Mathlete's Bootcamp

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THE EDUCATION FUND
FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

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ABSTRACT:

Students in Math classes of all levels (from Algebra I to Calculus II) will be involved in monthly Mathematics competitions that will encourage growth in Mathematical knowledge and in enthusiasm in the subject, as well as collaboration between students of various Mathematical abilities and backgrounds.

The goals of the "**bootcamp**" are:

1.) to encourage students of all levels to do Mathematics outside the classroom
2.) to encourage students of different math abilities and levels to work together towards a common goal: to learn more Mathematics
3.) to have several department teachers collaborate in building a core of student MATHLETES that can represent our school in various outside-of-school competitions
4.) to have fun doing mathematics and be proud of it!

All the activities described are extensions/revisions of activities that have been done at **Felix Varela Senior High** over the last six years.

Sunshine State Standards

MA.A.1.4.1, MA.A.1.4.2	π Necklace
MA.C.1.4.1, MA.C.3.4.2, MA.B.3.4.1, MA.D.1.4.1	Circumference / Diameter Ratio
MA.B.4.4.1, MA.B.4.4.2, MA.D.1.4.1, MA.D.2.4.1	Linear Regression
MA.D.1.4.1, MA.D.1.4.2	Integral Activity

National Council of Teachers of Mathematics

- Mathematics can and must be learned by all students.
- Part of being able to compute fluently means making smart choices about which tools to use and when.
- Algebra is more than moving symbols around.
- Students must understand and learn connections among mathematical ideas, and must recognize and apply mathematics in contexts outside of the mathematics classroom.

OCTOBER MATH CAMP

Most students will enjoy solving a "mix" of Math word problems that have Ghosts and Gravediggers as the main characters! The attached problems range in difficulty level and in Mathematical content. I photocopy the problems for every teacher that will be participating. Every student must get the questions the same day at the same time (preferably at the end of the day). I have a Halloween-decorated box in my room where I will place the student solutions in order of arrival. I am in charge of scoring and of selecting the winners. There is an all-around winner as well as a top prize per teacher participant. An alternative to this activity is to have each participating teacher collect the solutions, grade them, and award the prizes.

Also, if a Bulletin Board or Display Case is available, the questions can be displayed. The TV production class in your school can also read one or two questions to entice student participation.

For prizes, you can be creative. If funds are available, award compasses, scientific calculators, puzzles, sudoku magazines, etc. Even if they win a prize, students of all levels will like to receive a certificate with their name on it (see sample certificate.)

OCTOBER MATH CAMP

Many of these questions came out of The Mathematics Teacher Halloween Issue in 1994.
Others came out of the October 1998 & October 1999 Florida Mathematics League Tests.

QUESTION 1:

A bat, a cat, Dracula, and Igor line up for their annual Halloween portrait. If Igor & Dracula never stand beside each other, in how many different ways could the group line up?

QUESTION 2:

Gregor the Ghastly Gravedigger has been asked to prepare a grave for Gretel the recently Gone Ghoul. How much dirt can Gregor remove from a hole that is 6 feet deep, 2 feet wide, and 8 feet long?

QUESTION 3:

The Wolfman has a Hauntmobile. The last time he filled it up, the odometer read 25,843. When he got gas it read 26,141. If he purchased 33 gallons of gas, what gas mileage does the Hauntmobile get?

QUESTION 4:

An ancient Warlock named Munn, is twice as old as his son. Twenty-five years ago their age ratio strangely enough was three to one.

When does Munn celebrate his centenary?

QUESTION 5:

In a haunted house, Freddy Frog sits on a stand with his mouth 5 feet 6 inches above the ground. It is dark, and as people round a corner, they pass 6 inches in front of his nose. Freddy sticks out his tongue and gets them on the nose. If the tallest person he can hit on target has his/her nose 6 feet 6 inches above the ground, how long is Freddy's tongue?

QUESTION 6:

Shrieks are broadcast over the intercom every hour on the hour. One shriek occurs for each hour; at 3:00, three shrieks are heard. This ritual began at 1:00 AM on Halloween morning. If the school clocks are on a 24-hour system, how many shrieks will be broadcast on October 31st?

