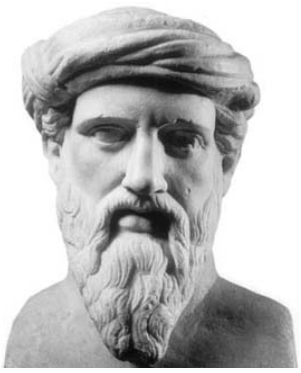
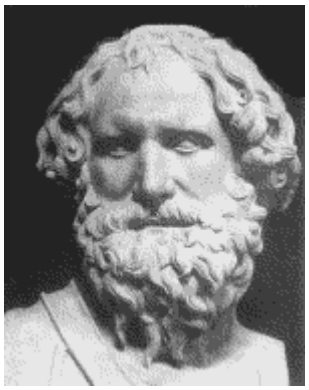


Pythagoras



Archimedes

Euclid

A MATHEMATICS Winter Number Land

Grade 9

Winter 2011-2012

Miami-Dade County Public Schools
Curriculum & Instruction

Table of Contents

WELCOME TO *A MATHEMATICS WINTER NUMBER LAND*

The realm of mathematics contains some of the greatest ides of humankind. The *A Mathematics Winter Number Land* activities included in this packet are a mathematical excursion designed to be read, fun to do, and fun to think and talk about. These activities will assist you in applying the concepts you have studied. Additionally, each activity addresses a specific Sunshine State Benchmark. Each benchmark is listed at the end of the activity.

The journey to true mathematics understanding can be difficult and challenging but be patient and stay the course. Mathematics involves profound ideas. As we make these ideas our own, they will empower us with strength, techniques, and the confidence to accomplish wonderful things. Enjoy working each activity.

Included as part of this packet, is a link to the Miami-Dade County Public Schools Student Portal *Links to Learning* technology activities. Individualized student learning paths have been designed based on FCAT/EOC scores and are aligned to the District's Pacing Guides. These online activities are supplemental and, as such, are not to be assigned or graded. All online activities are provided as a resource to both parents and students to engage learning using technology. Please log on just as you do at your school.

If you are in need of additional information about the *A Mathematics Winter Number Land* Winter Break Activity Packet, please contact the Division of Mathematics, Science, and Advanced Academic Programs, at 305 995-1939.

Tips for A Mathematics Winter Number Land

Read the activity and attempt to answer the questions that follow. The only rules are:

1. Make an earnest attempt to solve the problem. Record your attempts.
2. Be creative.
3. Don't give up. If you get stuck, look at the story and question a different way.
4. Discuss your story with your family.
5. HAVE FUN!

Who Were They?

Pythagoras was a Greek mathematical genius and often described as the first pure mathematician. He invented the Pythagorean theorem which states that: "In any right triangle, the area of the square whose side is the hypotenuse (the side of a right triangle opposite the right angle) is equal to the sum of areas of the squares whose sides are the two legs (i.e. the two sides other than the hypotenuse)."

Euclid, the Greek mathematician, was known as the "Father of Geometry". He taught at the university in Alexandria, Egypt. While at the university, he compiled his famous 13 volume treatise called *Elements* that is still the basis of the geometry taught in schools to this day. He used axioms (accepted mathematical truths) to develop a deductive system of proof, which he wrote in his textbook *Elements*. Euclid's first three postulates, with which he begins his *Elements*, are familiar to anyone who has taken geometry: 1) it is possible to draw a straight line between any two points; 2) it is possible to produce a finite straight line continuously in a straight line; and 3) a circle may be described with any center and radius.

Euclid also proved that it is impossible to find the "largest prime number," because if you take the largest known prime number, add 1 to the product of all the primes up to and including it; you will get another prime number. Euclid's proof for this theorem is generally accepted as one of the "classic" proofs because of its conciseness and clarity. Millions of prime numbers are known to exist, and more are being added by mathematicians and computer scientists. Mathematicians since Euclid have attempted without success to find a pattern to the sequence of prime numbers.

Archimedes is one of the great scientists of antiquity also known for his mathematical work. It is believed he studied under followers of Euclid. He proved that an object plunged into liquid becomes lighter by an amount equal to the weight of liquid it displaces. Popular tradition has it that Archimedes made the discovery when he stepped into the bathtub, then celebrated by running through the streets shouting "Eureka!" ("I have found it!"). He also worked out the principle of levers, developed a method for expressing large numbers, discovered ways to determine the areas and volumes of solids, and calculated an approximation of pi (π).

