. $y = 4x$ $f(x) = 4x$

    e. $y = x + 6$ $f(x) = x + 6$

Patterns and Slope

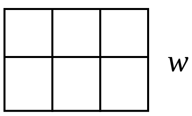
For this activity, you will need 15 square tiles.

Arrange three tiles in a rectangle as shown.

What is the width of the rectangle?

What is the perimeter of the rectangle?

Add another row of three tiles to the bottom of the rectangle as shown.



What is the width of the rectangle?

What is the perimeter of the rectangle?

Continue adding rows of three tiles and use the table below to collect the data of the varying widths and perimeters.

Input variable____________________

Output variable_____________________

x	y

What is the value of the <u>change</u> in the *y* values as the width of the rectangle was increased by 1 unit each time?

Does this table of values represent a linear relationship?

How can you tell?

Unit 3, Activity 4, Patterns and Slope

Graph the data on graph paper. Remember to title your graph, label both axes, and mark and label your intervals appropriately.

Does the graph represent a linear relationship?

How can you tell?

How is the change in y values shown on the graph?

How is the change in x values shown on the graph?

When you were originally collecting your data with the rectangles, each time there was a value which stayed constant when you determined your perimeter.

What is the constant value?

Then, to that constant value each time you added one more unit to the width, the perimeter changed by______________________.

This is called the rate of change or slope of the linear relationship.

RATE OF CHANGE/SLOPE = $\dfrac{\textit{change in y(dependent variable)}}{\textit{change in x(independent variable)}}$

Write an equation to model the relationship between width (x) and perimeter (y).

Circle the rate of change/slope in the equation.

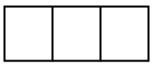
Explain and demonstrate how to find the rate of change of a linear relationship using a table, a graph, and a linear equation. Use another example of a linear relationship in your explanation.

Unit 3, Activity 4, Patterns and Slope with Answers

Patterns and Slope

For this activity, you will need 15 square tiles.

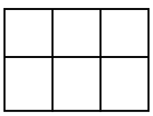
Arrange three tiles in a rectangle as shown.



What is the width of the rectangle? *1*

What is the perimeter of the rectangle? *8*

Add another row of three tiles to the bottom of the rectangle as shown.



What is the width of the rectangle? *2*

What is the perimeter of the rectangle? *10*

Continue adding rows of three tiles and use the table below to collect the data of the varying widths and perimeters.

Independent variable ___*width (x)*________________

Dependent variable __*perimeter(y)*_______________

x ____*width*___	y __*perimeter*____
1	*8*
2	*10*
3	*12*
4	*14*
5	*16*

What is the value of the change in the *y* values as the width of the rectangle was increased by 1 unit each time? *2*

Does this table of values represent a linear relationship? *yes*

How can you tell? *The change in the y values and the x values is constant*

Unit 3, Activity 4, Patterns and Slope with Answers

Graph the data on graph paper. Remember to title your graph, label both axes, and mark and label your intervals appropriately.

Does the graph represent a linear relationship? *yes*

How can you tell? *It makes a line*

How is the change in y values shown on the graph? *The vertical rise*

How is the change in x values shown on the graph? *The horizontal run*

When you were originally collecting your data with the rectangles, each time there was a value which stayed constant when you determined your perimeter.

What is the constant value? 6 *(the length of the rectangle times two because of the top and bottom of the rectangle)*

Then, to that constant value each time you added one more unit to the width, the perimeter changed by____*2*_____________________.

This is called the rate of change or slope of the linear relationship.

RATE OF CHANGE/SLOPE = $\dfrac{\textit{change in y(dependent variable)}}{\textit{change in x(independent variable)}}$

Write an equation to model the relationship between width (x) and perimeter (y).
$y = 6 + 2x$
Circle the rate of change/slope in the equation.

Explain and demonstrate how to find the rate of change of a linear relationship using a table, a graph, and a linear equation. Use another example of a linear relationship in your explanation.

1. David owns a farm market. The amount a customer pays for sweet corn depends on the number of ears that are purchased. David sells a dozen ears of corn for $3.00.

Complete the following:

a. Make a table reflecting prices for purchases of 6, 12, 18, and 24 ears of corn.
b. Write and graph 4 ordered pairs that represent the number of ears of corn and the price of the purchase.
c. Write an explanation of how the table was developed, how the ordered pairs were determined, and how the graph was constructed.
d. Draw a line through the points on the graph.
e. Find the slope of the line.
f. Explain the real-life meaning for the slope.
g. Determine the equation of the line by examining the graph for the slope and the *y*-intercept.
h. Explain which values for *x* and *y* are logical solutions to the linear equation.

2. You are saving money to buy a plasma television. You will be able to save $30.00 per week from your part-time job.

Complete the following:

a. Make a table reflecting savings for 4 weeks, 8 weeks, 12 weeks, and 16 weeks.
b. Write and graph 4 ordered pairs that represent the weeks and the amount of money saved at each interval.
c. Write an explanation of how the table was developed, how the ordered pairs were determined, and how the graph was constructed.
d. Draw a line through the points on the graph.
e. Find the slope of the line.
f. Explain the real-life meaning for the slope.
g. What is the *y*- intercept of the graph? What is its meaning?
h. Determine the equation of the line by examining the graph for the slope and the *y*-intercept.
i. How much have you saved after 18 weeks?
j. How would the situation change if your Grandmother gives you $300 to begin your savings program?
k. How would the graph change and how would the *y*-intercept change?
l. What would be the equation of the line?
m. How much do you have saved after 18 weeks?
n. Explain what types of numbers (*x, y*) are appropriate solutions to the linear equations

Unit 3, Activity 6, Rate of Change

1. David owns a farm market. The amount a customer pays for sweet corn depends on the number of ears that are purchased. David sells a dozen ears of corn for $3.00.

Complete the following:

a. Make a table reflecting prices for purchases of 6, 12, 18, and 24 ears of corn.

x	*y*
6	*1.50*
12	*3.00*
18	*4.50*
24	*6.00*

b. Write and graph 4 ordered pairs that represent the number of ears of corn and the price of the purchase. *(6, 1.50), (12, 3.00), (18, 4.50), (24, 6.00); see students' graphs.*

c. Write an explanation of how the table was developed, how the ordered pairs were determined, and how the graph was constructed. *Answers will vary.*

d. Draw a line through the points on the graph. *See students' graphs*

e. Find the slope of the line. *$0.25*

f. Explain the real-life meaning for the slope. *For every ear of corn purchased, the price goes up $.25*

g. Determine the equation of the line by examining the graph for the slope and the y-intercept. $y = 0.25x$

h. Explain which values for x and y are logical solutions to the linear equation. *The number of ears of corn purchased must be a whole number quantity. The y values are dollar values that are multiples of $.25.*

2. You are saving money to buy a plasma television. You will be able to save $30.00 per week from your part-time job.

Complete the following:

a. Make a table reflecting savings for 4 weeks, 8 weeks, 12 weeks, and 16 weeks.

x	*y*
4	*120.00*
8	*240.00*
12	*360.00*
16	*480.00*

b. Write and graph 4 ordered pairs that represent the weeks and the amount of money saved at each interval. *(4, 120.00), (8, 240.00), (12, 360.00), (16, 480.00); see students' graphs*

c. Write an explanation of how the table was developed, how the ordered pairs were determined, and how the graph was constructed. *Answers will vary.*

d. Draw a line through the points on the graph. *See students' graphs.*
e. Find the slope of the line. *30*
f. Explain the real-life meaning for the slope. *Each week you are saving $30 more*
g. What is the y intercept of the graph? What is its meaning? *The origin because you start with no money.*
h. Determine the equation of the line by examining the graph for the slope and the y-intercept. $y = 30x$
i. How much have you saved after 18 weeks? *$540*
j. How would the situation change if your Grandmother gives you $300 to begin your savings program? *Answers will vary*
k. How would the graph change and how would the y-intercept change? *The graph would start at 300 so the y-intercept would be 300*
l. What would be the equation of the line? $y = 300 + 30x$
m. How much do you have saved after 18 weeks? *$840*
n. Explain what types of numbers (x, y) are appropriate solutions to the linear equations.
The ordered pairs that represent solutions to the equations would have whole number values for x to represent the number of weeks you have saved money and whole number dollar values for y which are represented by the expression.
$300 + 30x$.

Investigating Slope

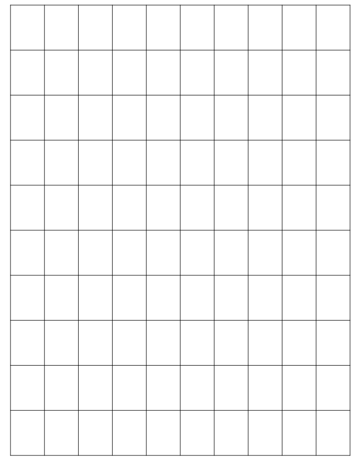
I. Answer questions 1-6 based on the following situation.

A gourmet coffee shop sells a certain coffee bean for $6 per pound and another type of coffee bean for $8 per pound.

1. Make a table of values for each type of coffee bean and graph the lines on the same graph.

Coffee Bean 1	
x	*y*
0	
1	
2	
3	
4	

Coffee Bean 2	
x	*y*
0	
1	
2	
3	
4	



2. Write the equation of each of the lines.

3. Find the slope and the *y*-intercept of each line.

4. What are the similarities and differences of the two lines?

5. Add a line to the graph that would be the cost of a coffee bean that is $4 per pound.

6. What similarities and differences exist between the new line and the two original lines?

II. Graph the following lines on the graphing calculator.

A. $y = x$
B. $y = 2x$
C. $y = 3x$
D. $y = 4x$

7. Describe what happens to the graph as the slope is increased.

III. Graph the following functions on the graphing calculator:

A. $y = x + 5$ B. $y = \left(\frac{1}{2}\right)x + 5$ C. $y = x + 5$ D. $y = \left(\frac{1}{3}\right)x + 5$

8. Describe what happens to the graph as the slope is decreased (but still a positive value).

IV. Graph the following functions on the graphing calculator:

A. $y = x - 2$
B. $y = -x - 2$
C. $y = -3x - 2$
D. $y = \left(-\frac{1}{2}\right)x - 2$

9. Describe what happens when the slope is a negative number.

10. Does the equation $y = -2x$ have a positive or negative slope? Without graphing, does this line tilt to the right or to the left? Explain your answer.

V. Graph the following functions on the graphing calculator

A. $y = 5$
B. $y = -2$
C. $y = 1$

11. Describe the lines that are graphed.

12. What is the slope of each line?

13. Write an equation of each line in slope-intercept form.

V. Graph the following by hand.

A. $x = 6$
B. $x = 3$
C. $x = -5$

14. Describe the lines that are graphed.

15. What is the slope of each line?

16. What are the differences between the two equations $y = 2$ and $x = 2$?

Unit 3, Activity 8, Graph Families with Answers

Investigating Slope

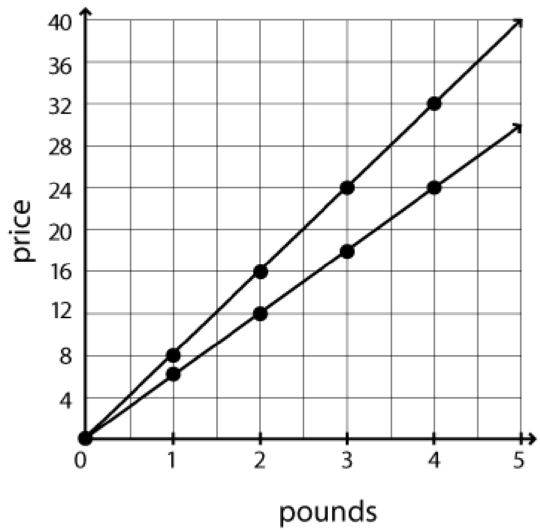
I. Answer questions 1-6 based on the following situation.

A gourmet coffee shop sells a certain coffee bean for \$6 per pound and another type of coffee bean for \$8 per pound.

1. Make a table of values for each type of coffee bean and graph the lines on the same graph

Coffee Bean 1	
x	*y*
0	*0*
1	*6*
2	*12*
3	*18*
4	*24*

Coffee Bean 2	
x	*y*
0	*0*
1	*8*
2	*16*
3	*24*
4	*32*



2. Write the equation of each of the lines.
y = 6x, y = 8x

3. Find the slope and the y-intercept of each line.
slope: 6 and 8
y – intercept: 0 for both lines

4. What are the similarities and differences of the two lines? *Answers will vary, sample: One is steeper, they both have the same y-intercepts.*

5. Add a line to the graph that would be the cost of a coffee bean that is \$4 per pound.

6. What similarities and differences exist between this line and the two original lines?
It is flatter than the other two lines, same y-intercept.

II. Graph the following lines on the graphing calculator.

A. $y = x$
B. $y = 2x$
C. $y = 3x$
D. $y = 4x$

7. Describe what happens to the graph as the slope is increased. *The line gets steeper.*

III. Graph the following functions on the graphing calculator:

A. $y = x + 5$ B. $y = \left(\frac{1}{2}\right) x + 5$ C. $y = \left(\frac{1}{4}\right) x + 5$ D. $y = \left(\frac{1}{3}\right) x + 5$

8. Describe what happens to the graph as the slope is decreased (but still a positive value).
The line gets flatter.

IV. Graph the following functions on the graphing calculator:

A. $y = x - 2$
B. $y = -x - 2$
C. $y = -3x - 2$
D. $y = \left(-\frac{1}{2}\right)$ x - 2

9. Describe what happens when the slope is a negative number. *The line slants in the opposite direction or as x increases, y decreases.*

10. Does the equation y = -2x have a positive or negative slope? Without graphing, is this line tilted to the right or to the left? Explain your answer. *Negative, left*

IV. Graph the following functions on the graphing calculator

A. $y = 5$
B. $y = -2$
C. $y = 1$

11. Describe the line that is graphed. *horizontal*

12. What is the slope of each line? *0*

13. Write an equation of each line in slope-intercept form. *y = 0x + 5, y = 0x – 2, y = 0x + 1*

V. Graph the following by hand.

A. $x = 6$
B. $x = 3$
C. $x = -5$

14. Describe the line that is graphed. *vertical*

15. What is the slope of each line? *undefined*

16. What are the differences between the two equations y = 2 and x = 2? *One is horizontal, and one is vertical.*

Slopes and *Y*-Intercepts

1. Graph these equations on your graphing calculator.

$y = 2x + 4$
$y = 2x + 1$
$y = 2x - 3$

How are these equations alike? ___________________________
How are these equations different? ________________________
How does the change in the *y*-intercept affect the graph?
____

2. Graph these equations on your graphing calculator.

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

How are these equations alike? ___________________________
How are these equations different? ________________________
How does the change in the *y*-intercept affect the graph?
____

3. Graph these equations on your graphing calculator.

$y = \frac{1}{3}x + 5$
$y = \frac{1}{3}x$
$y = \frac{1}{3}x - 1$

How are these equations alike? ___________________________
How are these equations different? ________________________
How does the change in the *y*-intercept affect the graph?
____

4. Graph these equations on your graphing calculator.

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

How does changing the slope affect the graph?
____

What do you observe about the difference in the graphs of positive and negative slopes? _____________________________________

5. Graph these equations on your graphing calculator.

$y = -\frac{2}{5}x - 2$
$y = \frac{1}{4}x - 2$
$y = -2$

How does changing the slope affect the graph?
____

What do you observe about the difference in the graphs of positive and negative slopes? _____________________________________

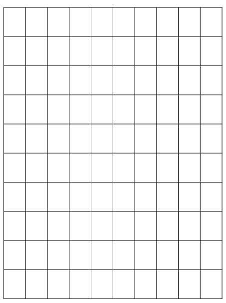
6. Graph these equations on your graphing calculator.

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

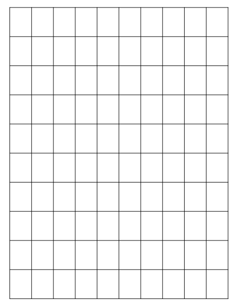
How does changing the slope affect the graph? ____

What do you observe about the difference in the graphs of positive and negative slopes? ___________________________________

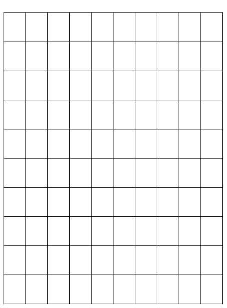
7. Graph $y = x$

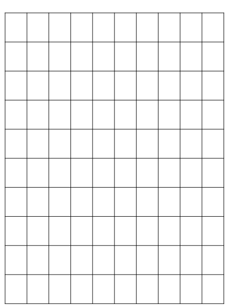


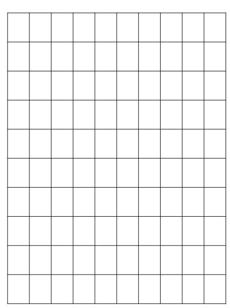
8. Graph $y = -x$

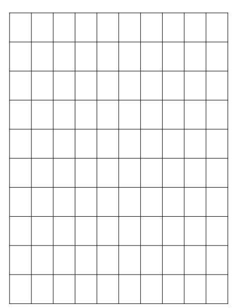


9. Make up 2 equations with horizontal lines and 2 equations with vertical lines. Graph them below and mark each one with the equation of the line.









Unit 3, Activity 9, Slopes and Y-intercepts with Answers

Slopes and *Y*-Intercepts

1. Graph these equations on your graphing calculator.

$y = 2x + 4$
$y = 2x + 1$
$y = 2x - 3$

How are these equations alike? __*They have the same slope.*________________
How are these equations different? _*They have different y-intercepts.*_________
How does the change in the y-intercept affect the graph? _I*t shifts the line up or down on the y-axis.*____

2. Graph these equations on your graphing calculator.

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

How are these equations alike? __*They have the same slope.*________________
How are these equations different? _*They have different y-intercepts.*_________
How does the change in the y-intercept affect the graph? __*It shifts the line up or down on the y-axis.*_______

3. Graph these equations on your graphing calculator.

$y = \frac{1}{3}x + 5$
$y = \frac{1}{3}x$
$y = \frac{1}{3}x - 1$

How are these equations alike? ___*They have the same slope.*_________
How are these equations different? _____*They have different y-intercepts.*___
How does the change in the y-intercept affect the graph? _*It shifts the line up or down on the y-axis.*______

4. Graph these equations on your graphing calculator.

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

How does changing the slope affect the graph? _*It makes the line steeper or flatter and it changes the direction of the slant of the line.*______________

What do you observe about the difference in the graphs of positive and negative slopes? __*Graph of line with positive slope slants right;, negative slope slants left.*___

5. Graph these equations on your graphing calculator.

$y = -\frac{2}{5}x - 2$
$y = \frac{1}{4}x - 2$
$y = -2$

How does changing the slope affect the graph? *It makes the line steeper or flatter and it changes the direction of the slant of the line*_____________

What do you observe about the difference in the graphs of positive and negative slopes? __*Graph of line with positive slope slants right;, negative slope slants left.*___

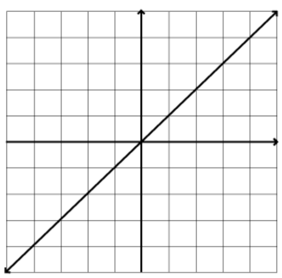
6. Graph these equations on your graphing calculator.