QUESTION 7:

Goblins hatch as do bees: males from unfertilized eggs and females from fertilized eggs. Thus, a male goblin has one female parent and a female goblin goblin has two parents (one male and one female). Make a seven-generation family tree for the male goblin. How many goblins will each generation produce?

QUESTION 8:

If the minimum number of "Friday the 13th's" that can occur in a calendar year is m and the maximum number of "Friday the 13th's" that can occur in a calendar year is M, what is the ordered pair (m,M)?

QUESTION 9:

How many "Friday the 13th's" will there be in the year 2013?

QUESTION 10:

At a classroom costume party, the average age of the b

boys is g and the average age of the g girls is b. If the average age of everyone at the party (all these boys and girls plus their 42-year-old teacher) is $b + g$, what is the value of $b + g$?

OCTOBER MATH CAMP

ANSWERS

1.) 12

2.) 0

3.) ~ 9.03 mi/gal

4.) Now! This year!

5.) ~ 13.42

6.) 276

7.) 1, 1, 2, 3, 5, 8, 13

8.) (1,3)

9.) 2

10.) 8

Felix Varela Senior High School

Mathematics Department

Jane Doe

is recognized as the

Halloween Trivia

Contest Winner

October 31st, 2007

Mrs. Sandra A. Daire / Contest Director

NOVEMBER SCAVENGER HUNT

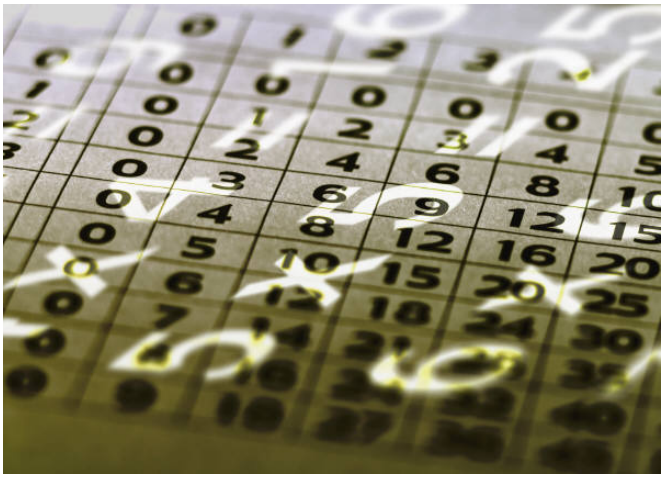
WHERE ARE THE "NUMB3RS" ?

QUESTION # 1: There is only one Math classroom in the school that has a PALINDROME as the room number. Get the teacher's initials to get credit for this question.

QUESTION # 2: The Varela ALGEBRA I HONORS teacher has question # 2 posted outside her door.

QUESTION # 3: What is the Dewey classification of Math books?

Personalize your SCAVENGER HUNT with questions like the above. Make sure that you ask other teachers to support your endeavor and perhaps help with the questions themselves. You can also have questions based on some of the episodes of the CBS show NUMB3RS or from other popular films, but be careful that the Math is not too entailed and that any clips shown are either PG or PG-13!



DECEMBER

Monopoly or Sudoku or Rubik's Cube Tournament

Host a Tournament with a minimum of 24 students.
Have several rounds of play to make it more fun!

MONOPOLY:

Have the winner be the wealthiest player after 90 minutes of play.
The top prize should include a MONOPOLY Game. You can have two rounds; the winners of round one play each other for the Monopoly Champion trophy.

Felix Varela Senior High Monopoly Players
December 2007

SUDOKU:

The winner must be the fastest to correctly solve 3 different SUDOKU puzzles. The top prize should include a SUDOKU book. If you ask your department teachers for help, you can give them practice puzzles as Opening Bell Ringers. You might be surprised how many kids still do not know what SUDOKU is.

RUBIK's CUBE:

Arrange all the competition cubes in the same manner (this takes a little time but it is the fairest.) This competition is VERY fast if you have some good players. The top prize should include a 4 x 4 x 4 or 5 x 5 x 5 RUBIK's CUBE. Many students will be interested in having a "clinic" to learn how to solve at least one face of a cube. The problem solving strategies will definitely help them in any class!