COOKIE DILEMMA

A BIT OF COOKIE HISTORY

According to the Nestle website, Ruth Wakefield, who was the owner of the Toll House Inn in Massachusetts, is credited with inventing the chocolate chip cookie. The story goes that one day in 1930 she cut a Nestlé's Semisweet Yellow Label Chocolate bar into small chunks and added it to her butter cookie dough. The cookies were an instant hit with her customers and word of their popularity reached the Nestle Company. Nestle must have realized that adding small chunks of their chocolate bar to cookie dough would appeal to the mass market because by 1939 Nestle was selling chocolate morsels (or chips). What a brilliant marketing plan it turned out to be when Nestle packaged the chips in a Yellow bag and then bought the rights to the Toll House name and Ruth Wakefield's chocolate chip cookie recipe. They called her recipe "The Famous Toll House Cookie" and printed it on the back of the Yellow bag of chocolate morsels.

HOLIDAY COOKIE DILEMMA

It is holiday time and you have decided to make some cookies. You are going to bake your cookies on a circular baking sheet. Your first task is to decide how big you will make your cookies. Your baking sheet is 15½ inches in diameter. You have cookie cutters for 3-inch, 4-inch and 5-inch cookies. Which cookie cutter size should you use in order to limit the amount of empty space on the cookie sheet? Which cookie cutter should you use? Why?

1. Select an appropriate scale and draw a diagram to scale of your cookie sheet, the 3-inch cookie, the 4-inch cookie, and the 5-inch cookie.

   Scale _____

2. Draw a scale diagram of each cookie arrangement on your cookie sheet. Estimate the number of cookies of each size that will fit on your cookie sheet.

3-Inch Cookie Diagram

Scale _____ Estimated # of Cookies _____

4-Inch Cookie Diagram

Scale _____ Estimated # of Cookies _____

5-Inch Cookie Diagram

Scale _____ Estimated # of Cookies _____

3. For each arrangement of cookies on the cookie sheet, determine the amount of "empty space." Describe verbally and algebraically how you arrived at your answer.

4. Write a paragraph describing which size cookie cutter you will use in order to minimize the amount of "empty" space on the 15½ inch cookie sheet.

BENCHMARKS

MA.912.A.10.1 Use a variety of problem- solving strategies, such as drawing a diagram, making a chart, guessing and checking, solving a simpler problem, writing an equation, working backwards, and creating a table.

MA.912.G.6.2 Define and identify: circumference, radius, diameter, arc, arc length, chord, secant, tangent and concentric circles.

PLANNING A TRIP

VISIT FLORIDA!

It's time to exchange digging out homework for digging your toes in sand on refreshing, Florida beaches. From the tranquil Emerald Coast in the northwest to the shell-lovers southwest sand and the southeast's Gold Coast your toes will thank you ten times for many Florida experiences. Come experience Florida's amazing cuisine, culture, nightlife, outdoors, shopping and more.

WINTER BREAK VACTION IN FLORIDA

You and your family are on winter break. You have two weeks with no school and no homework. You'd like to travel around the state of Florida. Where would you like to go? What Florida sites would you like to visit? Let's plan a family driving vacation.

Before you jump in the car and start driving, there are some decisions you will need to make. How much money do you have to spend on this trip? What will be your travel allowance? How many nights will you be away from home? Where will you go? How much should you have for admission fees for different attractions?

PART I: Let's plan our trip!

TRIP PLANNER	
Travel Allowance :	
Destination:	
Number of nights away from home:	
Number of days traveling:	
Dates of the trip	
Number of family members:	

I. Locate the hotel you will stay in. Search the newspaper and internet for hotels in the area.

a. Hotel _____
b. Cost per night including room tax _____
c. Number of family members _____
d. Number of nights in hotel _____
e. Miscellaneous hotel expenses _____

Workspace: Describe how you arrived at the above results

II. Locate the attraction(s) you will visit during your stay.

	Attraction	Entry Cost	Other Fees
1.			
2.			
3.			
4.			

Workspace: Describe how you arrived at the above results

III. Plan your meals.

a. Number meals per day per person _____
b. Cost of meals for one person per day _____
c. Number of family members _____
d. Total cost of meals for all family members _____

Daily Meal Planner			
	Restaurant	**Cost**	**Additional Fees**
Breakfast			
Lunch			
Dinner			

Workspace: Describe how you arrived at the above results.