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

How does changing the slope affect the graph? *It makes the line steeper or flatter, and it changes the direction of the slant of the line.*

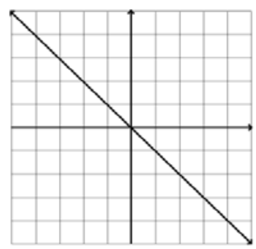
What do you observe about the difference in the graphs of positive and negative slopes? *Graph of line with positive slope slants right; negative slope slants left.*

7. Graph y = x



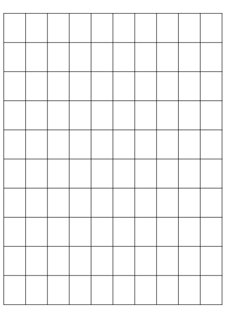
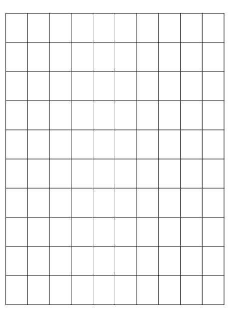
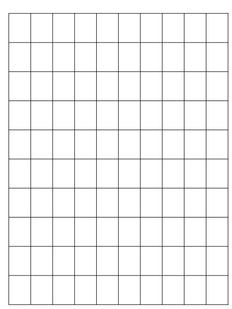
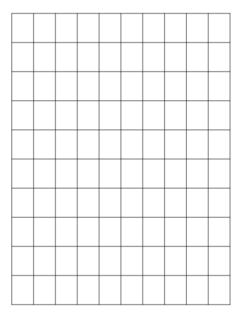
Graph y = x

8. Graph y = -x



Graph y = -x

9. Make up 2 equations with horizontal lines and 2 equations with vertical lines. Graph them below and mark each one with the equation of the line.

Functions of Time Project
Rubric

Directions: Write a report explaining the procedures and the conclusion of your function of time investigation. In your report, the following questions must be answered:

1. What did you investigate?
2. How did you and your partner decide what to investigate?
3. What is the domain and range of your function? Describe the domain and range in terms of your data.
4. Discuss whether the function is linear or non-linear. Include how you arrived at your decision.
4. Did you see any patterns in the relationship you observed?
5. How did you decide what values to use for your axes?
6. How did you divide up the work between you and your partner?
7. Did you have any problems conducting your investigation? If so, explain.

(Teachers may wish to add other questions to ensure understanding of the investigation.)

This rubric must be handed in with your final project.
Name___________________________________

Spreadsheet/Table

Demonstrates mastery of constructing a spreadsheet/table with no errors	Spreadsheet/table is constructed with 1 – 2 errors	Spreadsheet/table is constructed with 3 errors	Spreadsheet/table is constructed with 4 - 5 errors	Spreadsheet/table is constructed with many errors
4 points	3 points	2 points	1 points	0 points

Graph

Graph is exemplary. Title is included, axes are labeled appropriately, all points are plotted correctly.	Graph is sufficient but has 1 - 2 errors in construction.	Graph has 3 errors.	Graph has 4 -5 errors.	Graph is constructed with many errors.
4 points	3 points	2 points	1 point	0 points

Report

Report is exemplary. All questions are answered thoroughly. No grammatical errors.	Report is constructed with few grammatical errors or one question was not answered thoroughly.	Report is constructed with grammatical errors or 2 -3 questions were not answered thoroughly.	Report is constructed with many grammatical errors or 4 questions were not answered thoroughly.	Report is insufficient as explanation of project.
12 points	9 points	6 points	3 points	0 points

Unit 4, Activity 1, Vocabulary Awareness Chart

Procedure:

1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit, you should have the entire chart completed. Because you will be revising this chart, write in pencil.

Word	+	☑	**-**	**Example**	**Definition**
Slope of a line					
Slope-intercept form of a linear equation					
Point-slope form of a linear equation					
Standard form of a linear equation					
Scatterplot					
Line of Best Fit					
Line of Regression					
Linear Interpolation					
Linear Extrapolation					
y-intercept					
x-intercept					
Correlation coefficient(r)					
Rise Run					
Coefficient of a variable					
Constant term					

Unit 4, Activity 1, Generating Equations

Forms of Linear Equations

1. Given the slope and the y intercept, write the equation described in slope-intercept and standard forms.

A. m = $\frac{2}{9}$; b = 3

B. m = 0; b = 1

C. m = - $\frac{9}{2}$; b = 3

D. m = -3; b = 2

E. m = $\frac{3}{2}$; b = 4

2. Write an equation in point slope, slope intercept and standard forms for the line through the given point with the given slope.

A. (3, -4); m = 6

B. (-2, -7); m = -$\frac{3}{2}$

3. A line passes through the given points. Determine its slope. Write its equation in point-slope, slope-intercept and standard forms.

A. (-1, 0) (1, 2)
B. (6, - 4) (-3, -5)
C. (-3, -4) (3, -2)

Forms of Linear Equations with answers

1. Given the slope and the y intercept, write the equation described in slope intercept and standard forms.

A. $m = \frac{2}{9}$; b = 3 **Answers:** $y = \frac{2}{9}x + 3$ $2x - 9y = -27$

B. m = 0; b = 1 $y = 1$ $0x + y = 1$

C. $m = -\frac{9}{2}$; b = 3 $y = -\frac{9}{2}x + 3$ $9x + 2y = 6$

D. m = -3; b = 2 $y = -3x + 2$ $3x + y = 2$

E. $m = \frac{3}{2}$; b = 4 $y = \frac{3}{2}x + 4$ $3x - 2y = -8$

2. Write an equation in point slope, slope intercept and standard forms for the line through the given point with the given slope.

A. (3, -4); m = 6 **Answers:** $y + 4 = 6(x - 3)$ $y = 6x - 22$ $6x - y = 22$

B. (-2, -7); $m = -\frac{3}{2}$ $y + 7 = -\frac{3}{2}(x + 2)$ $y = -\frac{3}{2}x - 10$ $3x + 2y = -20$

3. A line passes through the given points. Determine its slope. Write its equation in point-slope, slope-intercept, and standard forms.

A. (-1, 0) (1, 2) **Answers:** ***m = 1,*** $y - 0 = 1(x + 1)$ or $y - 2 = 1(x - 1)$; $y = x + 1$; $x - y = -1$

B. (6, - 4) (-3, -5) $m = \frac{1}{9}$; $(y + 4) = \frac{1}{9}(x - 6)$; $y + 5 = \frac{1}{9}(x + 3)$; $x - 9y = 42$

C. (-3, -4) (3, -2) $m = \frac{1}{3}$; $y + 4 = \frac{1}{3}(x + 3)$ or $y + 2 = \frac{1}{3}(x - 3)$; $y = \frac{1}{3}x - 3$; $x - 3y = 9$

Graphing Linear Equations

Graph each equation on a coordinate plane. You may use a table of values or ordered pairs and slope.

1. A. $y = \frac{2}{9}x + 3$
   B. $y = 1$
   C. $y = -\frac{9}{2}x + 2$
   D. $y = -3x + 2$
   E. $y = \frac{3}{2}x + 4$

2. A. $y = 6x - 22$
   B. $y = -\frac{3}{2}x - \frac{25}{2}$

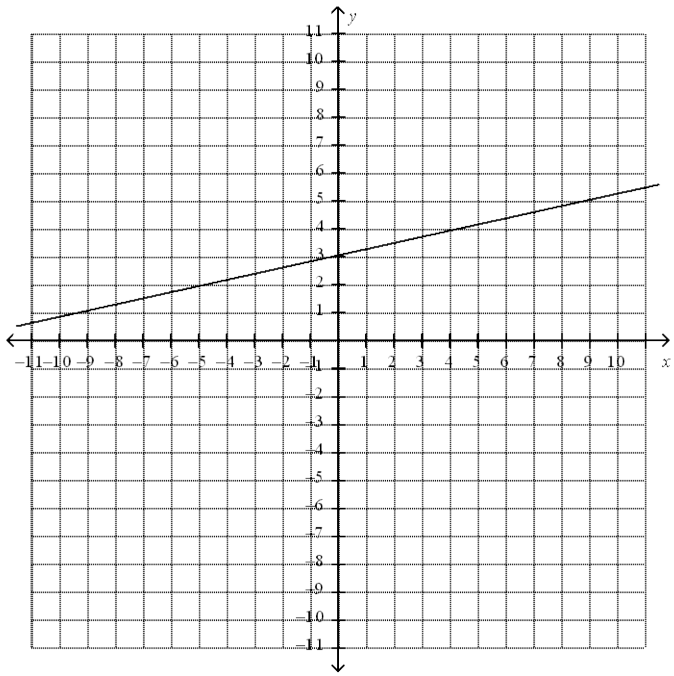
3. A. $y = x + 1$
   B. $y = -x + 1$
   C. $y = \frac{1}{3}x - 3$

.

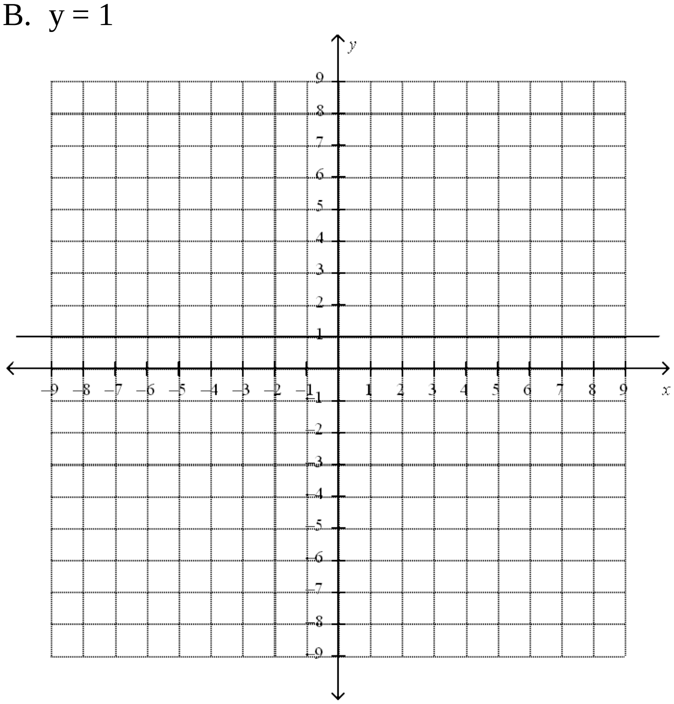
Unit 4, Activity 2, Graphing Equations with Answers

Graphing Linear Equations with Answers

1. A. $y = \frac{2}{9}x + 3$



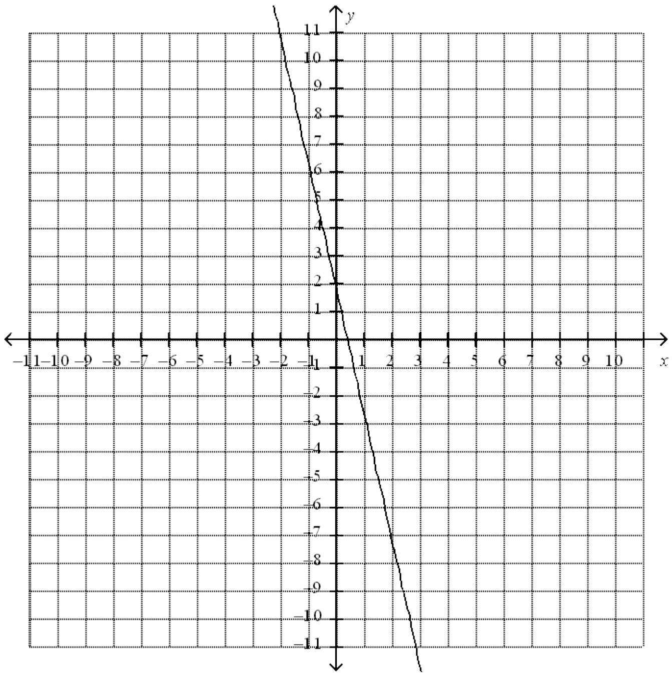
B. $y = 1$



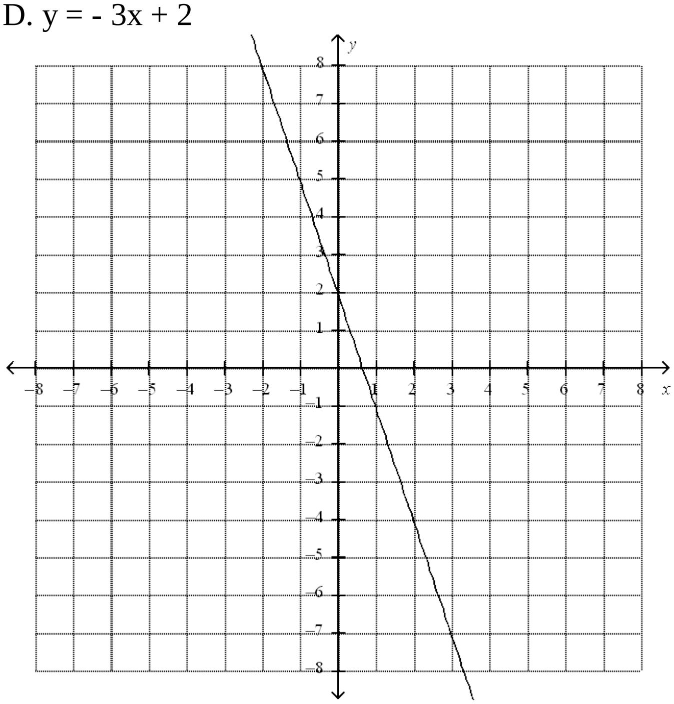
Unit 4, Activity 2, Graphing Equations with Answers

.

C. $y = -\frac{9}{2}x + 2$

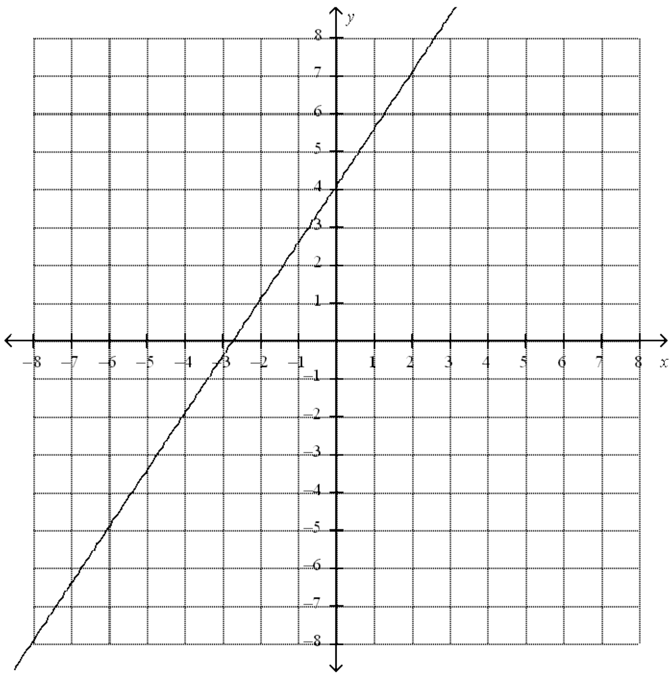


D. $y = -3x + 2$

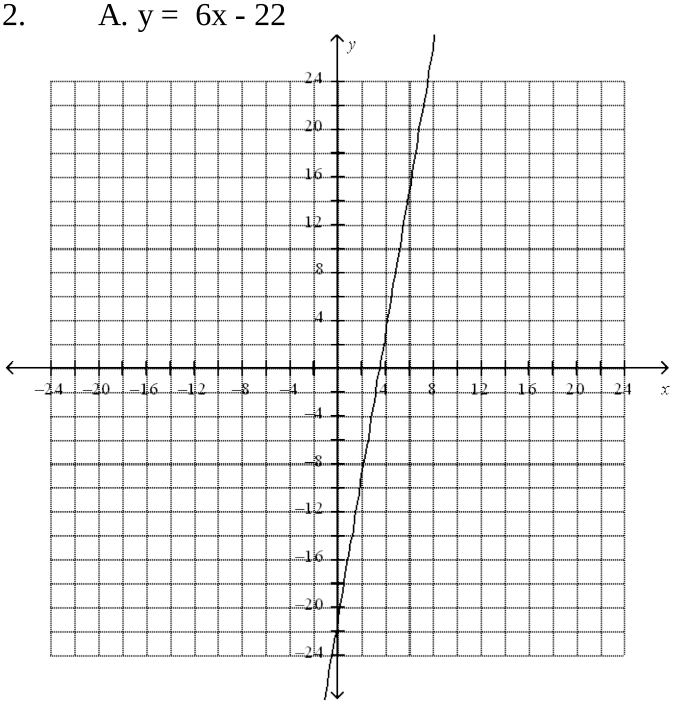


.