PRIZES

As in the other contests, if funds are available, the kids will love to get calculators, trophies, and even pencils! I designed a series of Math T-shirts and purchased them through a grant. All students who participate in these contests receive a shirt.

FEBRUARY

I ♥ MATH CONTEST

Each teacher in your department can have his/her own Valentine's Math Contest. I divide my classroom into different stations as it is shown below. As prizes, I purchased puzzles at Target for $1.00 and the kids loved them!

STATION # 1:

Fold an ORIGAMI heart.

STATION # 2:

Solve the following problem:

Lovey got three presents on Valentine's Day. Their combined weight was 60 kg. The two heaviest weigh 50 kg together, and the two lightest weigh 25 kg together. What is the weight in Kg of the heaviest package?

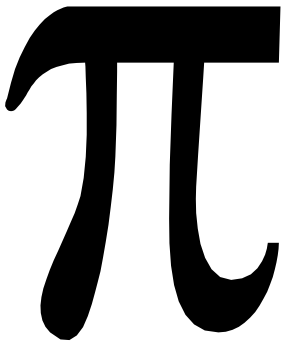
(From the February 2000 Florida Math League Contest)

STATION # 3:

Write the equation of a heart (cartioid) using polar coordinates.

MARCH
Celebrating the Number π

There are **MANY** ways to celebrate in March!



Option # 1:

Have a **π-off competition** on March 14th. Students are given 3 minutes 14 seconds to write as many digits of π as they can remember. You will notice that if you raffle off a graphing calculator the number of memorized digits will increase from year to year! I bought a plaque that is permanently in my room with the names of the winners from year to year.

Option # 2:

Give your Math teachers **π-related activities** and lessons to complete on March 14th

Option # 3:

Decorate the hallways and/or class doors with the digits of π.
Ask students to use school colors for the decorated digits!

Option # 4:

Send every Math teacher a **π-themed postcard (or e-card)** on March 14th.
Have kids make **π-necklaces** for every Math teacher.

Option # 5:

Have a **π-eating contest** during lunch.

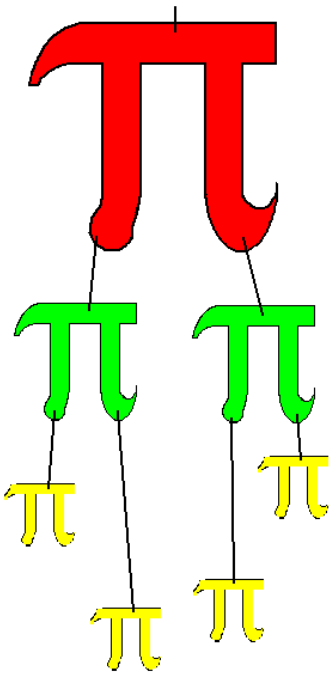
Option # 6:

Have a chorus of students **sing π-songs** throughout the building
(Math classes, Main Office, etc.)

Option # 7:

Do **all** of the above!!!!!!

π Mobile



Idea came from mathwithmrherte.com/pi_mobile.htm

MATERIALS NEEDED:

- Yarn
- Construction paper of different colors
- Hole puncher
- "π" stencils

DIRECTIONS:

Use the π stencils below to cut out ONE large π, 2 medium π & 4 small π.
Attach the center top of each π symbol to the bottom of the π leg of the next larger one as shown to the right.

ALGEBRA I and GEOMETRY π-Week Questions

Some questions were taken from edHelper.com

Answer the following questions to the best of your knowledge.
Return your answer sheet to your teacher by Wednesday 3/16 at 7:30 AM for the chance to win a **π-Week** prize.

1.) Measure the circumference of a DVD and divide it by its diameter.
What do you get as an answer?