IV. Estimate the cost of the gasoline for the car and determine your driving directions.

a. Number of miles between your home and your destination _____
b. Cost of a gallon of gasoline _____
c. Car's average miles per gallon _____
d. Total number of gallons needed for the trip _____
e. Total cost of the gasoline _____

Determine your driving directions. Print out the directions from MapQuest or another source.

Workspace: Describe how you arrived at the above results.

V. Estimate your souvenir costs.

	Souvenir	Cost
1.		
2.		
3.		
4		

Workspace: Describe how you arrived at the above results

VI. Research the destination's history. Identify three facts you did not know before. Cite the source of your information. Create a travel ad for your destination site.

VII. Calculate your total trip expenses. Be sure you have included expenses for every member of your family.

TOTAL TRIP EXPENSES		
OUR DESTINATION		
		Cost
Hotels:		
Meals:		
Gasoline:		
Admission Fees:		
Souvenirs		
Food:		
Miscellaneous Fees:		
	Total:	

Will your travel allowance cover all of your expenses? If not, what can you change in your planning that will allow you to take your trip?

Enjoy your vacation in Florida!

PART II Budget Analysis

1. Based on your estimated expenses, what percent of your budget was spent on the following:
   a. Gasoline _____
   b. Lodging _____
   c. Food _____
   d. Entertainment _____
   e. Miscellaneous _____

   Workspace: Describe how you arrived at the above results

2. Create a pie chart of illustrating your expenses.

3. Analyze your expenses. Are they reasonable?

MAP OF FLORIDA

BENCHMARKS

MA.912.A.10.1 Use a variety of problem- solving strategies, such as drawing a diagram, making a chart, guessing and checking, solving a simpler problem, writing an equation, working backwards, and creating a table.

MA.912.A.2.3 Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.

MA.912.A.2.13 Solve real-world problems involving relations and functions.

VACATION BASKETBALL

Adapted from The Mathematics Teacher, May 2004

In 1891, James Naismith, a Canadian physical education instructor, invented the game of basketball. Naismith was born in Almonte, Ontario and was educated in Montreal at McGill University. He was the physical education teacher at McGill University (1887 to 1890) and at Springfield College in Springfield, Massachusetts (1890 to 1895). At Springfield College, under the direction of American physical education specialist Luther Halsey Gulick, Naismith invented the indoor game of basketball.

The first formal rules were devised in 1892. Players dribbled a soccer ball up and down a court of unspecified dimensions. Points were earned by landing the ball in a peach basket. Iron hoops and a hammock-style basket were introduced in 1893. Another decade passed before the innovation of open-ended nets put an end to the practice of manually retrieving the ball from the basket each time a goal was scored. James Naismith was inducted into the Basketball Hall of Fame in 1959.

Thirteen Original Basketball Rules written by James Naismith

1. The ball may be thrown in any direction with one or both hands.
2. The ball may be batted in any direction with one or both hands, but never with the fist.
3. A player cannot run with the ball. The player must throw it from the spot on which he catches it, allowance to be made for a man running at good speed.
4. The ball must be held by the hands. The arms or body must not be used for holding it.
5. No shouldering, holding, pushing, striking or tripping in any way of an opponent. The first infringement of this rule by any person shall count as a foul; the second shall disqualify him until the next goal is made or, if there was evident intent to injure the person, for the whole of the game. No substitution shall be allowed.
6. A foul is striking at the ball with the fist, violations of Rules 3 and 4 and such as described in Rule 5.
7. If either side makes three consecutive fouls it shall count as a goal for the opponents (consecutive means without the opponents in the meantime making a foul).
8. A goal shall be made when the ball is thrown or batted from the grounds into the basket and stays there, providing those defending the goal do no touch or disturb the goal. If the ball rests on the edges, and the opponent moves the basket, it shall count as a goal.

9. When the ball goes out of bounds, it shall be thrown into the field and played by the first person touching it. In case of dispute the umpire shall throw it straight into the field. The thrower-in is allowed five seconds. If he holds it longer, it shall go to the opponent. If any side persists in delaying the game, the umpire shall call a foul on them.
10. The umpire shall be the judge of the men and shall note the fouls and notify the referee when three consecutive fouls have been made. He shall have power to disqualify men according to Rule 5.
11. The referee shall be judge of the ball and shall decide when the ball is in play, in bounds, to which side it belongs, and shall keep the time. He shall decide when a goal has been made and keep account of the goals, with any other duties that are usually performed by a referee.
12. The time shall be two fifteen-minute halves, with five minutes rest between.
13. The side making the most goals in that time shall be declared the winner.

