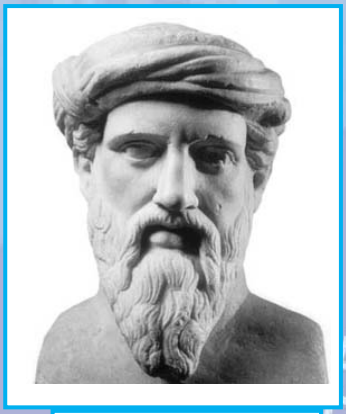
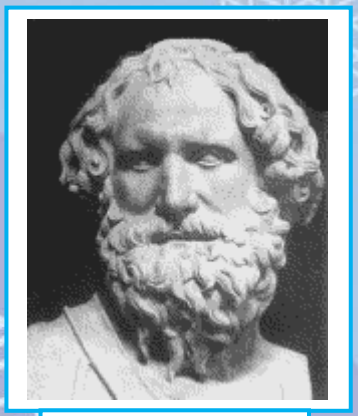


Pythagoras



Archimedes

Euclid

A MATHEMATICS Winter Number Land

ANSWER KEY

Grade 8

Winter 2011-2012

Miami-Dade County Public Schools
Curriculum & Instruction

THE SCHOOL BOARD OF MIAMI-DADE COUNTY, FLORIDA

WELCOME TO A MATHEMATICS WINTER NUMBER LAND

The realm of mathematics contains some of the greatest ideas 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 Next Generation 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 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.

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!

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 Academics Programs, at 305 995-1934.

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).

MUSICAL SHAPES

ACTIVITY PAGE

Pump up the Volume

Steps Directions

Gather the following materials: centimeter ruler and at least ten CDs.

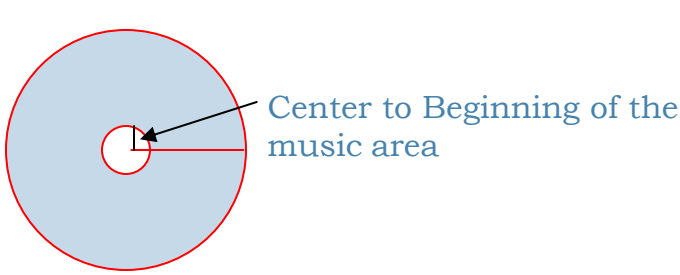
1. Measure the radius of a CD
   a. Find the height of a CD (hint: stack several CDs, measure their combined height, and divide by the number of discs)
   b. Find the volume of the CD
   c. Measure the radius from the center of the CD to the beginning of the music area. (see the photo below) This section contains no music. Find its volume.
   d. Subtract your answer to part (c) from your answer to part (b) to find the volume used for music.

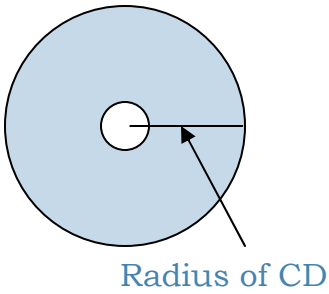
2. How many minutes of music are stored on a CD?

   A 700 MB CD hold about 74 minutes of music.

3. How many minutes are stored in each cubic centimeter of volume?

   Approximately 6 minutes per cubic centimeter.





Which format stores music more efficiently a CD or a DVD? Explain.

A DVD is more efficient because it stores more information than a similar sized CD.

EVALUATING EXPRESSIONS

Simplify each expression

1. $29 - (0 \cdot 9)$ **29**

2. $5 - (16 \div 4)$ **1**

3. $(8 \cdot 17) + (12 \cdot 17)$ **340**

4. $(12 \cdot 11) - (2 \cdot 11)$ **110**

5. $(24 + 4) \div (30 \div 2)$ **1.866**

6. $(16 \div 4) \div (1 \cdot 4)$ **1**

Evaluate each expression if $x = 2$, $y = 3$, and $z = 4$.