2.) Devin made seven pepperoni pizzas for a party. He cut the pepperoni himself from a sausage that was 13 inches long and $1\frac{3}{4}$ inches in diameter. The pizzas were each 14 inches in diameter. His friend Taylor is a real math whiz and took the opportunity to calculate what percent of the total pizza surface area was covered by pepperoni. The pepperoni was cut into slices $\frac{1}{4}$ of an inch thick. Each pizza has the same number of whole pepperoni slices (he ate any extra pepperoni!). What percent of the total pizza surface area was covered by the pepperoni? Round your answer to the nearest hundredth.

3.) A cylinder can approximate the shape of a snake. Which snake would have the most volume, one that is 48 cm long and 10 cm in diameter, or one that is 34 cm long and 13 cm in diameter?

4.) Simplify the following expression: $-2\frac{1}{2}\pi + 2(\pi - \frac{1}{2}) - \frac{1}{2}\pi + 14$

5.) $\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\pi}}}}}}}}}}\ldots$

6.) The world's biggest pizza was made in Norwood, South Africa in 1990. The diameter of the pizza was 37.3 meters. What was the area of the pizza?

7.) What is the 32nd decimal place of the number π?

8.) Angles can be measured in degrees or in radians. $1° = \frac{\pi}{180}$ radians.
Convert 45° to radian measure.

9.) Let $\mathbf{x} = \frac{\pi}{2}$, $\mathbf{y} = 3\pi\mathbf{x}$, $\mathbf{z} = \frac{2\mathbf{y}}{\pi}$, and $\mathbf{w} = \frac{1}{3}\mathbf{z}$. What is **w** equal to?

10.) The Americans celebrate π-Day on March 14th (3/14). When do the Europeans celebrate it?

ALGEBRA I and GEOMETRY π–Week Answers

ANSWERS

1.) π

2.) There are 52 pepperoni slices to be divided evenly by 7 pizzas – Each pizza gets 7 pepperonis (he eats the remaining 3!). Each pizza has an area of 153.938 and each pepperoni has an area of 2.405. Since each pizza has 7 pepperonis, the percent of the area covered is $\frac{(7)(2.405)}{153.938}(100) = 10.94\%$

3.) The snake that is 34 cm long and 13 cm in diameter has more volume.

4.) $-\pi + 13$

5.) 1

6.) 1092.163 m^2

7.) 0

8.) $\frac{\pi}{4}$ radians

9.) π

10.) On July 22nd (7/22) $(\pi \approx \frac{22}{7})$

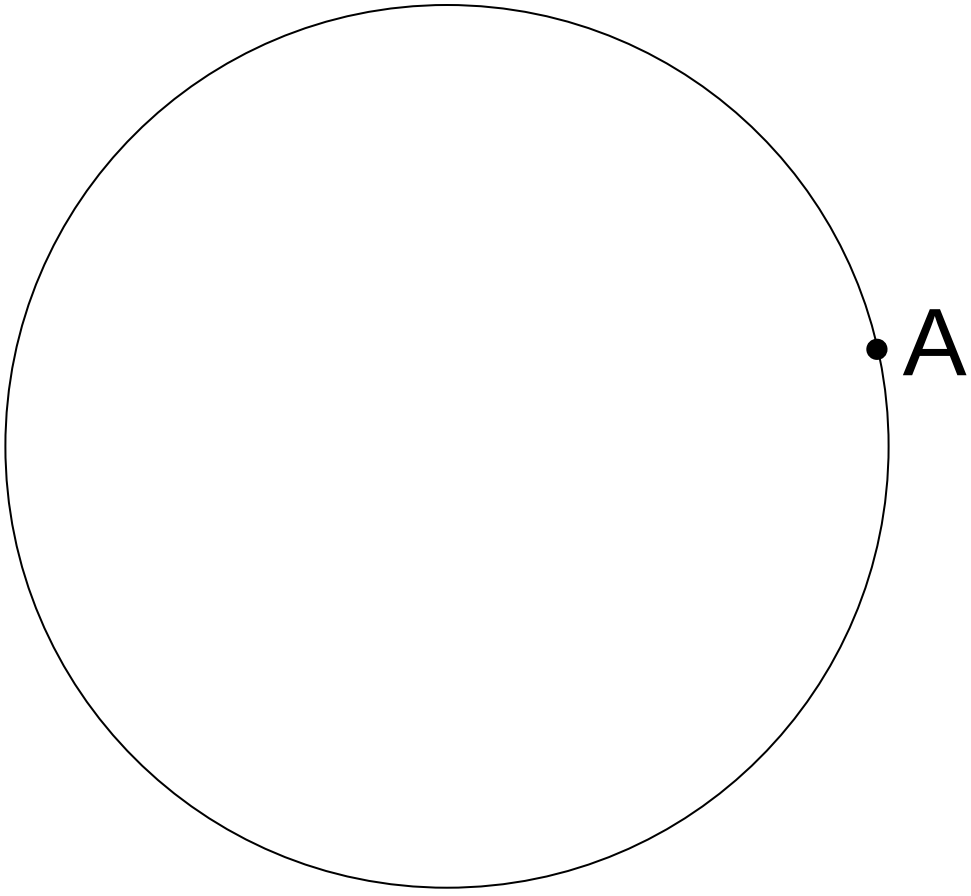
WHAT DO YOU HAVE LEFT?