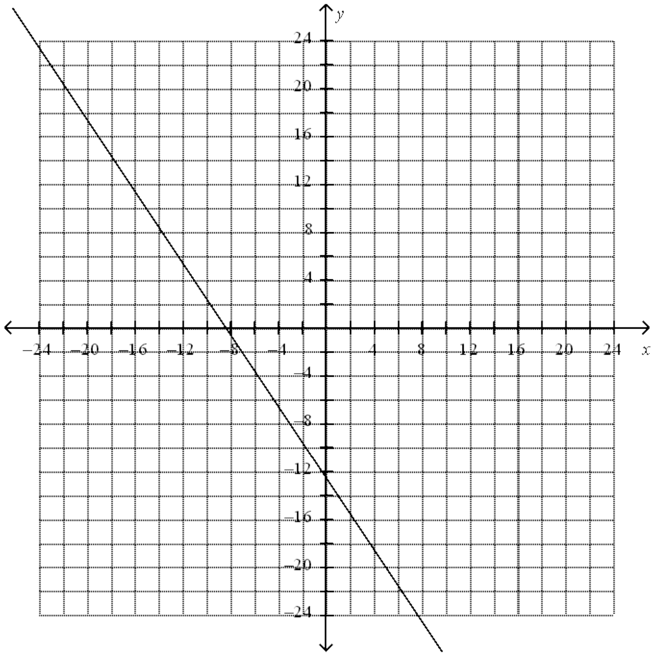
E. $y = \frac{3}{2}x + 4$



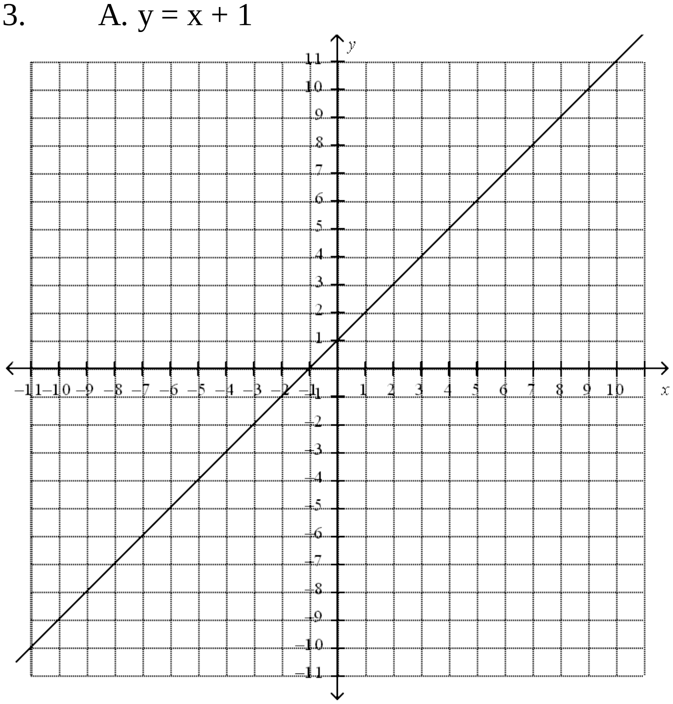
2. A. y = 6x - 22



B. $y = -\frac{3}{2}x - \frac{25}{2}$

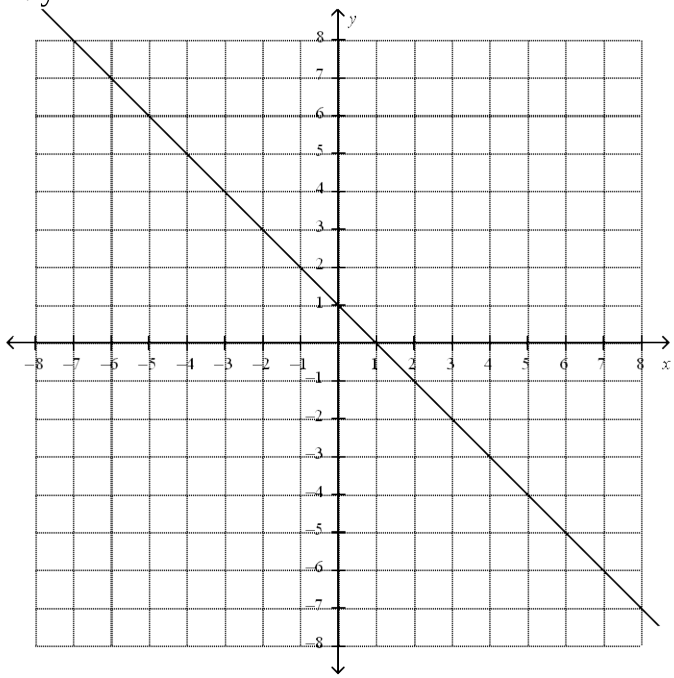


3. A. $y = x + 1$

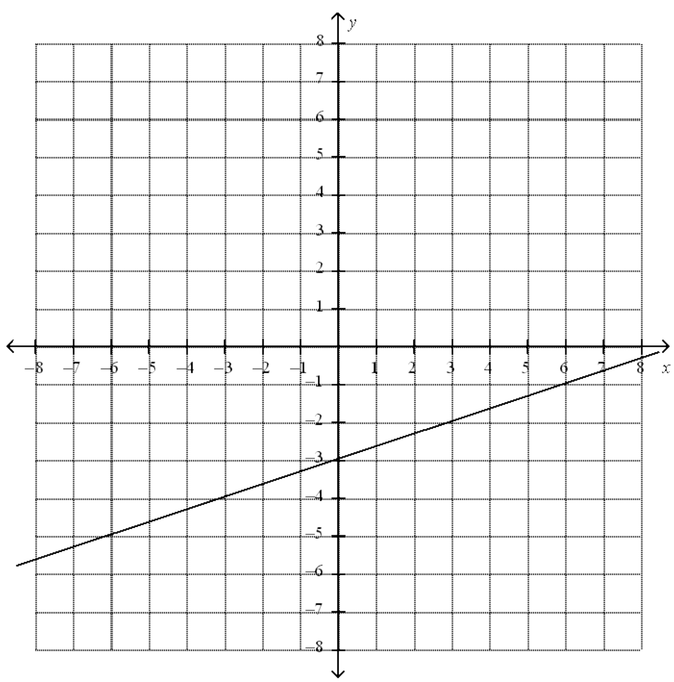


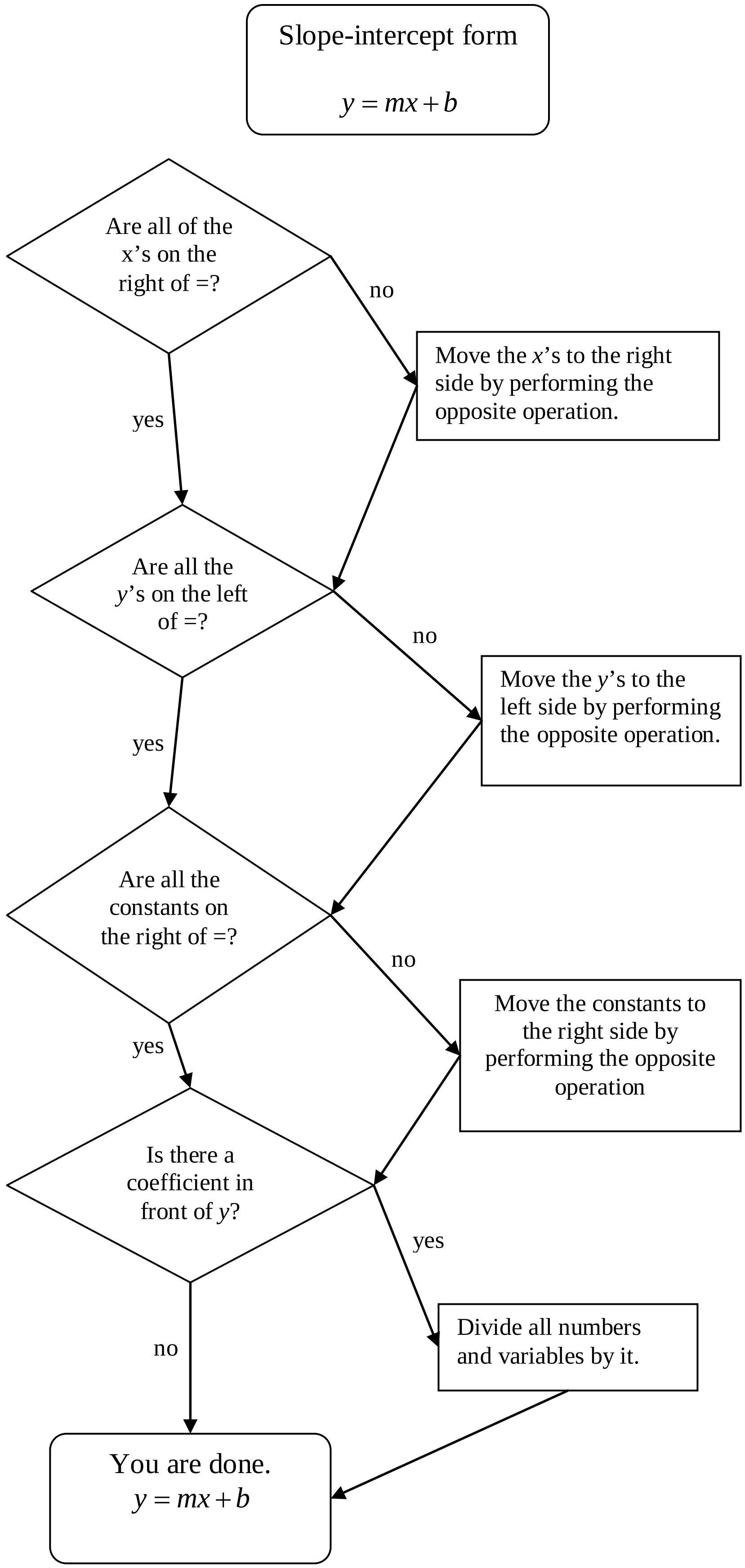
Unit 4, Activity 2, Graphing Equations with Answers

B. $y = -x + 1$

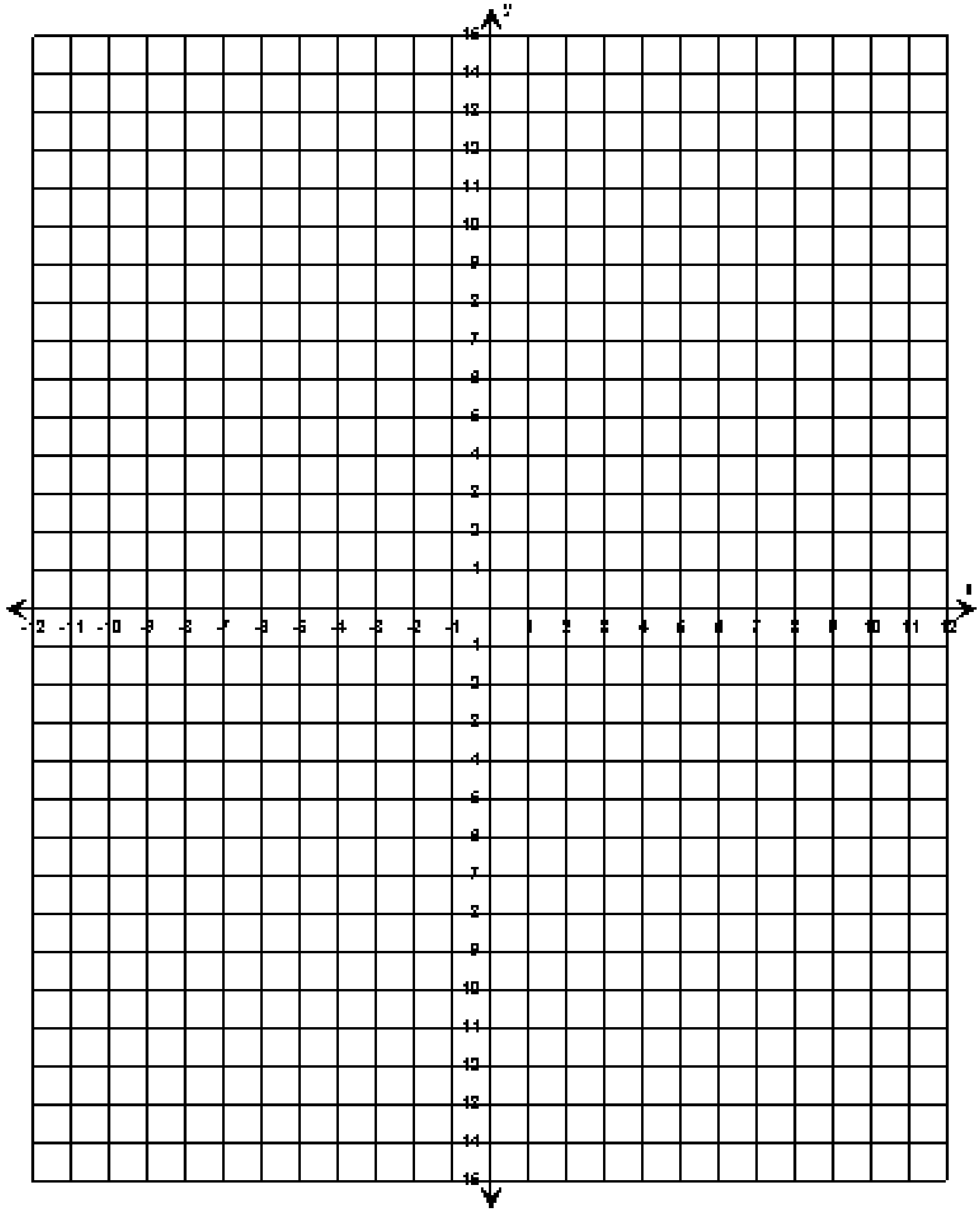


C. $y = \frac{1}{3}x - 3$




Slope-intercept form
$y = mx + b$
Are all of the x's on the right of =?
no
Move the x's to the right side by performing the opposite operation.
yes
Are all the y's on the left of =?
no
Move the y's to the left side by performing the opposite operation.
yes
Are all the constants on the right of =?
no
Move the constants to the right side by performing the opposite operation
yes
Is there a coefficient in front of y?
yes
Divide all numbers and variables by it.
no
You are done.
$y = mx + b$

Name ______________________________ Date ____________



Set up Chart Chart

Vessel	Aircraft carrier	Destroyer	Cruiser	Patrol Boat
Layout	• • • • •	• • • •	• • •	• •

Unit 4, Activity 5, Applications

In this activity, you will investigate the linear relationship between a person's foot length and the length of the arm from the elbow to fingertip. Work in groups of 4.

Foot Length is the independent variable and arm length is the dependent variable.
Enter your data on this table. Then, graph your individual data on the coordinate plane displayed on the overhead.

Foot Length (To the nearest millimeter)	Arm Length (To the nearest millimeter)

Answer these questions as a group:

1. Observing the characteristics of the graph on the overhead projector, do you see characteristics that suggest a relationship? ___________________________________

2. What happens to the *y*-values as the *x*-values increase? __________________________

3. Observe the piece of spaghetti. Using that as a line of best fit, determine two points that are contained in the line of best fit. _____________________________

4. Find the slope of the line. _______________________

5. Use the point-slope formula to write the equation. __________________________

6. What is the real-life meaning of the slope of the line?
____

7. Measure your teacher's foot. Using the equation you generated, estimate the arm length of your teacher. Length is approximately ______________________.

8. Enter your data from above into your graphing calculator. Enter the data from a group near you. Find the linear regression and compare it to the equation in #5 above. How close are the results? _______________________________________

Unit 4, Activity 5, Transparency Graphs

Unit 4, Activity 6, Experiment Descriptions

Bouncing Ball

Goal: to determine the relationship between the height of a ball's bounce and the height from which it is dropped

Materials: rubber ball, meter stick

Procedure: Drop a ball and measure the height of the first bounce. To minimize experimental error, drop from the same height 3 times and use the average bounce height as the data value. Repeat using different heights.

Stretched Spring

Goal: to determine the relationship between the distance a spring is stretched and the number of weights used to stretch it

Materials: spring, paper cup, pipe cleaner, weights, measuring tape

Procedure: Suspend a number of weights on a spring, and measure the length of the spring. A slinky (cut in half) makes a good spring; one end can be stabilized by suspending the spring on a meter stick held between two chair backs. A small paper cup (with a wire or pipe cleaner handle) containing weights, such as pennies, can be attached to the spring.

Burning Candle

Goal: to determine the relationship between the time a candle burns and the height of the candle.

Materials: birthday candle (secured to a jar lid), matches, ruler, stopwatch

Procedure: Measure the candle. Light the candle while starting the stopwatch. Record time burned and height of candle.

Marbles in Water

Goal: to determine the relationship between the number of marbles in a glass of water and the height of the water.

Materials: glass with water, marbles, ruler

Procedure: Measure the height of water in a glass. Drop one marble at a time into the glass of water, measuring the height of the water after each marble is added.

Marbles and Uncooked Spaghetti

Goal: to see how many pieces of spaghetti it takes to support a cup of marbles

Materials: paper cup with a hook (paper clip) attached, spaghetti, marbles

Procedure: place the hook on a piece of uncooked spaghetti supported between two chairs, drop in one marble at a time until the spaghetti breaks, repeat with two pieces of spaghetti, and so on.

Data Collection Sheet
Linear Data

Goal: To find the linear relationship of a set of data and use the equation of the line of best fit to interpolate and extrapolate values.

Title of experiment: ___________________________________

Write a brief description of your experiment. (What are you going to do to collect your data?)

Draw a diagram of your experiment. (What will the setup of your experiment look like?

Independent variable___________________ Units____________

Dependent variable____________________ Units ____________

____________ independent variable	____________ Trial 1	Trial 2	Trial 3	____________ Average (dep)

Data to be graphed (Use the average measurements) :

Equation of the line of best fit (by hand) ________________________

Equation of the line of best fit (calculator)______________________

Slope__________

Real-life meaning____

y-intercept____________________________

Real-life meaning____

Interpolation (Choose a value within your data range and substitute for the independent variable in your equation):

Extrapolation (Choose a value outside of your data range and substitute for the independent variable in your equation):

Write a word problem that requires solving for the independent variable.

Process Guide: What is the difference between causation and correlation?

1. What is the most common mistake that we, as consumers, make when we learn about scientific or health-related studies through news media?

2. In your own words, tell the meaning of a correlation.

3. How would you ensure the causality between two variables?

4. Identify the following situations as either causation (ca) or correlation (co).
    a. At a theme park the temperature and the number of bottles of water sold both increase on a given day
    b. A tall person has long arms
    c. Jerry, who has been smoking cigarettes for 30 years, is diagnosed with lung cancer
    d. Jessica who has a 32 on her ACT in mathematics has a 32 on the English/Language Arts portion
    e. Jenny left a pot of water on high setting on the stove burner. The water boiled.
5. Provide an example of correlation.
6. Provide an example of causation.

Unit 4, Activity 7, Correlation or Causation? With Answers

Process Guide: What is the difference between causation and correlation?

1.What is the most common mistake that we, as consumers, make when we learn about scientific or health related studies through news media?