A VACATION BASKETBALL ACTIVITY

NUM	PLAYER	POS	HT	WT	DOB	FROM	YRS
50	Joel Anthony	C	6-9	245	08/09/1982	Nevada-Las Vegas	R
30	Earl Barron	C	7-0	245	08/14/1981	Memphis	2
15	Mark Blount	C-F	7-0	250	11/30/1975	Pittsburgh	7
14	Daequan Cook	G	6-5	205	04/28/1987	Ohio State	R
31	Ricky Davis	G	6-7	205	09/23/1979	Iowa	9
7	Anfernee Hardaway	G-F	6-7	215	07/18/1971	Memphis	13
40	Udonis Haslem	F	6-8	235	06/09/1980	Florida	4
13	Alexander Johnson	F	6-9	230	02/08/1983	Florida State	1
33	Alonzo Mourning	C	6-10	261	02/08/1970	Georgetown	14
32	Shaquille O'Neal	C	7-1	325	03/06/1972	Louisiana State	15
21	Smush Parker	G	6-4	190	06/01/1981	Fordham	4
11	Chris Quinn	G	6-2	175	09/27/1983	Notre Dame	1
3	Dwyane Wade	G	6-4	216	01/17/1982	Marquette	4
55	Jason Williams	G	6-1	180	11/18/1975	Florida	9

Source: www.nba.com/heat/roster/2007

1. Convert all the heights in the table from feet and inches to inches. Record these conversions in the table below.

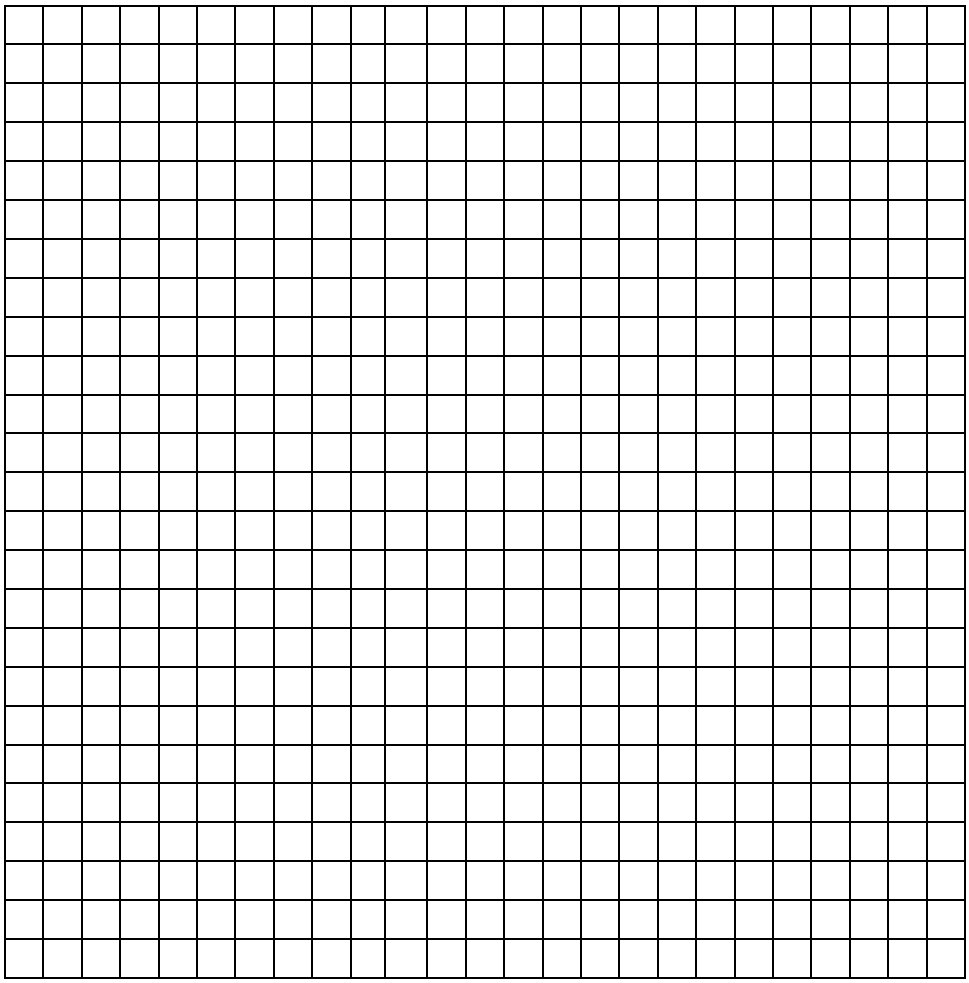
PLAYER	POS	HT	INCHES	WT
Joel Anthony	C	6'9"		245
Earl Barron	C	7'0"		245
Mark Blount	C-F	7'0"		250
Daequan Cook	G	6'5"		205
Ricky Davis	G	6'7"		205
Anfernee Hardaway	G-F	6'7"		215
Udonis Haslem	F	6'8"		235
Alexander Johnson	F	6'9"		230
Alonzo Mourning	C	6'10'		261
Shaquille O'Neal	C	7'1"		325
Smush Parker	G	6'4"		190
Chris Quinn	G	6'2"		175
Dwyane Wade	G	6'4"		216
Jason Williams	G	6'1"		180