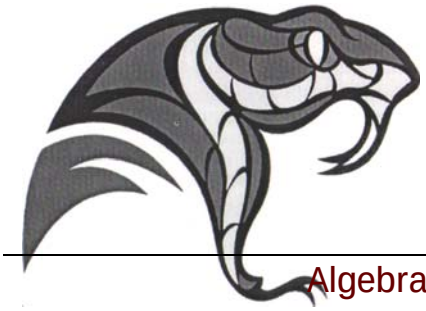
(Idea comes from "A Piece of PI")

A letter has vertical symmetry if it can be divided into right and left halves that are reflections of each other.

Examples:

Write all the letters of the alphabet around a circle using <u>capital block letters</u>. Cross out the letters with vertical symmetry. What do you have left?





π-Week Trivia Quiz

Algebra II / Analysis Of Functions / Pre-Calculus

Answer the following questions to the best of your knowledge.

Return your answer sheet to your teacher by Wednesday 3/16 at 7:30 AM for the chance to win a **π Week** prize.

1.) Who,in 1706, first gave the Greek letter π its current mathematical definition?
   a.) Albert Einstein
   b.) William Jones
   c.) Attila the Hun
   d.) Archimedes
   e.) Napoleon Bonaparte

2.) π is *transcendental*. What does this mean in mathematics?
   a.) it is equal to the ratio of two integers
   b.) its square root is imaginary
   c.) it cannot be expressed as an integer, or as a root, or as a quotient of integers
   d.) it was Ralph Waldo Emerson's favorite number

3.) If you calculated the circumference of a circle the size of the known universe, requiring that the answer be accurate to within the radius of one proton, how many decimal places of π would you need to use?
   a.) two million
   b.) 39
   c.) 48,000
   d.) 6 billion

4.) What is the earliest known reference to π in history?
   a.) The Rosetta Stone, approx. 200 BC
   b.) The Bible
   c.) An Egyptian papyrus scroll, written approximately 1650 BC by Ahmes the Scribe
   d.) Euclid's *Elements*, written in the 3rd century BC

5.) What is the current world record for the memorization of the decimal places of π?
   a.) 1000 places, by Alexander Craig Aitkin
   b.) 4096 places, by Simon Plouffe
   c.) 31,811 places, by Rajan Mahadevan
   d.) 42,000 places, by Alfred E. Neuman
   e.) None of the above

6.) Among the digits of π currently known, the concentration of each of the digits 0 – 9 are pretty close to equal. However, in the first 30 places of π 's decimal expansion, which digit is completely missing?
   a.) 7 b.) 2 c.) 0 d.) 8

7.) What is the "formal" definition of π?

a.) the surface area of a sphere of diameter $\frac{22}{7}$

b.) 3.1415926

c.) the radius of a circle

d.) the ratio of a circle's circumference to its diameter

8.) Imagine that you wrapped a rope tightly around the earth at the Equator. How much longer would you have to make the rope if you wanted to be exactly one foot above the surface all the way around? (Assume that the Equator is a perfect circle.)