Answers will vary. Check logic.

2. In your own words, tell the meaning of a correlation.

Answers will vary. Check logic.

3. How would you ensure the causality between two variables?

Answers will vary. Check logic.

4. Identify the following situations as either causation (ca) or correlation(co).
   a. At a theme park the temperature and the number of bottles of water sold both increase on a given day *co*
   b. A tall person has long arms *co*
   c. Jerry, who has been smoking cigarettes for 30 years, is diagnosed with lung cancer *ca*
   d. Jessica who has a 32 on her ACT in mathematics has a 32 on the English/Language Arts portion *co*
   e. Jenny left a pot of water on high setting on the stove burner. The water boiled. *ca*
5. Provide an example of a situation involving correlation. *Answers will vary. Please check the logic of the situation.*
6. Provide an example of causation. *Answers will vary. Please check the logic of the situation.*

Vocabulary Self-Awareness Chart: Systems of Equations

Word	+	☑	-	Example	Definition
System of equations					
Linear system					
Solution of a linear system					
Solving a system by substitution					
System of linear inequalities					
Solution of a system of linear inequalities					
Graph of a system of equations					
Graph of a system of inequalities					
Graph of a Boundary line					
Scatterplot					
Solving a system by linear combinations					
Matrix					
Matrix Dimension					

Graphing a System of Equations

1) Sam left for work at 7:00 a.m. walking at a rate of 1.5 miles per hour. One hour later, his brother James noticed that Sam had forgotten his lunch. James leaves home walking at a rate of 2.5 miles per hour. When will James catch up with Sam to give him his lunch?

Let's graph each situation on the same graph.

Sam:

Table

Time (hours)	Miles
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:

James:

Table:

Time (hours)	Miles
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:

This situation is an example of a system of equations.

<u>Definition</u>

<u>System of equations</u>:

A solution to a system of equations is the ordered pair that makes both equations true.

2) Solve each of the following systems of equations by graphing.

A. $y = -x + 1$
$y = x - 3$

B. $x + y = 3$
$x - y = -1$

3) Suppose James leaves his house one hour later but he walks at the same rate as Sam, 1.5 miles per hour. When will James catch up with Sam?

Sam:
Table

Time (x) (hours)	Miles (y)
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:

James:
Table:

Time (x) (hours)	Miles (y)
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:

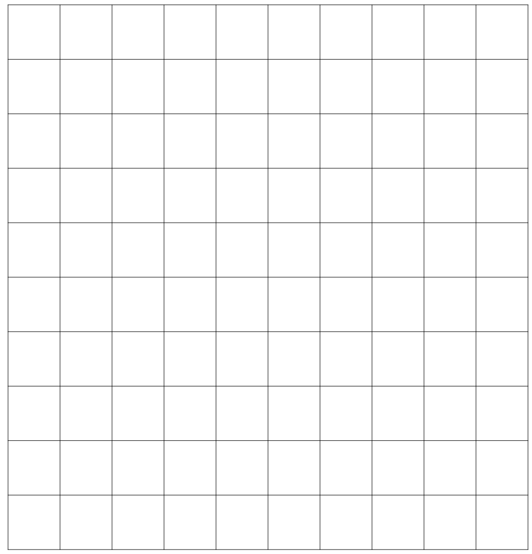
When will a system of equations have no solution?

4) Suppose James leaves at the same time as Sam and walks at the same rate as Sam. Demonstrate what this would look like graphically.

Sam:
Table

Time (x) (hours)	Miles (y)
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:



James:
Table:

Time (x) (hours)	Miles (y)
0	
0.5	
1	
1.5	
2	
2.5	
3	

Equation:

When will a system of equations have an infinite number of solutions?

Graphing a System of Equations

1) Sam left for work at 7:00 a.m. walking at a rate of 1.5 miles per hour. One hour later, his brother James noticed that Sam had forgotten his lunch. James leaves home walking at a rate of 2.5 miles per hour. When will James catch up with Sam to give him his lunch?

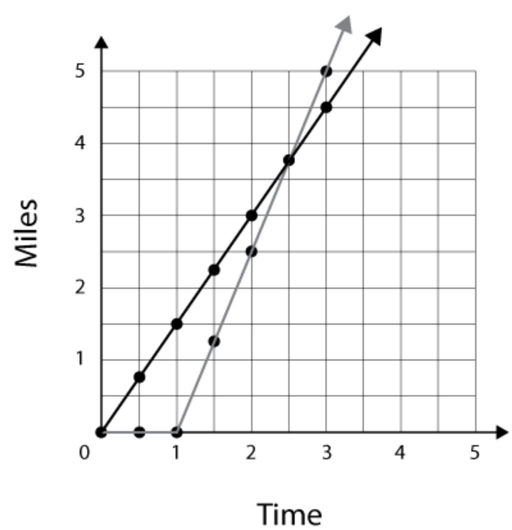
Let's graph each situation on the same graph.

Sam:
Table

Time (x) (hours)	Miles (y)
0	*0*
0.5	*.75*
1	*1.5*
1.5	*2.25*
2	*3*
2.5	*3.75*
3	*4.5*

Equation:

$y = 1.5x$



James:
Table:

Time (x) (hours)	Miles (y)
0	*0*
0.5	*0*
1	*0*
1.5	*1.25*
2	*2.5*
2.5	*3.75*
3	*5*

Equation:

$y = 2.5(x - 1)$

This situation is an example of a system of equations.

<u>Definition</u>

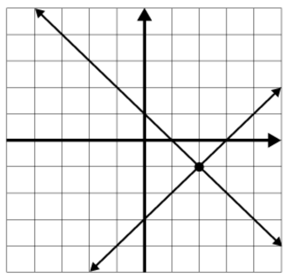
<u>System of equations</u>: *a set of two or more equations with two or more variables*

A solution to a system of equations is the ordered pair that makes both equations true.

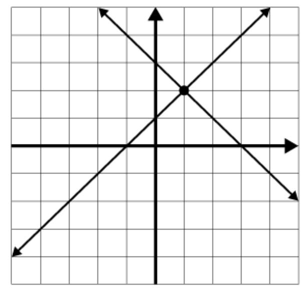
Unit 5, Activity 1, Graphing Systems of Equations with Answers

2) Solve each of the following systems of equations by graphing.

A. $y = -x + 1$
$y = x - 3$ *Answer: (2 ,-1)*



B. x + y = 3
x – y = -1 *Answer:(1, 2)*



3) Suppose James leaves his house one hour later but he walks at the same rate as Sam, 1.5 miles per hour. When will James catch up with Sam? *never*

Sam:
Table

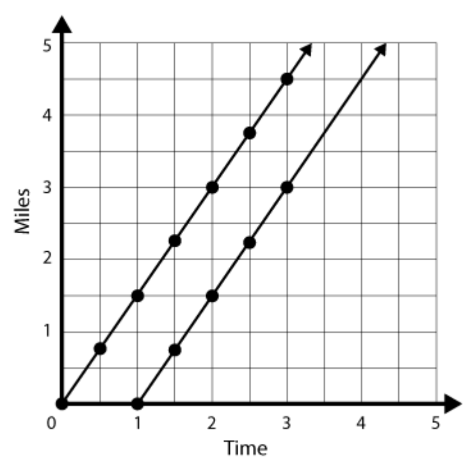
Time (x) (hours)	Miles (y)
0	*0*
0.5	*.75*
1	*1.5*
1.5	*2.25*
2	*3*
2.5	*3.75*
3	*4.5*

Equation: $y = 1.5x$

James:
Table:

Time (x) (hours)	Miles (y)
0	*0*
0.5	*0*
1	*0*
1.5	*.75*
2	*1.5*
2.5	*2.25*
3	*3*

Equation: $y = 1.5(x – 1)$



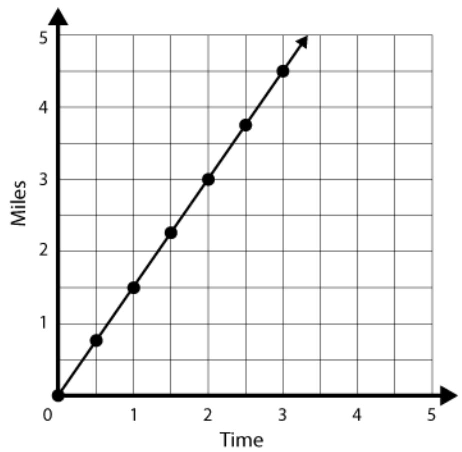
When will a system of equations have no solution? *When the slopes of the lines are the same and the y-intercepts are different (parallel lines the lines will never intersect so there will be no solution.)*

4) Suppose James leaves at the same time as Sam and walks at the same rate as Sam. Demonstrate what this would look like graphically.

Sam:
Table

Time (hours)	Miles
0	*0*
0.5	*.75*
1	*1.5*
1.5	*2.25*
2	*3*
2.5	*3.75*
3	*4.5*

Equation: $y = 1.5x$



James:
Table:

Time (hours)	Miles
0	*0*
0.5	*.75*
1	*1.5*
1.5	*2.25*
2	*3*
2.5	*3.75*
3	*4.5*

Equation: $y = 1.5x$

When will a system of equations have an infinite number of solutions? *When the equations are equivalent.*

Unit 5, Activity 2, Battle of the Sexes

Have you ever wondered about the comparison of the athletic abilities of men and women? Mathematically, we can use the past performance of athletes to make that comparison.

Listed below you will find the winning times of men and women in the Olympic competition of the 100-meter freestyle in swimming. You will use this data and what you have learned about systems of equations to make comparisons between the men and women.

Men's 100-Meter Freestyle		**Women's 100-Meter Freestyle**	
Year	**Time (seconds)**	**Year**	**Time(seconds)**
1920	61.4	1920	73.6
1924	59	1924	72.4
1928	58.6	1928	71
1932	58.2	1932	66.8
1936	57.6	1936	65.9
1948	57.3	1948	66.3
1952	57.4	1952	66.8
1956	55.4	1956	62
1960	55.2	1960	61.2
1964	53.4	1964	59.5
1968	52.2	1968	60
1972	51.2	1972	58.6
1976	50	1976	55.7
1980	50.4	1980	54.8
1984	49.8	1984	55.9
1988	48.6	1988	54.9
1992	49	1992	54.6
1994	48.7	1994	54.5
1996	48.7	1996	54.5

Using your graphing calculator, enter the men’s times in L1 and L2, and enter the women’s times in L1 and L3. Then create two different scatter plots and find the linear regression equations.

Graphing calculator directions:

1) Press [Y=] arrow up and highlight Plot 1 → Press Enter
2) [STAT] →Edit→[ENTER]
3) In L1 type in the year starting with 20
   20, 24, 28….(pay attention to the last three years!)

4) In L2 type in the times for the men’s 100-meter Freestyle
5) In L3 type in the times for the women’s 100-meter Freestyle

6) Press STAT PLOT ([2nd] [Y=]) → [ENTER] →ON→Scatter Plot→L1→L2
   (Use Mark 1)

7) Press STAT PLOT (2nd Y=)→Arrow down to 2→ ENTER →ON→Scatter Plot→L1→L3 (Use Mark 3)
8) Zoom 9
9) STAT →CALC→ 4(Linear Regression)→L1, L2, VARS→Y-VARS→ ENTER → ENTER → ENTER → GRAPH
10) STAT →CALC→4(Linear Regression)→L1, L3, VARS→Y-VARS→ ENTER →Arrow down to Y2→ ENTER → ENTER →GRAPH
11) ZOOM 3 (Zoom Out)→ ENTER (Continue to Zoom out until you clearly see the intersection)
12) 2nd TRACE (Calc)→5 (Intersect)→ ENTER → ENTER → ENTER

Guiding Questions

1. Describe what the point of intersection on the graph tells you.

2. According to the graph, is there ever a year that women and men swim the 100- meter freestyle in the same time? If so, what year and what time will they swim?

3. Write the equation in slope-intercept form that describes the time it takes the men to swim the 100-meter freestyle in a given year. y = ______________________________

4. Write the equation in slope-intercept form that describe the time it takes the women to swim the 100-meter freestyle in a given year. y =______________________________

5. How much faster are the women and the men each year?

Unit 5, Activity 2, Battle of the Sexes with Answers

Have you ever wondered about the comparison of the athletic abilities of men and women? Mathematically, we can use the past performance of athletes to make that comparison.

Listed below you will find the winning times of men and women in the Olympic competition of the 100-meter freestyle in swimming. You will use this data and what you have learned about systems of equations to make comparisons between the men and women.

Men's 100-Meter Freestyle		**Women's 100-Meter Freestyle**	
Year	**Time (seconds)**	**Year**	**Time(seconds)**
1920	61.4	1920	73.6
1924	59	1924	72.4
1928	58.6	1928	71
1932	58.2	1932	66.8
1936	57.6	1936	65.9
1948	57.3	1948	66.3
1952	57.4	1952	66.8
1956	55.4	1956	62
1960	55.2	1960	61.2
1964	53.4	1964	59.5
1968	52.2	1968	60
1972	51.2	1972	58.6
1976	50	1976	55.7
1980	50.4	1980	54.8
1984	49.8	1984	55.9
1988	48.6	1988	54.9
1992	49	1992	54.6
1994	48.7	1994	54.5
1996	48.7	1996	54.5

Using your graphing calculator, enter the men’s times in L1 and L2 and enter the women’s times in L1 and L3. Then create two different scatter plots and find the linear regression equations.

Graphing calculator directions:

1) Press [Y=] arrow up and highlight Plot 1 → Press Enter
2) [STAT] →Edit→[ENTER]
3) In L1 type in the year starting with 20
   20, 24, 28….(pay attention to the last three years!)

4) In L2 type in the times for the men’s 100-meter Freestyle
5) In L3 type in the times for the women’s 100-meter Freestyle

6) Press STAT PLOT ([2nd] [Y=]) → [ENTER] →ON→Scatter Plot→L1→L2

(Use Mark 1)

7) Press STAT PLOT (2nd Y=)→Arrow down to 2→ ENTER →ON→Scatter Plot→L1→L3 (Use Mark 3)
8) Zoom 9

9) STAT →CALC→ 4(Linear Regression)→L1, L2, VARS→Y-VARS→ ENTER → ENTER → ENTER → GRAPH

10) STAT →CALC→4(Linear Regression)→L1, L3, VARS→Y-VARS→ ENTER →Arrow down to Y2→ ENTER → ENTER →GRAPH

11) ZOOM 3 (Zoom Out)→ ENTER (Continue to Zoom out until you clearly see the intersection)

12) 2nd TRACE (Calc)→5 (Intersect)→ ENTER → ENTER → ENTER

Guiding Questions

1. Describe what the point of intersection on the graph tells you.

   It is the year that men and women swim the 100-meter freestyle in the same amount of time.

2. According to the graph, is there ever a year that women and men swim the 100-meter freestyle in the same time? If so, what year and what time will they swim?

   They will swim the race in 39.1 seconds in the year 2049.

3. Write the equation in slope-intercept form that describes the time it takes the men to swim the 100-meter freestyle in a given year. _*y = -0.167x + 64.06*___________

4. Write the equation in slope-intercept form that describe the time it takes the women to swim the 100-meter freestyle in a given year. _*y = -0.255x+77.23*____________

5. How much faster are the women and the men each year? *The men are 0.167 seconds faster each year, and the women are 0.255 seconds faster each year.*

Unit 5, Activity 8, Introduction to Matrices

The following charts give the electronic sales of A Plus Electronics for two store locations.

Store A				**Store B**			
	Jan.	**Feb.**	**Mar.**		**Jan.**	**Feb.**	**Mar.**
Computers	**55**	**26**	**42**	**Computers**	**30**	**22**	**35**
DVD players	**28**	**26**	**30**	**DVD players**	**12**	**24**	**15**
Camcorders	**32**	**25**	**20**	**Camcorders**	**20**	**21**	**15**
TVs	**34**	**45**	**37**	**TVs**	**32**	**33**	**14**

<u>Definition</u>

Matrix –

1) Arrange the store sales in two separate matrices.

<u>Definition</u>

Dimensions of a matrix –

2) Identify each of the following matrices using its dimensions.

$$A = \begin{bmatrix} 2 & 6 \\ -7 & 0 \\ 3 & 8 \end{bmatrix} \qquad B = \begin{bmatrix} 3 & -8 \\ 6 & 10 \end{bmatrix} \qquad C = \begin{bmatrix} 1 & -9 & 64 & 67 \end{bmatrix} \qquad D = \begin{bmatrix} -3 \\ 5 \\ 0 \\ -2 \end{bmatrix}$$

3) How could we use matrices to find the total amount of each type of electronic device sold at both stores for each month in the first quarter of the year?

4) How many more electronic devices did Store A sell than Store B?

5) When adding or subtracting matrices, ____

6) Add the following matrices:

$$\begin{bmatrix} 3 & 23 \\ -7 & -9 \end{bmatrix} + \begin{bmatrix} 2 \\ 8 \\ -2 \end{bmatrix} =$$

7) Two matrices can be added or subtracted if and only if __________________________

8) Guided Practice:

A) Add $\begin{bmatrix} 1 & 3 \\ -4 & 5 \end{bmatrix} + \begin{bmatrix} -7 & 4 \\ 0 & -2 \end{bmatrix} =$

B) Subtract $\begin{bmatrix} 2 & -5 & 4 \\ 4 & 0 & -6 \\ 7 & 9 & 12 \end{bmatrix} - \begin{bmatrix} -3 & 4 & -11 \\ -9 & 6 & 72 \\ 8 & -12 & 34 \end{bmatrix} =$

9) Another store, Store C, sold twice as many electronic devices as Store B. Use matrices to show how many devices were sold by Store C.

Definition

Scalar multiplication –

10) Multiply $-5\begin{bmatrix} 1.2 & 4 & 8 \\ \frac{1}{5} & 0 & -4 \end{bmatrix}$

Unit 5, Activity 7, Introduction to Matrices with Answers

The following charts give the electronic sales of A Plus Electronics for two store locations.

Store A **Store B**

	Jan.	**Feb.**	**Mar.**		**Jan.**	**Feb.**	**Mar.**
Computers	**55**	**26**	**42**	**Computers**	**30**	**22**	**35**
DVD players	**28**	**26**	**30**	**DVD players**	**12**	**24**	**15**
Camcorders	**32**	**25**	**20**	**Camcorders**	**20**	**21**	**15**
TVs	**34**	**45**	**37**	**TVs**	**32**	**33**	**14**

Definition

Matrix – *a rectangular array of numbers used to organize information*

Each item in a matrix is called an element.
The advantage of using a matrix is that the entire array can be used as a single item.