Workspace: Describe how you arrived at the above results

2. Identify the independent variable and the dependent variable? Explain your reasoning.
   a. Independent Variable _____
   b. Dependent Variable _____

3. Does the data set represent a relation that is a function? Explain

4. Select appropriate axis labels and graph the ordered pairs (weight, height).



5. Is the relation increasing or decreasing? Explain
6. Determine the equation of the line of best fit.

    a. Select two points (___,___) and (___,___)

    b. Determine the slope of the line between these two points

    Slope _____

    What is the real-world meaning of the slope? _____

    c. Write the equation of the line in slope/intercept form.

    Equation of Line-of-Best Fit _____

    d. Explain what the *y*-intercept in the equation represents

    _____

Workspace: Describe algebraically how you arrived at the above results

7. Use the slope of the line in step 8 to determine whether a basketball player's weight increases or decreases for every inch that his height increases.

8. By how many pounds does a basketball player's weight change for every inch that his height increases?

9. Use the equation in step 8 to estimate the weight of a player on this team who is 6 feet 6 inches tall.

10. Use your graphing calculator to enter the data into the list functions, graph the scatter plot, and determine the linear regression equation.

    a. Slope _____

    b. *Y*-intercept _____

    c. Value of *r* _____. What information is the correlation coefficient *r* providing you?

11. Discuss the similarities and differences between the equation you calculated by hand and the equation you found using the graphing calculator. Discuss your conclusions.

12. Use the calculator equation to determine the height of a player who weighs 350 pounds. Does this answer make sense in the real world? Explain.

BENCHMARKS

MA.912.A.10.1 Use a variety of problem- solving strategies, such as drawing a diagram, making a chart, guessing and checking, solving a simpler problem, writing an equation, working backwards, and creating a table.

MA.912.S.3.1 Read and interpret data presented in various formats. Determine whether data is presented in appropriate format, and identify possible corrections. Formats to include: bar graphs, line graphs, stem and leaf plots, circle graphs, histograms, box and whiskers plots, scatter plots, cumulative frequency (ogive) graphs

MA.912.S.3.2 Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries from the following bar graphs, line graphs, stem and leaf plots, circle graphs, histograms, box and whiskers plots, scatter plots, cumulative frequency (ogive) graphs

MA.912.S.3.3 Calculate and interpret measures of the center of a set of data, including mean, median, and weighted mean, and use these measures to make comparisons among sets of data.

BLACK FRIDAY

Black Friday is the day after Thanksgiving in the United States, where it is the beginning of the traditional Christmas shopping season. Since Thanksgiving falls on the fourth Thursday in November in the United States, ***Black Friday*** may be as early as the 23rd and as late as the 29th of November. ***Black Friday*** is not an official holiday, but many employers give the day off, increasing the number of potential shoppers. Retailers often decorate for the Christmas season weeks beforehand. Many retailers open very early (typically 5 am or even earlier) and offer **door buster deals** and loss leaders to draw people to their stores.

Although ***Black Friday***, as the first shopping day after Thanksgiving, has served as the unofficial beginning of the Christmas season at least since the start of the modern Macy's Thanksgiving Day Parade in 1924, the term ***"Black Friday"*** has been traced back only to the 1970s. ***"Black Friday"*** was originally so named because of the heavy traffic on that day, although most contemporary uses of the term refer instead to it as the beginning of the period in which retailers are in the black.

In many cities it is not uncommon to see shoppers lined up hours before stores with big sales open. Once inside, the stores shoppers often rush and grab, as many stores have only a few of the big draw items. Electronics and popular toys are often the most sought-after items and may be sharply discounted. Because of the shoulder-to-shoulder crowds, many choose to stay home and avoid the hectic shopping experience. The local media often will cover the event, mentioning how early the shoppers began lining up at various stores and providing video of the shoppers standing in line and later leaving with their purchased items. Traditionally Black Friday sales were intended for those shopping for Christmas gifts. For some particularly popular items, some people shop at these sales in order to get deep discounts on items they can then resell, typically online.