a.) 2π feet

b.) $2\pi r$ feet, where r is the radius of the Earth

c.) πr^2 feet, where r is the radius of the Earth

d.) $2\pi + 1$ feet

9.) How many hours did it take a supercomputer to calculate π to 51.5 billion digits, in 1997?

a.) 3 hours

b.) 29 hours

c.) 50 hours

d.) 78 hours

10.) π is an *irrational* number. What does that really mean?

a.) If we divided π by the number of students enrolled at Varela today we will get no remainder

b.) π is a real number, but it cannot be expressed as a ratio of two integers

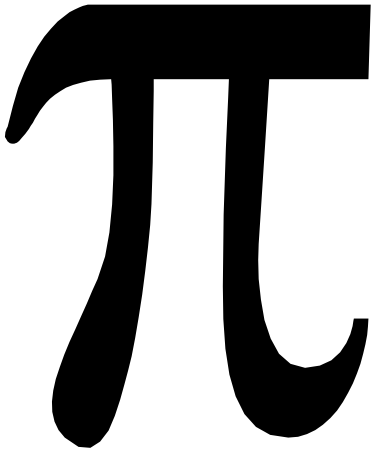
c.) π is not a real number because $e^{\pi i} = -1$

d.) a crazy mathematician was the first to compute π to 10,000 decimal places

"Probably no symbol in Mathematics has evoked as much mystery, romanticism, misconception, and human interest as the number π"

- William L. Schaaf, Nature and History of π

π-Week Trivia Quiz Answers



Algebra II / Analysis Of Functions / Pre-Calculus

ANSWERS

1.) b

2.) c

3.) b

4.) c

5.) e

6.) c

7.) d

8.) a

9.) b

10.) b

π-Week 2008 – Statistics

("Idea comes from PI Makes the World Go Around")

Linear Regression Activity / TEACHER NOTES

OBJECTIVE: Students will calculate π by finding the slope of the line $C = \pi d$. Students will discover the line of best fit (or regression line) is actually the formula for the circumference of a circle.

MATERIALS NEEDED: Circular objects, measuring tapes, rulers, graphing calculators.

METHOD: Divide students into groups. Each group will choose at least 5 circular objects and will measure the diameter and circumference of each. Each group will record their measurements in a table. Students will need to name their independent and dependent variables (explanatory & response variables). Next, students will enter the data into their graphing calculators and create a scatter plot of the data. Students will use the linear regression capability of the graphing calculator to find an equation of best fit.

EXTENSIONS: Construct a residual plot and examine if the relationship is really linear; combine the class data and do a regression on it. Look at r^2 and what it tells you about the strength of the association between the variables.

QUESTIONS TO ASK:

1.) What is the slope of the line that you found to represent your data?
2.) What does the slope represent?
3.) Does the equation of the line you found look familiar?
4.) If the diameter of a circle is d, what is the circumference of the circle? What is the circumference if the diameter is $d + 1$? What is the difference between the circumferences of these two circles?

CALCULUS

π Week 2008

(Idea comes from "PI Makes the World Go Around")

Come up with a definite integral that yields the number π, and turn it in to your teacher by Thursday March 17th.

The most creative and/or challenging definite integral will win a π week prize.

EXAMPLES:

$$\frac{3\pi}{152}\int_{4}^{6} x^2\,dx$$

$$\int_{\frac{\pi}{2}}^{\frac{3\pi}{2}} (1 - \sin x)\,dx$$

$$2\int_{\frac{\sqrt{2}}{2}}^{\frac{-\sqrt{2}}{2}} \frac{-1}{\sqrt{1 - x^2}}\,dx$$