1) Arrange the store sales in two separate matrices.

$$A = \begin{bmatrix} 55 & 26 & 42 \\ 28 & 26 & 30 \\ 32 & 25 & 20 \\ 64 & 45 & 37 \end{bmatrix} \qquad B = \begin{bmatrix} 30 & 22 & 35 \\ 12 & 24 & 15 \\ 20 & 21 & 15 \\ 32 & 33 & 14 \end{bmatrix}$$

Definition

Dimensions of a matrix – *number of rows by number of columns*

$A_{4 \times 3}$ $B_{4 \times 3}$

2) Identify each of the following matrices using its dimensions.

$$A = \begin{bmatrix} 2 & 6 \\ -7 & 0 \\ 3 & 8 \end{bmatrix} \qquad B = \begin{bmatrix} 3 & -8 \\ 6 & 10 \end{bmatrix} \qquad C = \begin{bmatrix} 1 & -9 & 64 & 67 \end{bmatrix} \qquad D = \begin{bmatrix} -3 \\ 5 \\ 0 \\ -2 \end{bmatrix}$$

$A_{3 \times 2}$ $B_{2 \times 2}$ $C_{1 \times 4}$ $D_{4 \times 1}$

3) How could we use matrices to find the total amount of each type of electronic device sold at both stores for each month in the first quarter of the year? *Add the two matrices together*

$$\begin{bmatrix} 55 & 26 & 42 \\ 28 & 26 & 30 \\ 32 & 25 & 20 \\ 64 & 45 & 37 \end{bmatrix} + \begin{bmatrix} 30 & 22 & 35 \\ 12 & 24 & 15 \\ 20 & 21 & 15 \\ 32 & 33 & 14 \end{bmatrix} = \begin{bmatrix} 85 & 48 & 77 \\ 40 & 50 & 45 \\ 52 & 46 & 35 \\ 96 & 78 & 51 \end{bmatrix}$$

4) How many more electronic devices did Store A sell than Store B?

$$\begin{bmatrix} 55 & 26 & 42 \\ 28 & 26 & 30 \\ 32 & 25 & 20 \\ 64 & 45 & 37 \end{bmatrix} - \begin{bmatrix} 30 & 22 & 35 \\ 12 & 24 & 15 \\ 20 & 21 & 15 \\ 32 & 33 & 14 \end{bmatrix} = \begin{bmatrix} 25 & 4 & 7 \\ 16 & 2 & 15 \\ 12 & 4 & 5 \\ 32 & 12 & 23 \end{bmatrix}$$

5) When adding or subtracting matrices, *add or subtract the corresponding elements.*

6) Add the following matrices:

$$\begin{bmatrix} 3 & 23 \\ -7 & -9 \end{bmatrix} + \begin{bmatrix} 2 \\ 8 \\ -2 \end{bmatrix} =$$ *can't be done because the dimensions are not the same*

7) Two matrices can be added or subtracted if and only if *the matrices have the same dimensions.*

8) Guided Practice:

A) Add $\begin{bmatrix} 1 & 3 \\ -4 & 5 \end{bmatrix} + \begin{bmatrix} -7 & 4 \\ 0 & -2 \end{bmatrix} = \begin{bmatrix} -6 & 7 \\ -4 & 3 \end{bmatrix}$

B) Subtract $\begin{bmatrix} 2 & -5 & 4 \\ 4 & 0 & -6 \\ 7 & 9 & 12 \end{bmatrix} - \begin{bmatrix} -3 & 4 & -11 \\ -9 & 6 & 72 \\ 8 & -12 & 34 \end{bmatrix} = \begin{bmatrix} 5 & -9 & 15 \\ 13 & -6 & -78 \\ -1 & 21 & -22 \end{bmatrix}$

9) Another store, Store C, sold twice as many electronic devices as Store B. Use matrices to show how many devices were sold by Store C.

$$2\begin{bmatrix} 30 & 22 & 35 \\ 12 & 24 & 15 \\ 20 & 21 & 15 \\ 32 & 33 & 14 \end{bmatrix} = \begin{bmatrix} 60 & 44 & 70 \\ 24 & 48 & 30 \\ 40 & 42 & 30 \\ 64 & 66 & 28 \end{bmatrix}$$

Definition

Scalar multiplication – *multiplying a matrix by a number*

10) Multiply $-5\begin{bmatrix} 1.2 & 4 & 8 \\ \frac{1}{5} & 0 & -4 \end{bmatrix} = \begin{bmatrix} -6 & -20 & -40 \\ -1 & 0 & 20 \end{bmatrix}$

Unit 5, Activity 9, Matrix Multiplication

The following chart shows t-shirt sales for a school fundraiser and the profit made on each shirt sold.

Number of shirts sold

	Small	**Medium**	**Large**
Art Club	**52**	**67**	**30**
Science Club	**60**	**77**	**25**
Math Club	**33**	**59**	**22**

Profit per shirt

	Profit
Small	**$5.00**
Medium	**$4.25**
Large	**$3.00**

1) Write a matrix for the number of shirts sold and a separate matrix for profit per shirt

2) Use matrix multiplication to find the total profit for each club.

3) Two matrices can be multiplied together if and only if ___________________________

Matrix Operations with the Graphing Calculator

To enter matrices into the calculator:

[MATRIX], EDIT, Enter dimensions, Enter elements

To perform operations:
From home screen ([2nd] [Quit]), [MATRIX], Enter matrix you are using to calculate, enter operation, [MATRIX], Enter on second matrix you are calculating, Enter to get solution.

Perform the indicated operations using the given matrices:

$$A = \begin{bmatrix} 2 & 3 \\ 1 & -5 \\ 6 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & -5 \\ 4 & 0 \end{bmatrix} \qquad C = \begin{bmatrix} 3 & -2 \\ 8 & -4 \end{bmatrix} \qquad D = \begin{bmatrix} 2 & 6 & 7 \end{bmatrix}$$

4) B – C =

5) 3A

6) AB

7) AD

Unit 5, Activity 9, Matrix Multiplication with Answers

The following chart shows T-shirt sales for a school fundraiser and the profit made on each shirt sold.

Number of shirts sold **Profit per shirt**

	Small	Medium	Large		Profit
Art Club	**52**	**67**	**30**	**Small**	**$5.00**
Science Club	**60**	**77**	**25**	**Medium**	**$4.25**
Math Club	**33**	**59**	**22**	**Large**	**$3.00**

1) Write a matrix for the number of shirts sold and a separate matrix for profit per shirt

Number of shirts sold

$$\begin{bmatrix} 52 & 67 & 30 \\ 60 & 77 & 25 \\ 33 & 59 & 22 \end{bmatrix}$$

Profit per shirt

$$\begin{bmatrix} 5 \\ 4.25 \\ 3 \end{bmatrix}$$

2) Use matrix multiplication to find the total profit for each club.

$$\begin{bmatrix} 52 & 67 & 30 \\ 60 & 77 & 25 \\ 33 & 59 & 22 \end{bmatrix} \bullet \begin{bmatrix} 5 \\ 4.25 \\ 3 \end{bmatrix} = \begin{bmatrix} 52(5)+67(4.25)+30(3) \\ 60(5)+77(4.25)+25(3) \\ 33(5)+59(4.25)+22(3) \end{bmatrix} = \begin{bmatrix} 634.75 \\ 702.25 \\ 481.75 \end{bmatrix}$$

3) Two matrices can be multiplied together if and only if _*their inner dimensions are equal.*

Matrix Operations with the Graphing Calculator

To enter matrices into the calculator:

[MATRIX], EDIT, Enter dimensions, Enter elements

To perform operations:
From home screen ([2nd] [Quit]), [MATRIX], Enter matrix you are using to calculate, enter operation, [MATRIX], Enter on second matrix you are calculating, Enter to get solution.

Unit 5, Activity 9, Matrix Multiplication with Answers

Perform the indicated operations using the given matrices:

$$A = \begin{bmatrix} 2 & 3 \\ 1 & -5 \\ 6 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & -5 \\ 4 & 0 \end{bmatrix} \qquad C = \begin{bmatrix} 3 & -2 \\ 8 & -4 \end{bmatrix} \qquad D = \begin{bmatrix} 2 & 6 & 7 \end{bmatrix}$$

4) B – C =   5) 3A   6) AB   7) AD

Solutions:

4) $\begin{bmatrix} -1 & -3 \\ -4 & 4 \end{bmatrix}$ 5) $\begin{bmatrix} 6 & 9 \\ 3 & -15 \\ 18 & 21 \end{bmatrix}$ 6) $\begin{bmatrix} 16 & -10 \\ -18 & -5 \\ 40 & -30 \end{bmatrix}$

7) Can't be done; inner dimensions are not equal.

Unit 5, Activity 10, Solving Systems of Equations Using Matrices

Multiply the following two matrices by hand.

1) $\begin{bmatrix} -1 & 2 \\ 1 & 6 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} =$

2) $\begin{bmatrix} -3 & 7 \\ 4 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} =$

3) Given the following systems of equations, rewrite as a matrix multiplication equation.

5x – 4y = 23
7x + 8y = 5

This is what we have so far: [A]*x* = [B]

4) What would we do to solve for the unknown variable *x*?

Instead of division, we will use A^{-1}.

<u>To solve systems of equations using matrices</u>: $[A]^{-1}[B] = x$

5) Solve the systems of equation above using matrices.

Try these:

Solve using matrices. Write the matrices used.

6) 3x + 5y = 4
3x + 7y = 2

7) 2x – 2y = 4
x + 3y = 1

8) x + y + z = 4
x – 2y –z = 1
2x – y – 2z = -1

Unit 5, Activity 10, Solving Systems of Equations Using Matrices with Answers

Multiply the following two matrices by hand.

1) $\begin{bmatrix} -1 & 2 \\ 1 & 6 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{matrix} -x+2y \\ x+6y \end{matrix}$

2) $\begin{bmatrix} -3 & 7 \\ 4 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{matrix} -3x+7y \\ 4x+2y \end{matrix}$

3) Given the following systems of equations, rewrite it as a matrix multiplication equation.

Solution:

5x – 4y = 23
7x + 8y = 5

$\begin{bmatrix} 5 & -4 \\ 7 & 8 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 23 \\ 5 \end{bmatrix}$

This is what we have so far: [A]*x* = [B]

4) What would we do to solve for the unknown variable *x*? *Divide by [A]*

Instead of division, we will use A^{-1}.

To solve systems of equations using matrices : $[A]^{-1}[B] = x$

5) Solve the systems of equation above using matrices. *x = 3, y = -2*

A = $\begin{bmatrix} 5 & -4 \\ 7 & 8 \end{bmatrix}$ $B = \begin{bmatrix} 23 \\ 5 \end{bmatrix}$ $[A]^{-1}[B] = x$

Try these:

Solve using matrices. Write the matrices used.

6) 3x + 5y = 4
3x + 7y = 2

x = 3, y = -1

7) 2x – 2y = 4
x + 3y = 1

x = 1.75, y = -.25

8) x + y + z = 4
x – 2y –z = 1
2x – y – 2z = -1

x = 2, y = -1, z = 3

Unit 5, Activity 10, Word Grid

Number of Solutions	Graphing	Substitution	Elimination	Matrices
0				
1				
Infinitely many				

Unit 5, Activity 10, Word Grid with Answers

Number of Solutions	Graphing	Substitution	Elimination	Matrices
0	Lines do not intersect (parallel)	All variables will cancel out and the result will be a false statement i.e., (3 = 4)	All variables will cancel out and the result will be a false statement i.e., (3 = 4)	Singular matrix error (use another method to determine number of solutions)
1	Lines intersect at a single point	Values can be found for both variables	Values can be found for both variables	Calculator gives answer in matrix form
Infinitely many	Lines are the same and lie on top of one another	All variables will cancel out and the result will be a true statement i.e., (0 = 0)	All variables will cancel out and the result will be a true statement i.e., (0 = 0)	Singular matrix error (use another method to determine number of solutions)

Absolute Error

At each measurement station, perform the indicated measurements and answer the questions below.

Measurement: Mass

	OBSERVED VALUE	ACCEPTED VALUE	ABSOLUTE ERROR
Scale 1			
Scale 2			
Scale 3			

Which scale is more accurate?________________________

Why?____

Measurement: Volume

	OBSERVED VALUE	ACCEPTED VALUE	ABSOLUTE ERROR
Beaker 1			
Beaker 2			
Measuring Cup			

Which measuring instrument is more accurate?________________________

Why?____

Measurement: Length

	OBSERVED VALUE	ACCEPTED VALUE	ABSOLUTE ERROR
Meter stick			
Ruler 1			
Ruler 2			

Which measuring instrument is more accurate?________________________

Why?____

Unit 6, Activity 1, Absolute Error

Measurement: Time

	OBSERVED VALUE	ACCEPTED VALUE	ABSOLUTE ERROR
Wrist watch			
Calculator			
Cell Phone			

Which measuring instrument is more accurate?___________________________

Why?____

Is it always possible to determine if a measuring instrument is accurate? Why or why not?

Explain how to determine if a measuring instrument is accurate or not.

Unit 7 Vocabulary Awareness Chart

Word	+	☑	-	Example	Definition
Common ratio					
Decay factor					
Exponential decay					
Exponential function					
Exponential growth					
Exponential regression					
Arithmetic sequence					
Geometric Sequence					
Growth factor					
Exponential interpolation					
Interest period (time)					
Polynomial					
Monomial					
Binomial					
Trinomial					
Standard form of a polynomial					
Algebra Tiles					

Procedure:
1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

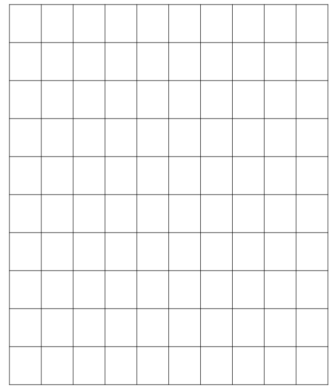
This chart will be used throughout the unit. By the end of the unit, you should have the entire chart completed. Because you will be revising this chart, write in pencil.

LINEAR AND EXPONENTIAL FUNCTIONS

1. Make a table of values and graph the following function. Use the domain {-2, -1, 0, 1, 2}

$\boldsymbol{y = 3x}$

x	y

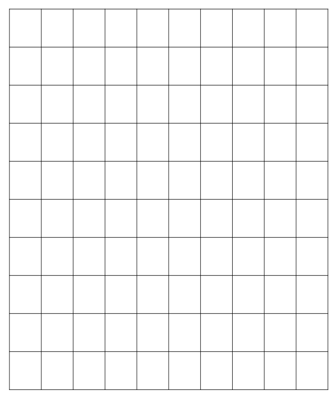


What type of function is this?

What is the slope of the line? _____________ Show how the slope is represented in the table.

2. Graph $\boldsymbol{y = 3^x}$ using the same domain

x	y



What type of function is this?

Find the difference in the y-values for this function as x increases by 1.

Is $y = 3^x$ a linear function? Why or why not?

How do the y-values increase as x increases by 1?

3. Compare the following functions by graphing on the graphing calculator. Use the table on the calculator to complete a table of values for each function.

a) $y = 2^x$

x	*y*

b) $y = 3^x$

x	*Y*

c) $y = 4^x$

x	*y*

4. What happens to the graph as the base is increased? Show this using the table of values.

Graph $y = \frac{1}{3}^x$ using the domain {-2, -1, 0, 1, 2}

x	*y*

5. What is the difference between the graphs of the functions of $y = 3^x$ and $y = \frac{1}{3}^x$?

6. In the function $y = 3^x$, as the *x* values increase, what happens to the *y* values?

7. In the function, $y = \frac{1}{3}^x$, as the *x* values increase, what happens to the *y* values?

8. $y = b^x$ is an example of an ___________________________________ function. Why?

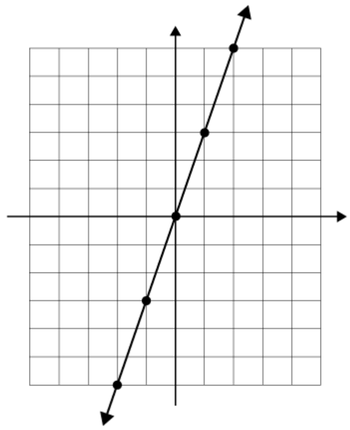
9. $y = b^{-x}$ or $\left(\frac{1}{b}\right)^x$ is an example of an ________________________________function. Why?

LINEAR AND EXPONENTIAL FUNCTIONS

1. Make a table of values and graph the following function. Use the domain {-2, -1, 0, 1, 2}

y* = 3*x

x	*y*
-2	*-6*
-1	*-3*
0	*0*
1	*3*
2	*6*

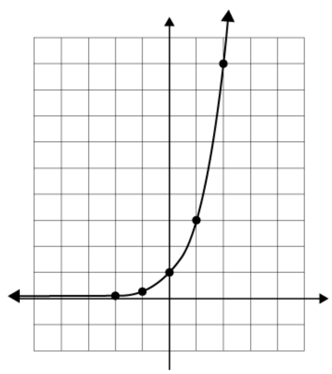


What type of function is this? *linear*

What is the slope of the line? _*3*________ Show how the slope is represented in the table.

2. Graph $y = 3^x$ using the same domain

x	*y*
-2	$\frac{1}{9}$
-1	$\frac{1}{3}$
0	*1*
1	*3*
2	*9*



What type of function is this? *exponential*

Find the difference in the *y*-values for this function as *x* increases by 1. *The differences are not constant, but they increase by the next power of 3.*

Is $y = 3^x$ a linear function? *No* Why or why not? *It does not increase by a constant value.*

How do the *y*-values increase as *x* increases by 1? *They are multiplied by 3.*

Unit 7, Activity 1, Evaluation: Linear and Exponential Functions with Answers

3. Compare the following functions by graphing on the graphing calculator. Use the table on the calculator to complete a table of values for each function.

a.) $y = 2^x$

x	y
-2	0.25
-1	0.5
0	1
1	2
2	4

b.) $y = 3^x$

x	y
-2	0.11
-1	0.33
0	1
1	3
2	9

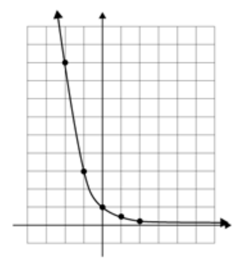
c) $y = 4^x$

x	y
-2	0.06
-1	0.25
0	1
1	4
2	16

4. What happens to the graph as the base is increased? Show this using the table of values.

Graph $y = \frac{1}{3}^x$ using the domain {-2, -1, 0, 1, 2}

x	y
-2	9
-1	3
0	1
1	.33
2	.11



5. What is the difference between the graphs of the functions of $y = 3^x$ and $y = \frac{1}{3}^x$?

They are both exponential, but one increases and the other decreases.