With all the **blockbuster sales** during the holiday season, it is the time of year when consumers who know their percentages are at their best. Knowing the common fractions such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{3}{4}$, can be a joy for them because they can quickly calculate their savings. Converting from percents to fractions can also be exhilarating because 25% off is easily converted to $\frac{1}{4}$ then a quick division by 4 tells the consumer his or her discount in seconds.

In this activity, you will work with percentages to find proportions and percent equations that can help you become a savvy sales calculator.

PART I: Here are some calculations that consumers will be doing this holiday season. Write the correct answers in the space provided. Use a separate sheet of paper to describe how you arrived at each solution.

25% of what is 28? _____	What percent of 72 is 18? _____	60% of what is 45? _____
What percent of 12 is 6? _____	What is 60% of 12? _____	75% of what is 48? _____
What is 20% of 650? _____	What percent of 150 is 90? _____	What percent of 90 is 63? _____
What is 38% of 60? _____	22.5% of what is 42? _____	45% of what is 99? _____
What percent of 210 is 10.5? _____	160% of what is 124? _____	What is 39% of 1500? _____
What is 250% of 14? _____	What percent of 20 is 36? _____	What is 8.25% of 160? _____

Write an equation to model each question and solve.

1. Pedro has a goal to lose 25lb. He has lost 16 lb. What percent of his goal has he reached?

   _____ _____
   Equation Solution

2. You spent 16% of your vacation money on food. If you spent $48 on food, how much money did you spend on your vacation?

   _____ _____
   Equation Solution

3. A writer earns $3400 a month. Last month she spent $204 on food. What percent of her income was spent on food?

   _____ _____
   Equation Solution

4. Arnetta spends 30% of her monthly income on rent. If she pays $810 for rent each month, what is her monthly income?

   _____ _____
   Equation Solution

5. Suppose that 62.5% of freshman entering a college graduate from it. If there are 2680 freshmen, how many will graduate from college?

   _____ _____
   Equation Solution

PART II: The formula for determining simple interest is ***I = prt.*** Using this formula, solve the following problems. (*p – principal, r – rate, t – time*)

6. You invest $1500 for three years. Find the amount of simple interest you can earn at an annual rate of 8.25%

7. Suppose that you invested $1200 for four years. You earned $312 in simple interest. What is the interest rate?

8. Suppose that you invested some money at 8% simple interest for five years. If you received $500 in interest, how much money did you invest?

Write an equation to model each question and solve.

What is 7% of 480?		What percent of 80 is 48?	
What is 150% of 26?		125% of what is 175?	
What is 35% of 360?		What percent of 36 is 9?	
45% of what is 36?		What is 80 % of 120?	
25% of what is 92?		What percent of 30 is 90?	
90% of what is 27?		75% of what is 90?	
What is 10.25% of 280?		What percent of 20 is 8?	
What is 39% of 800?			

BENCHMARKS

MA.912.A.10.1 Use a variety of problem- solving strategies, such as drawing a diagram, making a chart, guessing and checking, solving a simpler problem, writing an equation, working backwards, and creating a table.

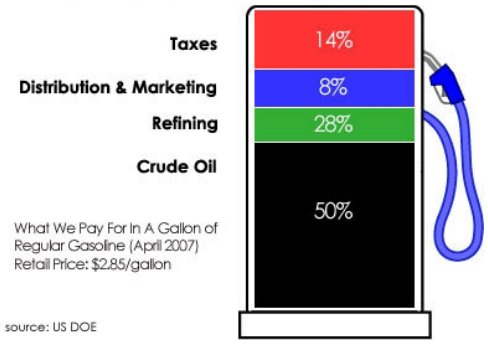
MA.912.F.4.2 Explain cash management strategies including debit accounts, checking accounts, and savings accounts.

MA.912.F.4.4 Establish a plan to pay off debt.

THE PRICE OF GASOLINE

Gasoline is the bloodline that keeps America moving. Our personal vehicles alone guzzle 140 billion gallons of gasoline and diesel fuel each year, up 3.2 percent from a year ago. Tracking gas prices can feel like a roller coaster ride. They're down a little one month, up the next, before shooting up more than 50 percent in a year. Plus, they're different depending on where you look. Other countries, and even other states and cities, can have very different gas prices from your local Gas-N-Go. To the average person, it probably seems as though there's little rhyme or reason to how gas prices are determined. In this article, we will look at the forces that impact the price of gas at the pump, and we'll find out where your gas money actually goes.