APRIL

Mathematics Awareness Month

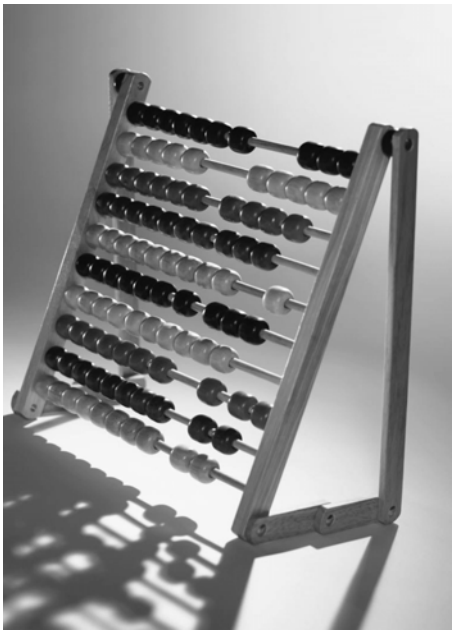
All teachers know concepts and ideas that are related to Mathematics but that are not necessarily part of the curriculum. April is the perfect Month to introduce these. I have found that using the school's TV production class as well as the Display Cases around the building help disseminate the information. Your department teachers can aid by providing ideas and/or posting them.

The *National Council of Teachers of Mathematics* also post many websites that can aid in this month's celebration. One of the most complete this past year was http://www.mathaware.org/index.html.

In addition to the sample postings that follow, you can also host an after school celebration for the students who so, far, have obtained straight A's in their Mathematics classes. One of my department teachers, Ms. Fonseca, has a

Mural of Excellence in Mathematics

posted at her door.
The kids love seeing their names highlighted!



Earthquakes and Logarithms

Adapted from *The Joy of Mathematics* by Theoni Pappas

The Richter scale was devised in 1935 by American seismologist Charles F. Richter. The scale measures an earthquake's magnitude by describing the amount of energy released at the focus of the earthquake. The Richter scale is logarithmic so the energy released increases by powers of 10 in relation to the Richter numbers. For example, an earthquake of magnitude 5 releases 10 times the energy than one of magnitude 4. Thus, an earthquake of magnitude 8 is NOT twice as powerful as one of magnitude 4, but 10^4 or 10,000 times as powerful!

The Richter scale numbers range from 0 to 9 but mathematically there is no upper limit. An earthquake of magnitude greater than 4.5 can cause damage; severe earthquakes have magnitudes greater than 7. For example, the Alaskan earthquake of 1964 was 8.4 on the Richter scale.

A seismograph is one of the instruments used to detect, measure, and graphically represent earthquakes and other ground vibrations.

The Helix: Math & Genetics

Adapted from *The Joy of Mathematics* by Theoni Pappas

The **helix** is a fascinating mathematical object which touches many areas of our lives, such as genetic make-up, growth patterns, motion, the natural world, and the manufactured world.

To understand the **helix** one must look at its formation. If rectangular blocks are cut diagonally and joined lengthwise, the result can be a 3-dimensional helix. **Deoxyribonucleicacid** (**DNA**), is composed of two 3-D helices. Examples of different types of helixes include the DNA molecule, circular staircases, screws, springs, and even candy canes. In nature, helices are found in the horns of antelopes, viruses, some shells of snails and mollusks, and even the human umbilical chord. The latter is a triple **helix** formed from one vein and two arteries that coil to the left.

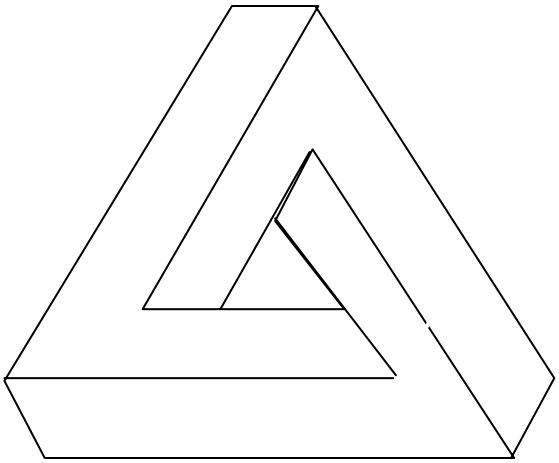
In motion, helical paths are evident in tornados, draining water, a squirrel's path up and down a tree, and in whirlpools.

With the discovery that the **helix** is linked to the DNA molecule, it is not surprising to find the appearance of helices in so many areas. The varying forms of helices and their growth patterns in nature are themselves governed by a genetic code, and thus are continually generated by nature.