6. In the function $y = 3^x$, as the x values increase, what happens to the y values?

It increases.

7. In the function, $y = \frac{1}{3}^x$, as the x values increase, what happens to the y values?

It decreases.

8. $y = b^x$ is an example of an <u>*exponential growth*</u> function. Why? *The function is exponential because it multiplies at a constant rate. It represents growth because it increases.*

9. $y = b^{-x}$ or $\left(\frac{1}{b}\right)^x$ is an example of an <u>*exponential decay*</u> function. Why? *The function is exponential because it multiplies at a constant rate. It represents decay because it decreases.*

COMPARE AND CONTRAST MAP

Linear Function:

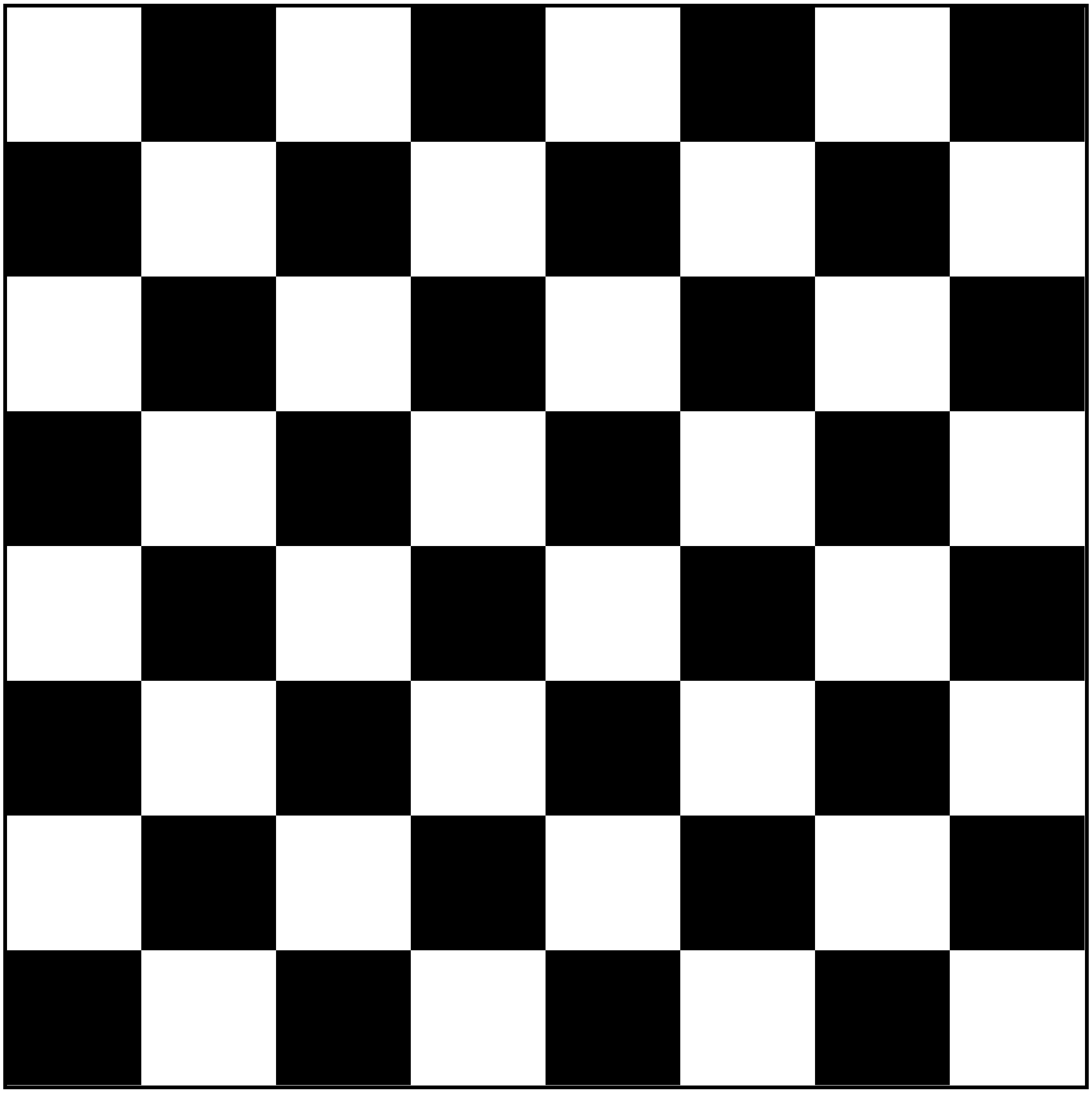
Exponential Function:

Different

Same

Different

Unit 7, Activity 2, Chessboard



Unit 7, Activity 3, Radioactive M&Ms®

Directions:

1. Place 50 atoms of M&Ms® (pieces of candy) in the Ziploc bag.
2. Seal the bag and gently shake for 10 seconds.
3. Gently pour out candy on to the paper plate.
4. Notice the pieces with the print side up. These atoms have "decayed."
5. Count the undecayed pieces (with the print side down) and record the data below.
6. Return the undecayed pieces to the bag. Reseal the bag.
7. Consume the "decayed" atoms.
8. Gently shake the sealed bag for 10 seconds.
9. Continue shaking, counting, and consuming until all the atoms have decayed. Complete the table at each part of the process.
10. Predict the equation that represents this exponential function.
11. Graph the number of undecayed atoms vs. time in your calculator.
12. Find the exponential equation that fits the curve.

Trial	Number of undecayed atoms
0	50

Unit 7, Activity 6, Exploring Exponents

Product of powers	Expanded product	Product as a single power	Explanation
$x^2 \cdot x^3$	$(x \cdot x) \cdot (x \cdot x \cdot x)$	x^5	
$x^5 \cdot x^4$			
$x \cdot x^3$			
$x^2 \cdot x^4$			
$x^m \cdot x^n$			

Quotient of powers	Expanded quotient	Quotient as a single power	Explanation
$\frac{x^5}{x^2}$	$\frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x}$	x^3	
$\frac{x^4}{x^3}$			
$\frac{x^9}{x^4}$			
$\frac{x^2}{x^5}$			
$\frac{x^m}{x^n}$			

Power of a power	Expanded power	Power as a single power	Explanation
$(x^2)^3$	$x^2 \cdot x^2 \cdot x^2$	x^6	
$(x^3)^4$			
$(x^5)^2$			
$(x^6)^4$			
$(x^m)^n$			

Unit 7, Activity 6, Exploring Exponents

Power of a fractional power	Expanded power	Power as a single power	Explanation
$\left(x^{\frac{1}{2}}\right)^2$	$x^{\frac{1}{2}} \cdot x^{\frac{1}{2}}$	x	
$\left(x^{\frac{1}{3}}\right)^3$			
$\left(x^{\frac{1}{n}}\right)^n$			

Product of powers	Expanded product	Product as a single power	Explanation
$x^2 \cdot x^3$	$(x \cdot x) \cdot (x \cdot x \cdot x)$	x^5	When you multiply 2 "x"s together times 3 "x"s that are multiplied together, you get 5 "x"s multiplied together which is x^5
$x^5 \cdot x^4$	$(x \cdot x \cdot x \cdot x \cdot x) \cdot (x \cdot x \cdot x \cdot x)$	x^9	When you multiply 5 "x"s together times 4 "x"s that are multiplied together, you get 9 "x"s multiplied together which is x^9
$x \cdot x^3$	$(x) \cdot (x \cdot x \cdot x)$	x^4	When you multiply 1 "x"s times 3 "x"s that are multiplied together, you get 4 "x"s multiplied together which is x^4
$x^2 \cdot x^4$	$(x \cdot x) \cdot (x \cdot x \cdot x \cdot x)$	x^6	When you multiply 2 "x"s together times 4 "x"s that are multiplied together, you get 6 "x"s multiplied together which is x^6
$x^m \cdot x^n$		x^{m+n}	When multiplying variables that have exponents, if the bases are the same, add the exponents.

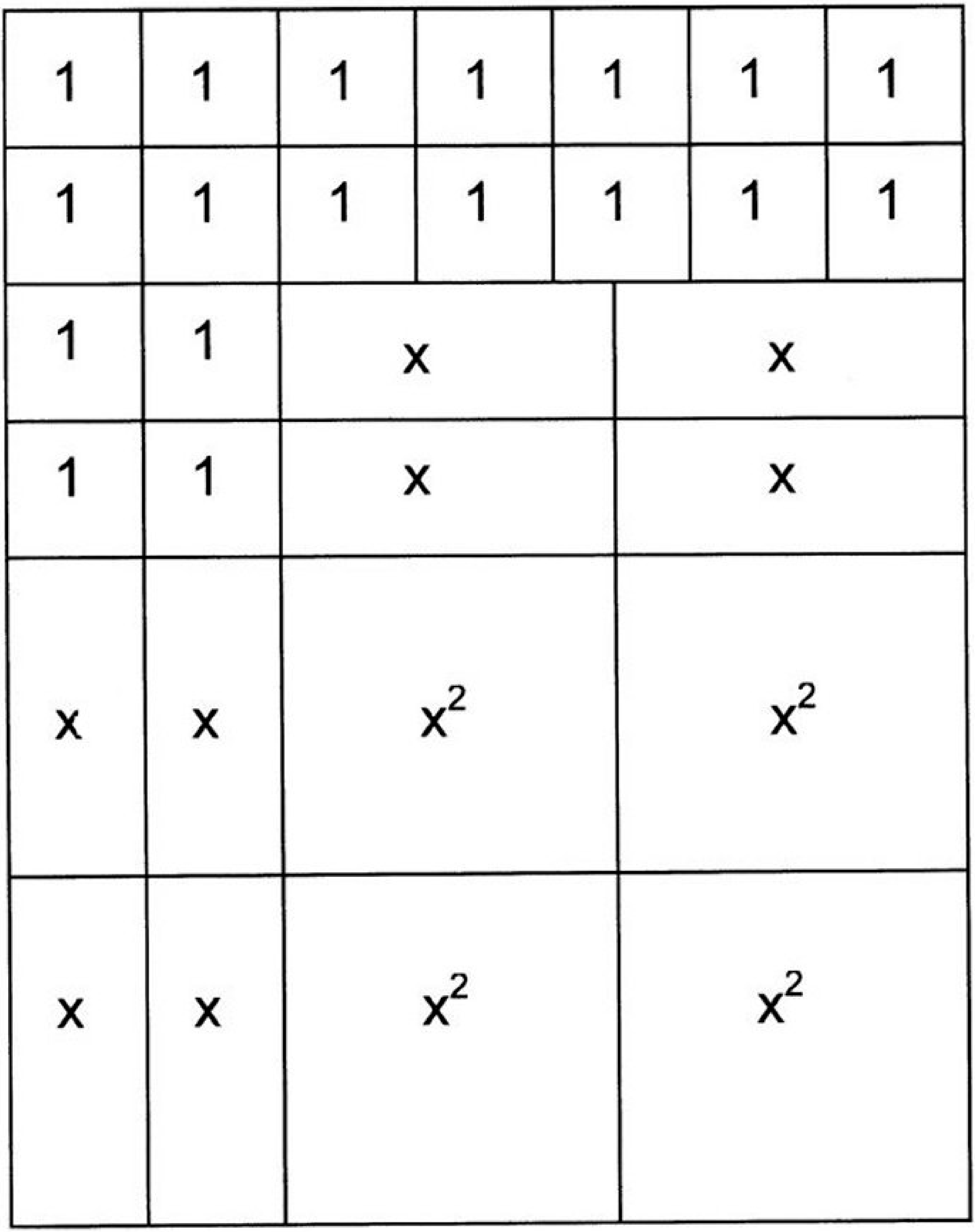
Quotient of powers	Expanded quotient	Quotient as a single power	Explanation
$\frac{x^5}{x^2}$	$\frac{x \cdot x \cdot x \cdot x \cdot x}{x \cdot x}$	x^3	When you have 5 "x"s that are multiplied together and you divide the product by 2 "x"s multiplied together, 2 "x"s will divide, yielding 1 and 3 "x" s or x^3
$\frac{x^4}{x^3}$	$\frac{x \cdot x \cdot x \cdot x}{x \cdot x \cdot x}$	X	When you have 4 "x"s that are multiplied together and you divide the product by 3 "x"s multiplied together, 3 "x"s will divide, yielding 1, and 1 "x"
$\frac{x^9}{x^4}$	$\frac{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x \cdot x \cdot x}$	x^5	When you have 9 "x"s that are multiplied together and you divide the product by 4 "x"s multiplied together, 4 "x"s will divide, yielding 1 and 5 "x" s or x^5
$\frac{x^2}{x^5}$	$\frac{x \cdot x}{x \cdot x \cdot x \cdot x \cdot x}$	$\frac{1}{x^3}$	When you have 2 "x"s that are multiplied together and you divide the product by 5 "x"s multiplied together, 2 "x"s will divide yielding 1, and 3 "x" s in the denominator of the fraction or $\frac{1}{x^3}$
$\frac{x^m}{x^n}$		x^{m-n}	When dividing variables that have exponents, if the bases are the same, subtract the exponents

Unit 7, Activity 6, Exploring Exponents with Answers

Power of a power	Expanded power	Power as a single power	Explanation
$\left(x^2\right)^3$	$x^2 \cdot x^2 \cdot x^2$	x^6	Multiply x^2 together three times, add the exponents to get x^6
$\left(x^3\right)^4$	$x^3 \cdot x^3 \cdot x^3 \cdot x^3$	x^{12}	Multiply x^3 together four times, add the exponents to get x^{12}
$\left(x^5\right)^2$	$x^5 \cdot x^5$	x^{10}	Multiply x^5 together two times, add the exponents to get x^{10}
$\left(x^6\right)^4$	$x^6 \cdot x^6 \cdot x^6 \cdot x^6$	x^{24}	Multiply x^6 together four times, add the exponents to get x^{24}
$\left(x^m\right)^n$		x^{mn}	When taking a power to a power, multiply the exponents.

Power of a fractional power	Expanded power	Power as a Single power	Explanation
$\left(x^{\frac{1}{2}}\right)^2$	$x^{\frac{1}{2}} \cdot x^{\frac{1}{2}}$	x	Multiply $x^{\frac{1}{2}}$ two times, add the exponents to get x.
$\left(x^{\frac{1}{3}}\right)^3$	$x^{\frac{1}{3}} \cdot x^{\frac{1}{3}} \cdot x^{\frac{1}{3}}$	x	Multiply $x^{\frac{1}{3}}$ three times, add the exponents to get x.
$\left(x^{\frac{1}{n}}\right)^n$		x	Multiply $x^{\frac{1}{n}}$ n times, add the exponents to get $x^{\frac{n}{n}} = x^1 = x$.

[*Unit 7, Activity 7, Algebra Tiles Template*



Unit 7, Activity 8, Arithmetic and Geometric Sequences

Read the following passages and provide the solutions to the problems below each passage.

1. Two types of number sequences are represented in this activity-arithmetic sequences and geometric sequences. When the terms of a sequence are based on adding a fixed number to each previous term, the pattern is known as an **arithmetic sequence**. The fixed number is called the **common difference**.

Examples: Look at the pattern of -7, -3, 1, 5. What is the common difference between each of the terms? The common difference is +4. So to find the next term in the sequence, you would add 4 to 5 to obtain 9.

Now, determine the common difference for 17, 13, 9, and 5. The common difference is __, and the next term in the sequence is ___.

A rule for finding the nth term of an arithmetic sequence can be found by using the following guidelines: Consider the sequence 7, 11, 15, 19,... in which the common difference is +4. Let n = the term number of the sequence.
Let $A(n)$ = the value of the nth term of the sequence
$A(1) = 7$; $A(2) = 7 + 4 = 11$; $A(3) = 7 + 2(4) = 15$; $A(4) = 7 + 3(4) = 19$; and $A(n) = 7 + (n-1)4$.

If you were asked to find the 10th term of the sequence, $A(10) = 7 + (10 - 1)4 = 43$,

the 20th term would be _________________________.

Thus, the nth term $A(n)$ rule for an arithmetic sequence is $A(n) = a + (n - 1)d$ where a = the first term, n = the term number, and d = the common difference.

Find the common difference of the arithmetic sequence.

2. 9, 13, 17, 21, . . .
3. 5, 5.3, 5.6, 5.9, . . .
4. $2, 1\frac{8}{9}, 1\frac{7}{9}, 1\frac{2}{3}, \ldots$
5. The common difference in an arithmetic sequence is ____________ a positive number.

Find the first, fourth, and tenth terms of the arithmetic sequence described by the given rule.

6. $A(n) = 12 + (n-1)(3)$

7. $A(n) = -6 + (n-1)\left(\frac{1}{5}\right)$

8. $A(n) = -3 + (n-1)(-2.2)$

Geometric Sequences:

Unit 7, Activity 8, Arithmetic and Geometric Sequences

Two types of number sequences are represented in this activity-arithmetic sequences and geometric sequences. When the terms of a sequence are determined by multiplying a term in the sequence by a fixed number to find the next term, the sequence is called a geometric sequence.

Examples: Look at the pattern of 3, 12, 48, 192. What is the common ratio between each of the terms? The common ratio is ×4. So to find the next term in the sequence, you would multiply 4 by 192 to obtain 768.

Now, determine the common ratio for 80, 20, 5, and 1.25. The common ratio is ___, and the next term in the sequence is__________.

A rule for finding the *n*th term of an geometric sequence can be found by using the following guidelines: Consider the sequence 1, 3, 9, 27,... in which the common ratio is ×3. Let n = the term number of the sequence.
Let $A(n)$ = the value of the *n*th term of the sequence.
$A(1) = 1$; $A(2) = 1(3) = 3$; $A(3) = 1(3)(3) = 1(3)^2$; $A(4) = 1(3)(3)(3) = 1(3)^3$; and $A(n) = 1(3)^{n-1}$

If you were asked to find the 10th term of the sequence, $A(10) = 1(3)^9 = 19{,}683$,

the 20th term would be ______________________________________.