When you pump $20 dollars into your tank, that money is broken up into little pieces that get distributed among several entities. Gas is just like any other consumer product: There's a supply chain and several groups who are responsible for setting the price of the product. The media can sometimes lead you to believe that the price of gas is based solely on the price of crude oil, but there are actually many factors that determine what you pay at the pump. No matter how expensive gas becomes, all of these entities have to get their slice of the pie.



The single largest entity impacting the world's oil supplies is the Organization of the Petroleum Exporting Countries (OPEC), a consortium of 12 countries: Algeria, Angola, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.

Together, these 12 nations are responsible for 40 percent of the world's oil production and hold two-thirds of the world's oil reserves, according to the Energy Information Administration (EIA). When OPEC wants to raise the price of crude oil, it simply reduces production. This causes gasoline prices to jump because of the short supply, but also because of the possibility of future reductions. When oil production dips, gas companies get nervous. The mere threat of oil reductions can raise gas prices.

With ever rising gas prices, it is important to know how we consume gas and how to conserve it. In this activity, you will use equations, table of values, and graphs to interpret travel data.

PART I: Determine each of the following solutions. Use a separate sheet of paper to show how you arrived at each solution.

1. Suppose a van gets 22 mi/gal. The distance traveled *D(g)* is a function of the gallons of gas used.

   a. Use the rule *D(g) = 22g* to make a table of values and then graph it. Label your graph.

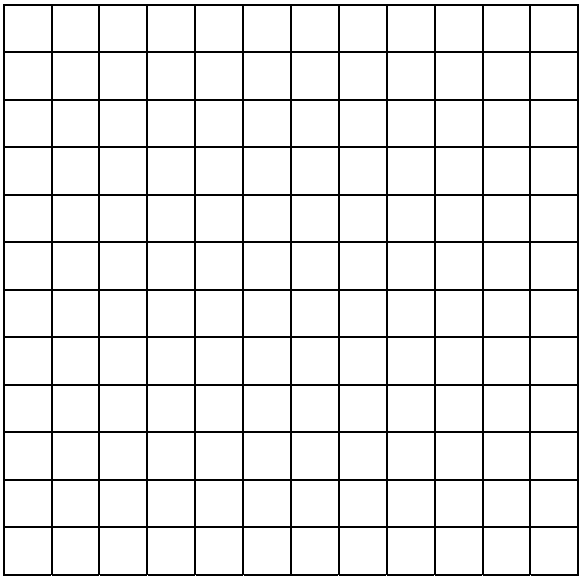
Table of Values

b. How far did the van travel if it used 10.5 gallons of gas?

c. Should the points of the graph be connected by a line? Explain.

2. The equation $D = 10h$ shows the distance in miles, D that a scooter travels in h hours. Use a function table to graph the function. How does the distance change every hour? Label your graph.

Label	Time in hours	Distance in miles,
Unit	***h***	***D***
	1	10
	2	
	3	
	4	



d. How does the distance change as time increases?

e. How does the distance change every hour?

3. The admission to a fairground is $3.00 per vehicle plus $0.50 per passenger. The total admission is a function of the number of passengers

Use the rule $T(n) = 3 + 0.50n$ to make a table of values and then graph it. Label your graph.

Table of Values

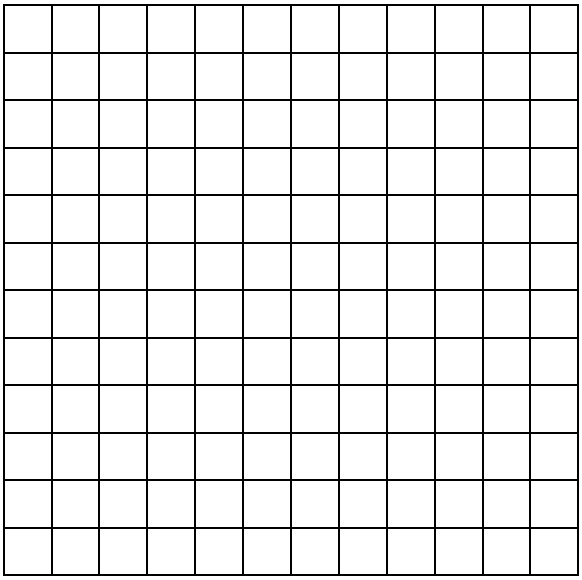
Label		
Unit		

f. What is the admission for a car with six people in it?

g. Should the points of the graph be connected by a line? Explain.

