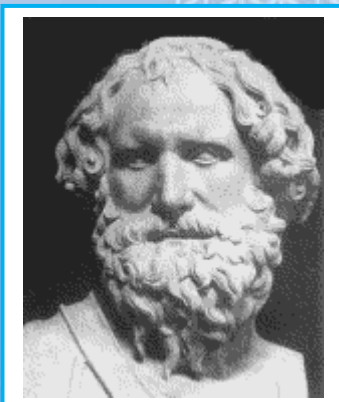Pythagoras

Archimedes

Euclid

A
MATHEMATICS
Winter Number Land

Grade 10

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. *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).

A FLOODING DILEMMA

BREAKING NEWS

tricityherald.com **Water main breaks in south Seattle, flooding homes**

Published Thursday, November 29th, 2007

The Associated Press

SEATTLE (AP) - A Seattle Public Utilities crew is working to repair a water main that broke in the White Center neighborhood , flooding seven homes and leaving 100 without water.

Spokesman Joe Mickelson says a 16-inch line split horizontally Wednesday night and the leaking water flooded basements in nearby homes up to 4 feet deep in places. The fire department was called to help.

Mickelson says the repair crew had to shut off an 8-inch residential line serving homes in the area.

Mickelson says the repairs should be completed Thursday morning and service restored.

(KOMO-TV, KING-TV, KIRO-TV)

A FLOODING DILEMMA

Suppose a water pipe in your house breaks. How much water will it take to fill your bedroom?

1. Draw a diagram of your bedroom. Determine the measurements of your bedroom. Find each dimension – the length, the width, and the height. Describe what unit of measurement you will use – stick length, shoe length, step length, yard, inch. Describe what tool you used and how you used your tool to determine the measurements.

2. Convert your measurement to feet? Why is this important for volume?

   Dimensions in feet _____

3. Determine the volume of your bedroom in cubic feet.   Explain how you arrived at your volume measurement.

   Volume of your room _____

4. Determine the number of gallons of water needed to fill your room. There are approximately 7.5 gallons in each cubic foot.

Drywall is a common manufactured building material used globally for the finish construction of interior walls and ceilings. Drywall is typically available in 4 ft (1219 mm) wide sheets of various lengths. Newly formed sheets are cut from a belt, the result of a continuous manufacturing process. In some commercial applications, sheets up to 16 ft are used. Larger sheets make for faster installation, since they reduce the number of joints that must be finished. Often, a sizable quantity of any custom length may be ordered, from factories, to exactly fit ceiling-to-floor on a large project.

The most commonly used drywall is one-half-inch thick but can range from one quarter (6.35 mm) to one inch (25 mm). For soundproofing or fire resistance, two layers of drywall are sometimes laid at right angles to each other. In North America, five-eighths-inch-thick drywall with a one-hour fire-resistance rating is often used where fire resistance is desired.

5. You have decided to refurbish your room after it has flooded. You will need to remove the wet drywall and replace it with new drywall. How much drywall will you need and how much will it cost to refurbish your room? Use the internet or newspaper to determine the size and cost of one sheet of drywall. Calculate the number of sheets of dry wall you will need for your walls and ceiling. How much will it cost you to re-drywall your room. Be sure to describe algebraically and verbally how you arrived at your solution.

One gallon of paint will cover approximately 350 square feet. You need slightly more than a gallon if the walls are unpainted drywall, which absorbs more of the paint. You also need to consider whether to paint more than one coat. If you're painting walls that are unfinished, heavily patched, or dark in color, plan on applying two coats of paint.

6. Determine the number of gallons of paint and cost of painting your newly re-dry walled room.   Be sure to use the newspaper or internet to determine price of a gallon of paint. Paste your information in the space below. Algebraically and verbally describe how you arrived at your conclusion.

7. You have decided to put wood laminate on your floor. Determine the quantity of wood laminate you will need and the cost of putting the new flooring in your room.

8. What is the total cost of refurbishing your room? Include 7% tax in your calculations.

Suppose you live in Seattle…

9. If you lived in Seattle and your bedroom is in the basement of the house, how much water was in your room as a result of the broken water main?