The Impossible Tribar

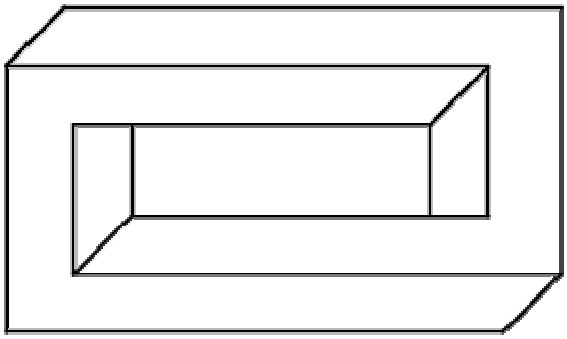
Adapted from *The Joy of Mathematics* by Theoni Pappas

The **tribar** was first published in 1958 in the *British Journal of Psychology*. Roger Penrose called his design a "three-dimensional rectangular structure."
The three right angles appear to be normal, but are spatially impossible.
(These three right angles also seem to form a triangle, but a triangle is a plane object, not three-dimensional, & the triangle angle sum is 180° not 270°.)

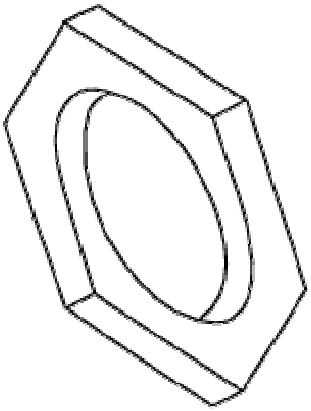


http://www-iri.upc.es/people/ros/WebThesis/tutorial.html

Look at the Optical Illusions shown below. Can you see how these objects, although depicted as a picture, cannot be physically constructed ?



http://mathworld.wolfram.com/Tribox.html



http://mathworld.wolfram.com/AmbihelicalHexnut.html

SOME PRINTED RESOURCES

Beckman, Petr. *A History of π (PI).* St. Martin's Press, 1971.

Bokhari, Naila. *Piece of Pi: Wit-Sharpening,*

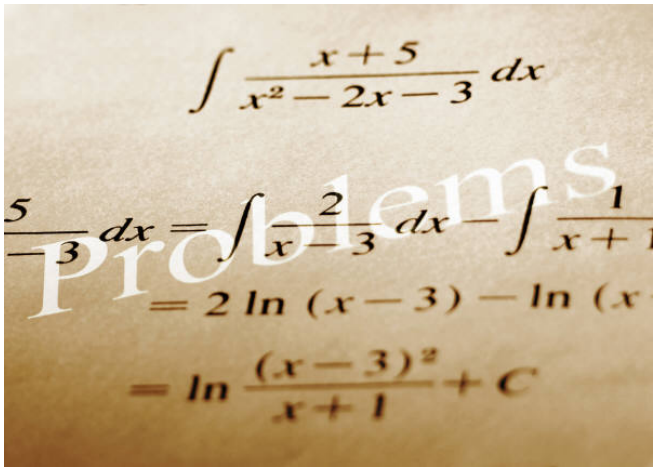
Blatner, David. *The Joy of π.* Walker and Company, 1997.

Brain-Bruising, Number-Crunching Activities with Pi. Dandy Lion Publications, 2001.

DeVoss, Angie. "PI Makes the World Go Around", 52nd FCTM Annual State Conference, Miami, Florida, October 2004.

The Mathematics Teacher, Monthly Calendar problems. (Especially the February 1994 and the March 2006 issues.)

Neuschwander, Cindy. *Sir Circumference and the Dragon of Pi: a math adventure.* Charlesbridge, 1999.



WEBSITES

www.123Greetings.com

http://mathwithmrherte.com/pi

http://www.edhelper.com/PiDayMath1.htm

http://www.notsohumblepi.com/index.php

CATALOG RESOURCES

D & H. (800) 340-1006

MindWare: brainy toys for kids of all ages. (800) 999-0398

Nasco. (800) 558-9595

NCTM Resources for the Mathematics Educator. (800) 235-7566

Oriental Trading Company, Inc. (800) 228-2269