Thus, the *n*th term $A(n)$ rule for an geometric sequence is $A(n) = a \cdot r^{n-1}$ where a = the first term, n = the term number, and r = the common ratio.

The common difference or the common ratio can be used to determine whether a sequence is arithmetic or geometric. If there is no common difference or ratio, then the sequence is neither geometric nor arithmetic.

Examples: 2, 4, 6, 8... the common difference is 2 so the sequence is arithmetic.
2, 4, 8, 16 ... the common ratio is 2 so the sequence is geometric.

Find the common ratio of the sequence:
9. 2, –10, 50, –250, . . .
10. –164, –82, –41, –20.5, . . .
11. Find the next three terms of the sequence 3, 9, 27, 81...

Determine whether the sequence is *arithmetic* or *geometric*.
12. –2, 10, –50, 250, . . .
13. Find the first, fourth, and eighth terms of the sequence. $A(n) = -2 \cdot 2^{n-1}$

14. Find the next three terms of the sequence. Then, write a rule for the sequence.
648, 216, 72, 24

Unit 7, Activity 8, Arithmetic and Geometric Sequences with Answers

Read the following passages and provide the solutions to the problems below each passage.

1. Two types of number sequences are represented in this activity-arithmetic sequences and geometric sequences. When the terms of a sequence are based on adding a fixed number to each previous term, the pattern is known as an **arithmetic sequence**. The fixed number is called the **common difference**.

Examples: Look at the pattern of -7, -3, 1, 5. What is the common difference between each of the terms? The common difference is +4. So to find the next term in the sequence, you would add 4 to 5 to obtain 9.

Now, determine the common difference for 17, 13, 9, and 5. The common difference is *-4*, and the next term in the sequence is *1.*

A rule for finding the nth term of an arithmetic sequence can be found by using the following guidelines: Consider the sequence 7, 11, 15, 19,... in which the common difference is +4. Let n = the term number of the sequence.
Let $A(n)$ = the value of the nth term of the sequence.
$A(1) = 7$; $A(2) = 7 + 4 = 11$; $A(3) = 7 + 2(4) = 15$; $A(4) = 7 + 3(4) = 19$; and $A(n) = 7 + (n-1)4$.

If you were asked to find the 10th term of the sequence, $A(10) = 7 + (10 - 1)4 = 43$,

the 20th term would be *A(20) = 7 + (20-1)4 = 83.*

Thus, the nth term $A(n)$ rule for an arithmetic sequence is $A(n) = a + (n - 1)d$ where a = the first term, n = the term number, and d = the common difference.

Find the common difference of the arithmetic sequence.

2. 9, 13, 17, 21, . . . *Answer: +4*
3. 5, 5.3, 5.6, 5.9, . . . *Answer: +0.3*
4. $2, 1\frac{8}{9}, 1\frac{7}{9}, 1\frac{2}{3}, \ldots$ *Answer:* $-\frac{1}{9}$
5. The common difference in an arithmetic sequence is *sometimes* a positive number.

Find the first, fourth, and tenth terms of the arithmetic sequence described by the given rule.

6. $A(n)=12+(n-1)(3)$ *Answer: 12, 21, 39*

7. $A(n)=-6+(n-1)\left(\frac{1}{5}\right)$ *Answer: -6,* $-5\frac{2}{5}$, $-4\frac{1}{5}$

8. $A(n)=-3+(n-1)(-2.2)$ *Answer: -3, -9.6, -22.8*

Geometric Sequences:

Unit 7, Activity 8, Arithmetic and Geometric Sequences with Answers

Two types of number sequences are represented in this activity-arithmetic sequences and geometric sequences. When the terms of a sequence are determined by multiplying a term in the sequence by a fixed number to find the next term, the sequence is called a geometric sequence.

Examples: Look at the pattern of 3, 12, 48, 192. What is the common ratio between each of the terms? The common ratio is ×4. So to find the next term in the sequence, you would multiply 4 by 192 to obtain 768.

Now, determine the common ratio for 80, 20, 5, and 1.25. The common ratio is *0.25*, and the next term in the sequence is $\frac{5}{16}$ *or 0.3125.*

A rule for finding the *n*th term of an geometric sequence can be found by using the following guidelines: Consider the sequence 1, 3, 9, 27,... in which the common ratio is ×3. Let n = the term number of the sequence.
Let $A(n)$ = the value of the *n*th term of the sequence,
$A(1) = 1$; $A(2) = 1(3) = 3$; $A(3) = 1(3)(3) = 1(3)^2$; $A(4) = 1(3)(3)(3) = 1(3)^3$; and $A(n) = 1(3)^{n-1}$.

If you were asked to find the 10th term of the sequence, $A(10) = 1(3)^9 = 19{,}683$.

the 20th term would be
$$\begin{aligned} A(20) &= 1(3)^{20-1} \\ &= 1(3)^{19} \\ &= 1{,}162{,}261{,}467 \end{aligned}$$

Thus, the *n*th term $A(n)$ rule for an geometric sequence is $A(n) = a \cdot r^{n-1}$ where a = the first term, n = the term number, and r = the common ratio.

The common difference or the common ratio can be used to determine whether a sequence is arithmetic or geometric. If there is no common difference or ratio, then the sequence is neither geometric nor arithmetic.

Examples: 2, 4, 6, 8... the common difference is 2 so the sequence is arithmetic.
2, 4, 8, 16 ... the common ratio is 2 so the sequence is geometric.
Find the common ratio of the sequence.

9. 2, –10, 50, –250, . . . *Answer: -5*
10. –164, –82, –41, –20.5, . . . *Answer:* $\frac{1}{2}$
11. Find the next three terms of the sequence 3, 9, 27, 81... *Answer: 243, 729, 2187*
    Determine whether the sequence is *arithmetic* or *geometric*. *Geometric*
12. –2, 10, –50, 250, . . . *Answer: -1250*

13. Find the first, fourth, and eighth terms of the sequence. $A(n) = -2 \cdot 2^{n-1}$

Answer: -2; -16; -256

14. Find the next three terms of the sequence. Then write a rule for the sequence.

648, 216, 72, 24 *Answer: 8,* $\frac{8}{3}, \frac{8}{9}$*;* $A(n) = 648 \cdot \left(\frac{1}{3}\right)^{n-1}$

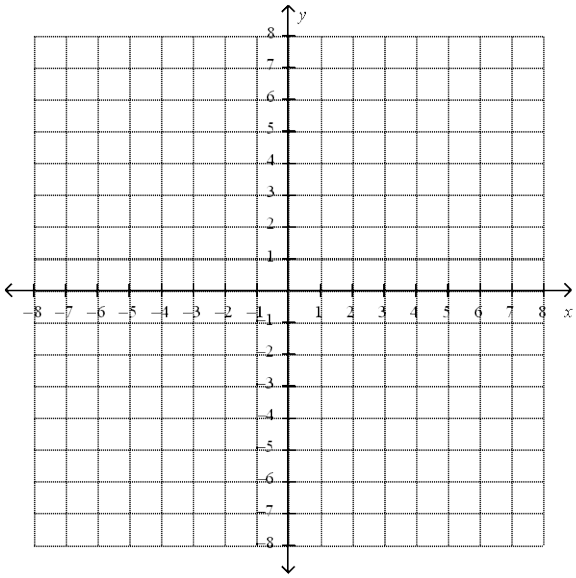
Word	+	☑	-	**Example**	**Definition**
Parabola					
Quadratic Equation in Standard Form					
Zeros					
Completing the Square					
Scatterplot					
Discriminant					
Quadratic Formula					
Vertex					
Axis of Symmetry					
Y-intercept					
X-intercept					
Solutions to a quadratic equation					
Real solution					
Complex Solution					
Roots of a quadratic					
Vertex form of a quadratic equation					

Procedure:
1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit you should have the entire chart completed. Because you will be revising this chart, write in pencil.

Unit 7, Activity 10, Graphing Quadratic Equations

1. Graph $x^2 + 3x + 2 = y$



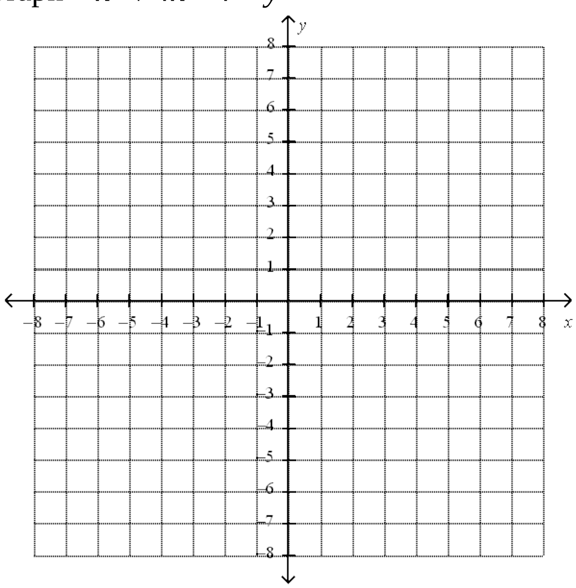
a. Determine the axis of symmetry: ______

b. Determine the vertex: _______

c. Name the solution(s) to

$x^2 + 3x + 2 = 0$: _________

2. Graph $-x^2 + 4x - 4 = y$



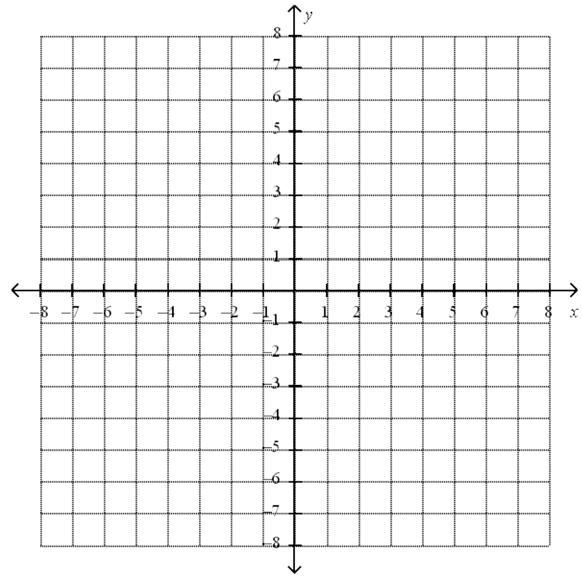
a. Determine the axis of symmetry: ______

b. Determine the vertex: ______

c. Name the solution(s) to

$-x^2 + 4x - 4 = 0$: _________

3. Graph $y = x^2 + 3$



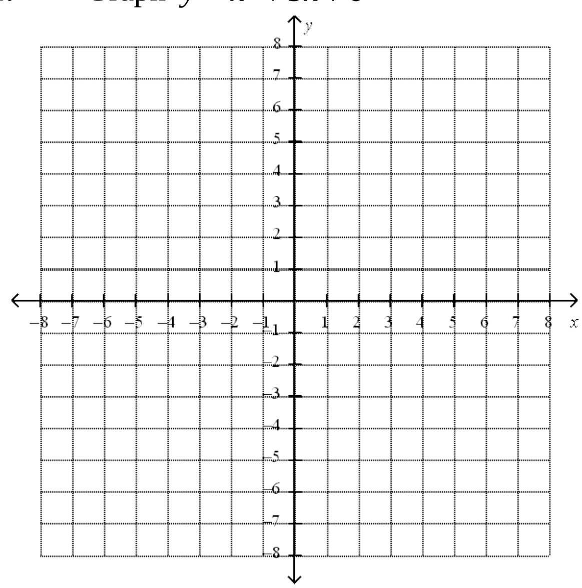
a. Determine the axis of symmetry: _____

b. Determine the vertex: ______

c. Name the solution(s) to

$0 = x^2 + 3$: _________

4. Graph $y = x^2 + 5x + 6$



a. Determine the axis of symmetry: ______

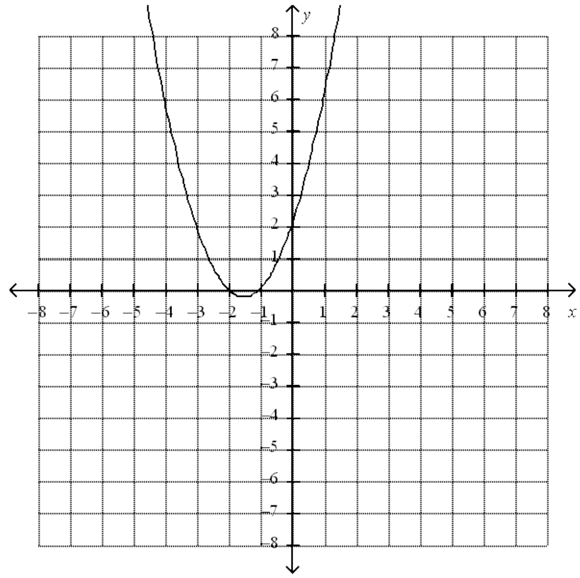
b. Determine the vertex: _________

c. Name the solution(s) to

$0 = x^2 + 5x + 6$: _________

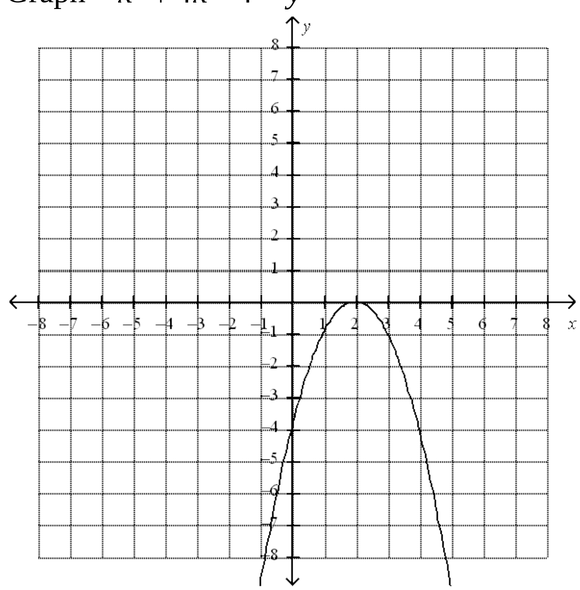
Unit 7, Activity 10, Graphing Quadratic Equations with Answers

1. Graph $x^2 + 3x + 2 = y$



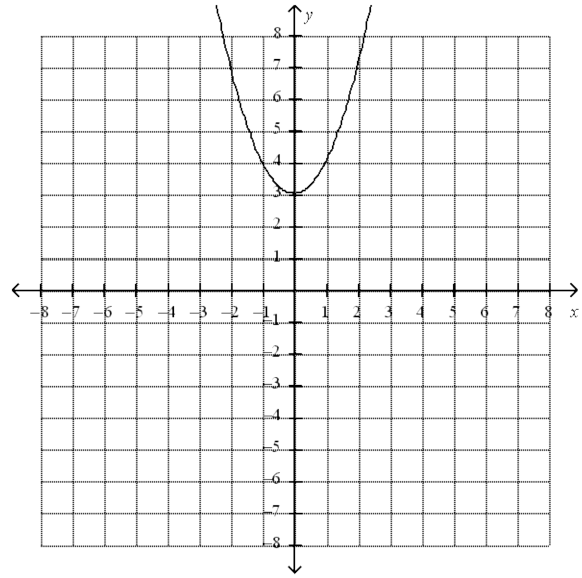
a. Determine the axis of symmetry: <u>*x = -1*</u>
b. Determine the vertex: ***(** -1.5, -.25 **)***
c. Name the solution(s) to
$x^2 + 3x + 2 = 0$: <u>*(-2, 0) (-1, 0)*</u>

2. Graph $-x^2 + 4x - 4 = y$



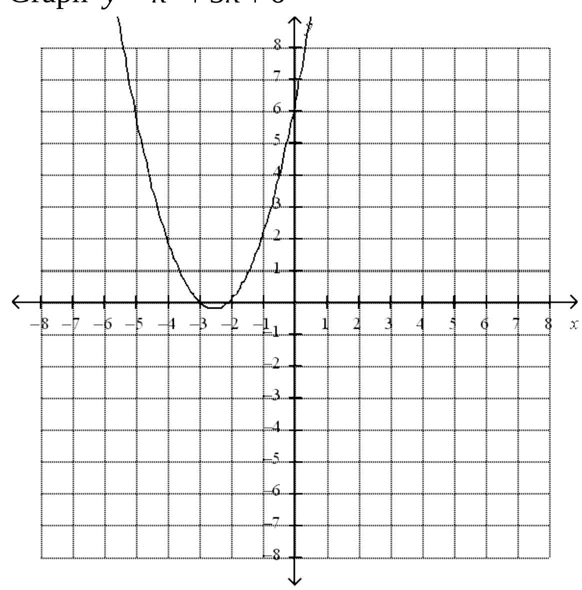
a. Determine the axis of symmetry: <u>*x = 2*</u>
b. Determine the vertex: *(2, 0)*
c. Name the solution(s) to
$-x^2 + 4x - 4 = 0$: <u>*(2, 0)*</u>

3. Graph $y = x^2 + 3$



a. Determine the axis of symmetry: <u>*x = 0*</u>
b. Determine the vertex: *(0, 3)*
c. Name the solution(s)
$0 = x^2 + 3$: <u>*(No real solution)*</u>

4. Graph $y = x^2 + 5x + 6$



a. Determine the axis of symmetry: <u>*x = -2.5*</u>
b. Determine the vertex: ***(** <u>-2.5, -.25</u>)*
c. Name the solution(s) to
$0 = x^2 + 5x + 6$: <u>*(-3, 0) (-2,0)*</u>

Unit 8, Activity 1, Vocabulary Self-Awareness Chart

Vocabulary Self-Awareness Chart

WORD	+	√	?	EXAMPLE	DEFINITION
Central Tendency					
Mean					
Median					
Mode					
Range					
Quartile					
Interquartile Range					
Standard deviation					
Stem and Leaf Diagram					
Dot Plot					
Histogram					
Box Plot					
Line Plot					
Odds					
Experimental Probability					
Theoretical Probability					

Unit 8, Activity 1, Vocabulary Self-Awareness Chart

Geometric Probability					
Permutations					
Combinations					
Sample Space					
Independent Event					
Dependent Event					

Procedure:
1. Examine the list of words you have written in the first column.
2. Put a + next to each word you know well and for which you can write an accurate example and definition. Your definition and example must relate to the unit of study.
3. Place a ☑ next to any words for which you can write either a definition or an example, but not both.
4. Put a – next to words that are new to you.

This chart will be used throughout the unit. By the end of the unit you should have the entire chart completed. Because you will be revising this chart, write in pencil.