10. How fast would the water move if it took 15 minutes to fill your bedroom with water that is 4 feet deep?

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.7.5 Explain and use formulas for lateral area, surface area, and volume of solids.

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.

PLANNING YOUR DREAM VACATION

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.

RESTAURANT MATH

A LITTLE BIT OF PYTHAGORAS
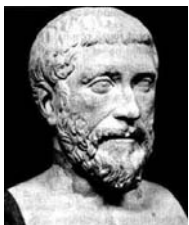
Pythagoras lived in the 500's BC. The records of the life of Pythagoras are limited. Exact dates are not known with certainty. He was born on the island of Samos in ancient Greece, a time in which belief in gods, spirits, and the mysterious was paramount. Religious cults were popular and people were superstitious. He was one of the first Greek mathematical thinkers. He spent most of his life in the Greek colonies in Sicily and southern Italy.

He had a group of followers who followed him around and taught other people what he had taught them. Pythagoras's cult known as the secret brotherhood that worshiped numbers and numerical relationships attempted to find mathematical explanations for music, the gods, and the cosmos, Pythagoras believed that all relations could be reduced to number relations. The Pythagoreans were known for their pure lives. They wore their hair long, and wore simple clothing and went barefoot. Both men and women were Pythagoreans.

Pythagoreans were interested in philosophy, but were especially in mathematics and music. Mathematics and music enabled the Pythagoreans two methods of making order out of chaos. Mathematics is rules for how the world works and music is noise that makes sense out of chaos.

Pythagoras himself is best known for proving what is known as the Pythagorean Theorem. The Pythagorean Theorem says that in a right triangle, the sum of the squares of the two legs of the triangle will always equal the square of the hypotenuse (the long side), or more commonly stated $a^2 + b^2 = c^2$. The Sumerians, two thousand years earlier, already knew that this relationship between the legs and the hypotenuse of a right triangle was true, and they used it in their measurements. Pythagoras is said to have proven the relationship to always be true.

The Egyptians knew that a triangle with sides 3, 4, and 5 make a 90° angle. As a matter of fact, they had a rope with 12 evenly spaced knots like the one shown: that they used to build perfect corners in their buildings and pyramids. It is believed that they only knew about the 3, 4, 5 triangle and not the general theorem that applies to all right triangles.

The Chinese also knew this theorem. It is attributed to Tschou-Gun who lived in 1100 BC. He knew the characteristics of the right angle. The theorem was also known to the Caldeans and the Babylonians more than a thousand years before Pythagoras. A clay tablet of Babylonian origin was found with the following inscription: "4 is the length and 5 the diagonal. What is the breadth?"

So why is it called the Pythagorean Theorem? Even though the theorem was known long before his time, Pythagoras certainly generalized it and made it popular. It was Pythagoras who is attributed with its first geometrical demonstration.

The following plaques are above the door of a popular Tokyo restaurant.   Math is everywhere! Let's explore!

The four triangles in each plaque are congruent right triangles. Suppose we label the sides as follows:

1. What is the length of a side of the square in the center of the plaque in terms of a and b?

2. What is the area of the square in the center of the plaque?

3. Determine the total area of the two red triangles in three different ways. Illustrate the each area calculation by arranging the triangles in different ways.

4. Determine the total area of the four triangles and the square in the center of the plaque.

5. Express the area of the large square in two different ways.

MATHEMATICAL QUILTS
Adapted from the *Mathematics Teacher,* October *2008*

As we travel through the states of North Carolina, South Carolina, Tennessee, Kentucky, and Georgia we continually observe quilt stores. Each quilt is made of artful and colorful squares.   Throughout history, people have enjoyed quilts for many different reasons. Quilts can provide clues to the past. Quilts can provide warmth. Quilts can provide beauty and value. Quilts can provide heritage. Quilts can provide enjoyment from working with color, texture, and pattern.

The *Quilters Complete* Guide provides the following quilting history. "Quilting can be traced back to ancient Egypt and China where three layers of fabrics (top, batting for warmth, and backing) were stitched together to keep the middle layer from slipping and clumping.