4. For a car traveling at a constant rate of 60 mi/h, the distance traveled is a function of the time traveled. Label your graph.

Label	Time in hours	Distance in miles
Unit	*h*	*D*
	1	
	5	
	10	



h. Express the relation as a function.

_____

i. What do the domain and range represent?

Domain: _____

Range: _____

BENCHMARKS

MA.912.A.2.3 Describe the concept of a function, use function notation, determine whether a given relation is a function, and link equations to functions.

MA.912.A.2.4 Determine the domain and range of a relation.

MA.912.A.2.13 Solve real-world problems involving relations and functions.

MA.912.A.3.10 Write an equation of a line given any of the following information: two points on the line, its slope and one point on the line, or its graph. Also, find an equation of a new line parallel to a given line, or perpendicular to a given line, through a given point on the new line.

MA.912.A.3.11 Write an equation of a line that models a data set and use the equation or the graph to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change.

FORENSIC MATHEMATICS

Adapted from a NUM3RS activity

The word ***"algebra"*** is derived from the Arabic word ***al-jabr***. This term is found in Mohammed ibn Musa al-Khwarizmi's book *The Comprehensive Book of Calculation by Balance and Opposition*, written around the year 825. Balance is a translation of the word ***al-jabr***, which eventually became ***algebra***.

In al-Khwarizmi's book, he did not use the modern algebraic notation, neither did he use equations. Instead, everything was in words. For example, he used the Arabic word shay, or thing, in place of ***X***. The text was a manual for solving equations. He mainly dealt with square (of the unknown), roots of the square, and absolute numbers (constants). He noted six different types of quadratic equations, such as squares equal to roots ($ax^2 = bx$) and squares equal to numbers ($ax^2 = c$).

Today, from scuba diving to crime fighting, Algebraic equations are used to solve problems. Fighting crime may not be the first thing that springs to mind when you think of Algebra. But ***CSI Miami, Numb3rs*** and ***NCIS*** on **CBS** television, are just a few of the shows that feature the use of math in solving crimes.

The neat tricks TV cops use, such as de-blurring number plates and reconstructing accidents from skid marks, are not as far fetched as they seem. In the fight against crime for both TV cops and the real police force, the secret weapon is mathematics.

In "Harvest," Don and David discover a secret operating room in the basement of an old motel, which is being used to perform illegal kidney transplants. They find blood-soaked sheets and a pile of ice melting on a sheet of plastic in a corner. When Charlie sees the FBI's pictures, he notices that the size of the puddle formed by the melting ice depends on the time the picture was taken. He and Amita discuss how this information can be used to determine when the ice first started to melt. This will tell them when their suspects last used the operating room.

In this activity, we will assume that the ice is on a level surface, that it melts into a circular puddle of constant thickness, and that the room's temperature remains constant.

1. If the ice melts at a constant rate, what does that tell us about the rate at which the area of the puddle increases?

2. Use the formula A = πr^2 to complete the following table for the area of a growing puddle. Leave your answers in terms of π.

Puddle Number	1	2	3	4
Radius	5 cm	10 cm	15 cm	20 cm
Area				

Workspace: Show how you arrived at each solution in the table above.

3. How does the area of the puddle increase when the radius increases from its original size by 5 cm, 10 cm, and 15 cm? Can you generalize the change in area for an increase of n cm?

4. Algebraically, how much larger is $(n + r)^2$ than r^2? Compare this to your answers to #3.

Suppose Charlie has two pictures of the melting ice; the first one was taken at 8:45 A.M. and the second one was taken at 9:45 A.M. In the first picture, he determines the radius of the puddle to be 30 cm. In the second picture, it has grown to 32 cm.

5. What is the area in square centimeters (cm^2) that the puddle covered in each picture? What is the corresponding rate of increase in the area (cm^2/min)? (Use 3.14 for π.)

6. When did the ice start to melt? (Hint: use the rate of increase in the area to find how long it took the puddle to grow to a radius of 30 cm.)

BENCHMARKS

MA.912.D.1.1 Use recursive and iterative thinking to solve problems, including identification of patterns, population growth and decline, and compound interest

MA.912.G.6.5 Solve real-world problems using measures of circumference, arc length, and areas of circles and sectors

MA.912.G.8.2 Use a variety of problem solving strategies, such as drawing a diagram, making a chart, guess-and-check, solving a simpler problem, writing an equation, and working backwards.

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