Unit 8, Activity 1, Measures of Central Tendency

1) The basketball coach wants to compare the attendance at basketball games with other schools in the area. She collected the following numbers for attendance at games:

100, 107, 98, 110, 115, 90, 62, 50, 97, 101, 100

Construct a line plot of the data.

Find the mean, median, and mode of the attendance at basketball games.

Mean_________ Median_________ Mode_________

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?

2) Alajuan Motor Vehicles monitors their sales monthly. The company sold 34, 35, 29, 31, 34, 30, 32, 35, 34, 31, 29, and 33 vehicles over the last year.
Construct a line plot of the data.

Find the mean, median, and mode of the monthly vehicle sales.

Mean_________ Median_________ Mode_________

Mark the mean, median, and mode on the line plot.

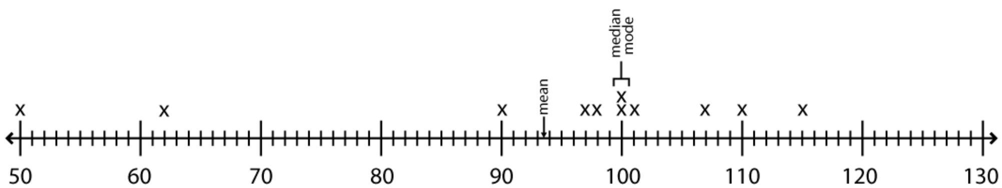
Which measure of central tendency is the most appropriate to use to represent the data? Why?

Unit 8, Activity 1, Measures of Central Tendency

1) The basketball coach wants to compare the attendance at basketball games with other schools in the area. She collected the following numbers for attendance at games:

100, 107, 98, 110, 115, 90, 62, 50, 97, 101, 100

Construct a line plot of the data.



Find the mean, median, and mode of the attendance at basketball games.

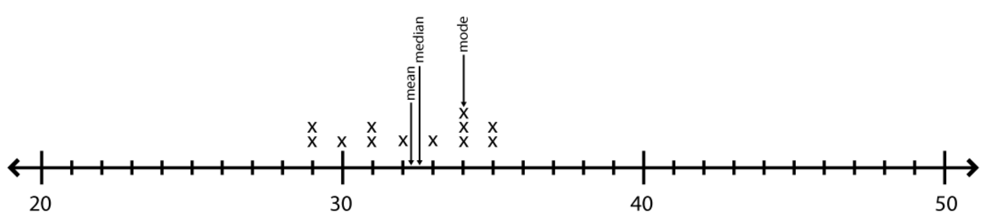
Mean *93.6*   Median *100*   Mode *100*

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?
In this set of data, the median is the most appropriate measure because 50 and 62 are outliers.

2) Alajuan Motor Vehicles monitors their sales monthly. The company sold 34, 35, 29, 31, 34, 30, 32, 35, 34, 31, 29, and 33 vehicles over the last year.

Construct a line plot of the data.



Find the mean, median, and mode of the monthly vehicle sales.

Mean *32.25*   Median *32.5*   Mode *34*

Mark the mean, median, and mode on the line plot.

Which measure of central tendency is the most appropriate to use to represent the data? Why?
The mean is the most appropriate measure because there are no outliers

Unit 8, Activity 2, Standard Deviation Graphic Organizer

Step 1
Find the mean value of the data.

↓

Step 2
Subtract the mean from each item.

↓

Step 3
Square each of these values.

↓

Step 4
Find the sum of these squares.

↓

Step 5
Divide this number by the number of items minus one.

↓

Step 6
Take the square root of this number.

Unit 8, Activity 2, Statistics

A teacher recorded the test scores of class of students. The following data shows students' percentages on the test:
89, 77, 100, 92, 79, 86, 95, 70, 89, 87, 78

What is the sum of all test scores?

How many students took the test?

Mean/Quartile 2: What is the average test score?

Put the items in numerical order.
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ ____
Median: Which score falls in the middle of this list?

Rewrite the numbers to the left of the middle number.
_____ _____ _____ _____ _____
Quartile 1: What is number falls in the middle of this list?

Rewrite the number to the right of the middle number.
_____ _____ _____ ____ ____
Quartile 3: What is number falls in the middle of this list?

Interquartile Range: What is the difference between quartile 3 and quartile 1?

Mode: Out of the original list, which number appears the most?

Out of the original list, which test score is the least?

Out of the original list, which test score is the greatest?

Range: What is the difference between the greatest and the least score?

Standard deviation:
Step 1 answer

Step 2 answer

Step 3 answer

Step 4 answer

Step 5 answer

Step 6 answer

Unit 8, Activity 2, Statistics with Answers

A teacher recorded the test scores of class of students. The following data shows students' percentages on the test:
89, 77, 100, 92, 79, 86, 95, 70, 89, 87, 78
What is the sum of all test scores?
942
How many students took the test? *11*
Mean/Quartile 2: What is the average test score?
85.63636364
Put the items in numerical order.
__*70*__ ___*77*_ ___*78*__ ___*79*_ __*86*__ __*87*__ ___*89*__ ___*89*__ __*92*__ __*95*__ _*100*__
Median: Which score falls in the middle of this list?
87
Rewrite the numbers to the left of the middle number.
__*70*__ ___*77*_ ___*78*__ ___*79*_ __*86*__
Quartile 1: What is number falls in the middle of this list?
78
Rewrite the number to the right of the middle number.
___*89*__ ___*89*__ __*92*__ __*95*__ _*100*__
Quartile 3: What is number falls in the middle of this list?
92
Interquartile Range: What is the difference between quartile 3 and quartile 1?
14
Mode: Out of the original list, which number appears the most?
89
Out of the original list, which test score is the least?
70
Out of the original list, which test score is the greatest?
100
Range: What is the difference between the greatest and the least score?
30
Standard deviation:
Step 1 answer
Mean=85.63636364
Step 2 answer
-15.636364, -8.636364, -7.636364, -6.636364, .363636, 1.363636, 3.363636, 3.363636, 6.363636, 9.363636, 14.363636
Step 3 answer
244.4959, 74.5868, 58.3140, 44.0413, 0.1322, 1.8595, 11.3140, 40.4959, 40.4959,_87.6777, 206.3140
Step 4 answer
809.7272
Step 5 answer
*80.9727*Step 6 answer
8.9985

Unit 8, Activity 2, Music Scoring

Students from two high schools went to a band competition. Each student gave a solo performance and was rated by the judges. The possible scores ranged from 3 (one point from each judge) to 21 (seven points from each judge). The data show the scores of two groups of students.

Westlake Student Scores: 8, 10, 15, 21, 3, 15, 10, 21, 15, 20

Northshore Student Scores: 5, 6, 19, 10, 12, 10, 12, 9, 20, 8

a. Find the mean and the range of the data for the Westlake High School students and for the Northshore High School students.

b. Find the standard deviation for each set of data. Round to the nearest tenth.

c. Draw a box and whisker plot.

d. Use your results from parts **a** and **b** to compare the scores of the students from the two high schools.

Students from two high schools went to a band competition. Each student gave a solo performance and was rated by the judges. The possible scores ranged from 3 (one point from each judge) to 21 (seven points from each judge). The data show the scores of two groups of students.

Westlake Student Scores: 8, 10, 15, 21, 3, 15, 10, 21, 15, 20

Northshore Student Scores: 5, 6, 19, 10, 12, 10, 12, 9, 20, 8

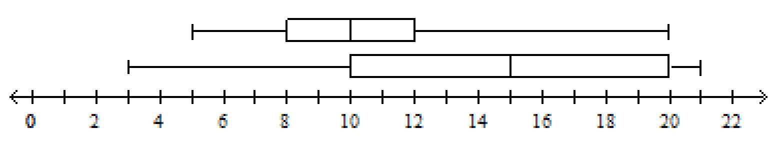
a. Find the mean and the range of the data for the Westlake High School students and for the Northshore High School students.

Westlake mean = 13.8, range = 18
Northshore mean = 11.1, range = 15

b. Find the standard deviation for each set of data. Round to the nearest tenth.

Westlake standard deviation = 5.7
Northshore standard deviation = 4.7

c. Draw a box and whisker plot.



d. Use your results from parts **a** and **b** to compare the scores of the students from the two high schools.

Sample: The Westlake students had a higher mean score and a larger amount of variation in the scores, as shown by the larger range and standard deviation. The Northshore students had a lower mean score and less variation.

Unit 8, Activity 7, It's Conditional

Determine whether the events are dependent or independent. Explain your answer,

1. Toss a penny and a nickel

2. Draw a name from a hat; without replacement, select another name

3. A basket contains orange and green balls. Select one, then return it and pick again.

Explain the difference between independent and dependent events. Provide an example of each.

4. Suppose you chose a letter tile form a bag containing 2 As, 3 Bs and 4 Cs. Replace the first tile chosen and choose again. Determine the probability.

   A. P(A and A) _____ *B.* P(B and C) _____ C. P(C and C) _____

5. Write the letters in the word "*PROBABILITY,*" one letter on each index card. Select one card; without replacing the card, select another. Determine each probability. For this example "Y " is a vowel.

   A. P (vowel then vowel) _____ B. P(consonant then vowel) _____

   C. P (I then I) _____ D. P(A then A) _____

6. Two letters are chosen from the alphabet randomly without replacement. Find the probability of choosing a vowel followed by a second vowel. P (vowel then vowel) = ______

7. Two letters of the alphabet are selected at random without replacement. What is the probability of selecting a consonant followed by another consonant. P (consonant then consonant) = ______

8. Write four probability problems, two involving independent events and two involving dependent events or conditional probability. Mix them up. Find a partner and exchange problems. Determine each of the probabilities.

Answers vary. Check student problems for logical situations and correct calculation of probabilities.

Unit 8, Activity 7, It's Conditional with answers

Determine whether the events are dependent or independent. Explain your answer,

1. Toss a penny and a nickel *Independent because you still have 2 in the sample space for each coin*
2. Draw a name from a hat; without replacement, select another name *Dependent because with one name gone, the sample space has changed.*
3. A basket contains orange and green balls. Select one, then return it and pick again. *Independent because the sample space has not changed.*

Explain the difference between independent and dependent events. Provide an example of each. *Answers will vary. Check student work for appropriate examples.*

4. Suppose you chose a letter tile form a bag containing 2 As, 3 Bs and 4 Cs. Replace the first tile chosen and choose again. Determine the probability.

   A. P(A and A) $\frac{4}{81}$ *B.* P(B and C) $\frac{4}{27}$ C. P(C and C) $\frac{16}{81}$

5. Write the letters in the word "*PROBABILITY,*" one letter on each index card. Select one card; without replacing the card, select another. Determine each probability. For this example "Y " is a vowel.

   A. P (vowel then vowel) $\frac{9}{110}$ B. P(consonant then vowel) $\frac{3}{11}$

   C. P (I then I) $\frac{1}{55}$ D. P(A then A) 0

6. Two letters are chosen from the alphabet randomly without replacement. Find the probability of choosing a vowel followed by a second vowel. P (vowel then vowel) = $\frac{2}{65}$
7. Two letters of the alphabet are selected at random without replacement. What is the probability of selecting a consonant followed by another consonant. P (consonant then consonant) = $\frac{42}{65}$
8. Write four probability problems, two involving independent events and two involving dependent events or conditional probability. Mix them up. Find a partner and exchange problems. Determine each of the probabilities.

Answers vary. Check student problems for logical situations and correct calculation of probabilities.

Permutations and Combinations

1. Factorial: The expression 6! is read “6 factorial.” It means he product of all the whole numbers from 6 to 1. $6! = 6 \bullet 5 \bullet 4 \bullet 3 \bullet 2 \bullet 1 = 720$. The factorial can be used to calculate the number of different batting orders that can be made with 9 baseball players. There are 9 choices for the first position, 8 for the next position, 7 for the next, and so on. There are 9! possible batting orders 9! = 362,880 possible batting orders

a. The swimming pool at the park has 8 lanes. In how many ways can 8 swimmers be assigned to the swimming lanes for a race. _______________________

b. There are 10 skaters preparing for the finals in a competition. How many different orders are possible for the final program? ____

2. Permutation: A factorial is a special arrangement in which selections are made one at a time. It is a special type of permutation. A permutation is a counting problem which determines the number of possible arrangement of objects in a set. Each of the arrangements is a permutation. A permutation is an arrangement of objects in a specific order.

The expression ${}_nP_r$ represents the number of permutations of n objects arranged r at a time.

n will be the first factor

${}_nP_r = n(n - 1)(n - 2)...$

Stop when you have r factors....

${}_8P_3$ means 8 players chosen 3 at a time, or 8(7)(6) = 336.
This expression could be used to solve a problem such as 8 students are running a race. In how many arrangements can they finish in 1st, 2nd, and 3rd places?

A. ${}_7P_4$ = ______ B. ${}_9P_3$ =_____ C, ${}_7P_3$ =_____

d. At a track meet, 42 students have entered the 100 m race. In how many ways can 1st, 2nd, 3rd and 4th places be awarded? _____________________

e. A car dealer has 35 cars to sell. Each day 3 cars are chosen for advertising specials. One car appears in a newspaper ad, one appears in a television commercial, and one appears in an online ad. In how many ways can the 3 cars be chosen? ____________________

3. Combinations: A combination is a collection of objects not regarding the order of the objects. For example, the toppings on a pizza can be placed in any order without changing the pizza The expression ${}_nC_r$ represents the number of combinations of n objects arranged r at the time.

$${}_nC_r = \frac{1}{r!} \bullet {}_nP_n = \frac{n(n-1)(n-2)\ldots}{r(r-1)(r-2)\ldots}$$

The numerator consists of r factors starting with n; the denominator consists of r factors, beginning with r. The expression ${}_4C_3 = \frac{4(3)(2)}{3(2)(1)}$ = 4. The expression could represent the number of 3-topping pizza combinations that can be made from 4 possible toppings.

A. ${}_4C_2$ = ______ B. ${}_7C_3$ = ________ C. ${}_{10}C_4$ = ______

D. If twenty people report for jury duty, how many different ways can a twelve person jury be seated? ____

4. Determine whether each situation is a combination or permutation, then determine the number of arrangements represented by the situation.

a. At a party there are 12 people present. Each person at the party will shake hands with every other person at the party exactly one time. How many handshakes occur? _____________________________________

b. A roller coaster has room for 10 people, all sitting single file, one behind the other. How many different arrangements for the 10 passengers are possible? ____

c. In how many ways can a president. a vice president, a secretary, and a treasurer can be chosen from a group of 25 running for office? _______________________________________

d. Fifteen students from the freshman class have volunteered to be on a committee to organize the spring dance. In how many ways can 5 students be chosen for the committee? ____

E. From fifty entries in the talent show, how many ways can five semi-finalists be chosen? ____

Permutations and Combinations

1. Factorial: The expression 6! is read "6 factorial." It means he product of all the whole numbers from 6 to 1. 6! = 6•5•4•3•2•1 = 720. The factorial can be used to calculate the number of different batting orders that can be made with 9 baseball players. There are 9 choices for the first position, 8 for the next position, 7 for the next, and so on. There are 9! possible batting orders 9! = 362,880 possible batting orders

   a. The swimming pool at the park has 8 lanes. In how many ways can 8 swimmers be assigned to the swimming lanes for a race. *8! = 40, 320 ways*

   b. There are 10 skaters preparing for the finals in a competition. How many different orders are possible for the final program? *10! = 3, 628, 800 orders for final performances*

2. Permutation: A factorial is a special arrangement in which selections are made one at a time. It is a special type of permutation. A permutation is a counting problem which determines the number of possible arrangement of objects in a set. Each of the arrangements is a permutation. A permutation is an arrangement of objects in a specific order.

   The expression ${}_nP_r$ represents the number of permutations of n objects arranged r at a time.

   n will be the first factor

   ${}_nP_r = n(n - 1)(n - 2)...$
   Stop when you have r factors....

   ${}_8P_3$ means 8 players chosen 3 at a time, or 8(7)(6) = 336.
   This expression could be used to solve a problem such as 8 students are running a race. In how many arrangements can they finish in 1st, 2nd, and 3rd places?

   A. ${}_7P_4$ = *840*   B. ${}_9P_3$ = *504*   C, ${}_7P_3$ = *210*

   d. At a track meet 42 students have entered the 100 m race. In how many ways can 1st, 2nd, 3rd and 4th places be awarded? ${}_{42}P_4$ = *2,686,320*

   e. A car dealer has 35 cars to sell. Each day 3 cars are chosen for advertising specials. One car appears in a newspaper ad, one appears in a television commercial, and one appears in an online ad. In how many ways can the 3 cars be chosen? ${}_{35}P_3$ = *50,616 ways*

3. Combinations: A combination is a collection of objects not regarding the order of the objects. For example, the toppings on a pizza can be placed in any order without changing the pizza The expression ${}_nC_r$ represents the number of combinations of n objects arranged r at the time.

$${}_nC_r = \frac{1}{r!} \bullet {}_nP_n = \frac{n(n-1)(n-2)...}{r(r-1)(r-2)...}$$

The numerator consists of r factors starting with n; the denominator consists of r factors, beginning with r. The expression ${}_4C_3 = \frac{4(3)(2)}{3(2)(1)}$ = 4. The expression could represent the number of 3-topping pizza combinations that can be made from 4 possible toppings.

A. ${}_4C_2$ = ___*6*___ B. ${}_7C_3$ = ___*35*___ C. ${}_{10}C_4$ = ___*210*

D. If twenty people report for jury duty, how many different ways can a twelve person jury be seated. ${}_{20}C_{12}$ = *125,970 twelve person juries*

4. Determine whether each situation is a combination or permutation, then determine the number of arrangements represented by the situation.

a. At a party there are 12 people present. Each person at the party will shake hands with every other person at the party exactly one time. How many handshakes occur? *Combination; 66 handshakes*

b. A roller coaster has room for 10 people, all sitting single file, one behind the other. How many different arrangements for the 10 passengers are possible? *Permutation; 3,628,800 possible seating arrangements*

c. In how many ways can a president. a vice president, secretary, treasurer can be chosen from a group of 25 running for office? *Permutation; 303,600 possible ways to fill the offices*

d. Fifteen students from the freshman class have volunteered to be on a committee to organize the spring dance. In how many ways can 5 students be chosen for the committee? *Combination; 3,003 possible ways*

e. From fifty entries in the talent show, how many ways can five semi-finalists be chosen? *Combination; 2, 118,760 possible ways*