1. $5x$ **10**

2. $(4x) + 7$ **15**

3. $(2x) + (2y)$ **10**

4. $\frac{1}{2} \cdot (z - x)$ **1**

5. $(4x) - 8$ **0**

6. $6y$ **18**

7. $(3y) - 9$ **0**

8. $(3z) - (4x)$ **4**

9. $\frac{2}{3} \cdot (y + 6)$ **6**

10. $4z - (8x)$ **0**

11. xy **6**

12. $(5z) - 7$ **13**

13. $8(y + z)$ **56**

14. $\frac{(y + x)}{(y - x)}$ **5**

15. $(5yz) - x$ **58**

16. yz **12**

17. $(8x) + 7$ **23**

18. $7(y - x)$ **-7**

19. $\frac{(z + y)}{(z - y)}$ **7**

20. $8 + (9xy)$ **62**

NUMB3RS Activity: Meltdown

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?

   The area of the puddle increases at a constant rate.

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	**25 π cm^2**	**100 π cm^2**	**225 π cm^2**	**400 π cm^2**

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?

   Area increases by 75π, 200π, 375π; $(n + r)^2$

NUMB3RS Activity: Meltdown

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

Because (n + r)2 = n2 + 2nr + r2, the difference is n2 + 2nr, which checks with the answers in #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.)

First picture: 2,826 cm^2, second picture: 3,215.36 cm^2, a difference of 389.36 cm^2/hr or 6.49 cm^2/min

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.)

The puddle in the first picture covers an area of 2,826 cm^2, and has been increasing at the rate of 6.49 cm^2/min. So, the ice started melting 2,826 ÷ 6.49 ≈ 435.4 minutes earlier. This is about 7.26 hours, or about 7 hours and 15 minutes. So, the ice started melting at around 1:30 A.M., a perfect time for an illegal kidney transplant.

CUT, FOLD, AND CONSTRUCT

Adapted from M-DCPS's Geometry Measures Up Packet

ACTIVITY SHEET

A ***Regular Polyhedron*** is a solid, three-dimensional figure each face of which is a regular polygon with equal sides and equal angles. Every face has the same number of vertices, and the same number of faces meet at every vertex. An inscribed (inside) sphere touches the center of every face, and a circumscribed sphere (outside) touches every vertex.

There are five and only five of these figures, also called the Platonic Solids: the ***tetrahedron, cube, octahedron, dodecahedron***, and ***icosahedron***.

Before cutting out the figures, find the measurements of the sides and the heights of the triangles where appropriate. Write the measurements in the table below. If there are four sides that have the same dimensions, indicate the dimensions x 4.

Figure	Dimensions	Area of Base	Surface Area	Volume
CUBE	**1.75" x 1.75" x1.75"**	**3.06 in^2**	**18.36 in^2**	**5.36 in^3**
ICOSAHEDRON				
OCTAHEDRON				
TETRAHEDRON				

ANSWERS WILL VARY

Cut out each shape along the exterior sides. Decorate each shape. Fold along the interior segments. Assemble the solids by tucking in the tabs and gluing or taping. Display your solids by hanging them on a hanger or mounting them on a board (i.e., shoe box lid).

THE GOLDEN RATIO

Adapted from NCTM Journal 'mathematics teaching in the MIDDLE SCHOOL,' Oct. 2007

ACTIVITY SHEET

Example measurements:

	Express Each Ratio in Both its Fraction and Decimal Form				
Name	**B/N**	**F/K**	**L/N**	**A/E**	**X/Y**
1. Paulette	$\frac{65}{39}$ **or** **1.666**	$\frac{2.5}{1.5}$ **or** **1.66**	$\frac{34}{17.3}$ **or** **1.97**	$\frac{27}{10}$ **or 2.7**	$\frac{8.3}{4.5}$ **or** **1.84**
2. Kim	$\frac{72}{44}$ **or** **1.633**	$\frac{2.8}{1.5}$ **or** **1.86**	$\frac{36}{19}$ **or 1.89**	$\frac{27}{12}$ **or 2.25**	$\frac{8}{4}$ **or 2.0**
3. Roy					
4. Ray					
5. Linda					

USE TABLE 1 TO RECORD YOUR MEASUREMENTS

Table 1

	Express Each Ratio in Both its Fraction and Decimal Form				
Name	**B/N**	**F/K**	**L/N**	**A/E**	**X/Y**
1.					
2.					
3.					
4.					
5.					

ANSWERS WILL VARY

1. Which ratios in your table were close to the golden ratio and which were not?

2. Are you Golden? Explain why or why not.

If any ratio is between to 1.62 and 1.66, then the individual can be golden

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