 Later in the Eleventh Century, quilting was used to hold together the layers of padding under armor. From then on quilting was a common form of needle work.
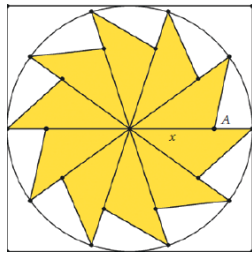
In the Eighteenth Century, it was stylish for English women to wear quilted petticoats and underskirts and for men to wear quilted waistcoats. Quilted bedding was also popular. Quilts were first brought to the American Colonies during this century.

There are only written references of the first American quilts. These quilts were probably styled after English quilts. The first American quilts were probably not patchwork or appliqué but whole cloths.

Quilting in American became popular in the Nineteenth Century was when. Distinctly American patchwork and appliqué designs were created. These quilts were produced for utility and pleasure and are the inspiration for today's quilters. They are also an important part of American Folk Art.

From the 1940s to the 1970s, quilting was not a regular pastime for America. Since 1976, quilting has again become popular."

1. Are the 10 congruent triangles in the diagram above isosceles triangles? Justify your response.

2. Is the combined area of the 10 congruent triangles equal to half of the area of the square? If not, which is greater – the area of the background or the combined area of the triangles?

3. Suppose the side of square in the diagram above is 8 feet. Let *x* represent the length of the line segment from the center of the square to point A.

   a. Find the value of *x* for which the combined area of the triangles is equal to the area of the blue background?

   b. Find the value of *x* for which the combined area of the triangles is equal to half the area of the blue background.

   c. Find the value of *x* for which the combined area of the triangles is equal to twice the area of the blue background.

   d. What is the largest fraction of the area of the square that the combined area of the triangles could represent?

4. Create an original quilt square using a combination of polygons.
    a. Describe how you constructed your quilt square. Show the steps used in the construction of your quilt square.

    b. Compose three mathematical questions that can be answered using your quilt creation.

    c. Color your quilt and present it to your teacher.

BENCHMARKS

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

MA.912.G.7.5 Explain and use formulas for lateral area, surface area, and volume of solids.

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.

ANTI-DISCRIMINATION POLICY

Federal and State Laws

The School Board of Miami-Dade County, Florida adheres to a policy of nondiscrimination in employment and educational programs/activities and strives affirmatively to provide equal opportunity for all as required by law:

Title VI of the Civil Rights Act of 1964 - prohibits discrimination on the basis of race, color, religion, or national origin.

Title VII of the Civil Rights Act of 1964, as amended - prohibits discrimination in employment on the basis of race, color, religion, gender, or national origin.

Title IX of the Educational Amendments of 1972 - prohibits discrimination on the basis of gender.

Age Discrimination in Employment Act of 1967 (ADEA), as amended - prohibits discrimination on the basis of age with respect to individuals who are at least 40.

The Equal Pay Act of 1963, as amended - prohibits gender discrimination in payment of wages to women and men performing substantially equal work in the same establishment.

Section 504 of the Rehabilitation Act of 1973 - prohibits discrimination against the disabled.

Americans with Disabilities Act of 1990 (ADA) - prohibits discrimination against individuals with disabilities in employment, public service, public accommodations and telecommunications.

The Family and Medical Leave Act of 1993 (FMLA) - requires covered employers to provide up to 12 weeks of unpaid, job-protected leave to "eligible" employees for certain family and medical reasons.

The Pregnancy Discrimination Act of 1978 - prohibits discrimination in employment on the basis of pregnancy, childbirth, or related medical conditions.

Florida Educational Equity Act (FEEA) - prohibits discrimination on the basis of race, gender, national origin, marital status, or handicap against a student or employee.

Florida Civil Rights Act of 1992 - secures for all individuals within the state freedom from discrimination because of race, color, religion, sex, national origin, age, handicap, or marital status.

Veterans are provided re-employment rights in accordance with P.L. 93-508 (Federal Law) and Section 295.07 (Florida Statutes), which stipulates categorical preferences for employment.

Revised 9/2008