Fall 2016

NAZARETH COLLEGE DEPARTMENT OF MATHEMATICS

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There are 10 types of people in the world: those who understand binary, those who don't, and those who didn't expect this problem to be in ternary.

Inside this issue:

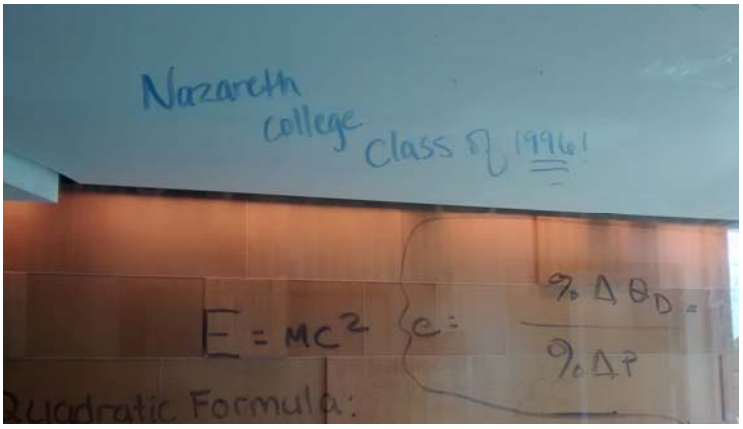
Ar Newsletter

The Arrrrrrrrchimedian

Filled with hidden treasure

Talk like a Pirate Day pre-party: The Naz Reunion

International Talk Like a Pirate Day (September 19) falls on a Monday this year, which will make the work-week start off in an interesting way, but what — you may ask — should you do the weekend before to celebrate? Come to Naz, of course, for Reunion Weekend! And this year is special, because the Math Department has a formal role! This role consists of hanging out on the second floor of Peckham Hall (at the Braveman Collaborative Center and the Walker Math Center) on Saturday, September 17, from 11am to 2pm, saying hello — or possibly Ahoy Matey — to anyone who stops by.



Association for Women in Mathematics Essay Contest

Are you a student, interested in learning about careers in mathematics? Do you know students who might be interested in learning more? Every year the Association of Women in Mathematics, with support from Math for America, sponsors an essay contest in which middle school, high school, and undergraduate students interview a women with a mathematical career and then write an essay, due January 31. More information (including what to do if you don't know any women with a career in math) and all of the previous winning essays can be found at https://sites.google.com/site/awmmath/programs/essay-contest

Questions can be directed to Heather Ames Lewis at hlewis5@naz.edu (which, not coincidentally, is the exact same name and email address as one of the newsletter editors! What are the odds of that?!)

Yousuf Leveled Up to Administration

Our own Dr. Yousuf George was recently promoted to Associate Dean of the College of Arts and Sciences! Although we're all happy for him and for the College, we confess to being glad that he'll still be teaching a few math classes every semester.

The logo is Creative Commons, Creative Commons http://axginz.deviantart.com/art/Level-Up-302567667

Math in the News: Team USA brought home the gold!

This was the summer of Olympics and Olympiads, and in anticipation of this treasure-filled newsletter, the United States went the extra mile and brought home a bunch of gold. The United States team won the International Mathematical Olympiad for the first time in over twenty years. Go Team USA!

More Math in the News: Mathematician and Football player John Urschel

Football season is starting, and all eyes are on the mathematician in the NFL: John Urschel of the Baltimore Ravens. Urschel has already earned a master's degree in mathematics, has published a couple papers, and has a theorem in graph theory named after him (The Urschel-Zikatanov Theorem). He's currently working on his PhD in math at MIT.

The February 2016 issue of the *Notices of the American Mathematical Society* includes an interview with John Urschel. In one question the interviewer said, "Many mathematicians find it hard to avoid thinking about math, and many football fans are often consumed by the excitement of an upcoming big game. How do you shut off one part of your mind in order to focus on a second interest?"

Urschel's reply was, "I think the difference is that if I'm thinking about math on the football field, this is going to get me killed. So that's just survival instinct. And when I'm doing math, it's all encompassing and I'm 100% in it, and there's really nothing else to think about when I'm doing math. I love mathematics, I love the elegance, I love the challenge, and so that's been natural for me." That's such an awesome math-filled answer that we're willing to overlook the fact that the Ravens beat the Bills in their first game of the season.

The photo of John Urschel is Creative Commons, https://commons.wikimedia.org/wiki/File:John_Urschel.jpg

Archimedes

This issue was named after the Greek mathematician Archimedes, but we ran out of room to talk about him on the first page.

Archimedes of Syracuse[1] (c.287 BCE – c.212 BCE) was a Greek mathematician, scientist, and inventor (but not a pirate), frequently regarded as one of the greatest mathematicians of all time. Some of his most well-known work includes deriving the area of a circle, the surface area and volume of a sphere, and the area under a parabola. He is also credited with developing a form of exponentiation to work with very large numbers. His method of approximating π using polygons with successively more sides is one of the most accurate methods of his era.

Beyond mathematics, Archimedes was a skilled inventor, having developed the Archimedean screw as an efficient way of moving water uphill. (Fun fact: The first steam-powered ship with a screw propeller was named the SS Archimedes.) Although undocumented, the legend of his discovery of the Archimedean Principle (that an object submerged in water displaces a volume of water equal to its own volume) by taking a bath and subsequently running through the streets naked shouting, "Eureka!" is widely known.

Recently, the Archimedes Palimpsest was analyzed using X-ray and UV light and it was discovered that Archimedes was using methods very similar to modern calculus to solve some of the geometric problems for which is he is famous.

[1] That's Syracuse the city in ancient Greece[2], not Syracuse the city in New York.
[2] That's Greece the country in Europe[3], not Greece the city in New York.
[3] That's Europe the continent on Earth, not Europa the moon of Jupiter.

This drawing of Archimedes may not be 100% accurate, but it's still pretty old. It's from an engraving in the 1586 book *Les vrais pourtraits et vies des hommes illustres grecz, latins et payens.*

Did you solve the Sudoku? Send in this coupon for 50% off the next newsletter!

7	9	8	6	4	1	3	2	5
6	5	2	9	3	7	1	4	8
4	1	3	2	5	8	6	7	9
9	8	4	7	2	3	5	6	1
5	2	6	8	1	9	7	3	4
3	7	1	4	6	5	9	8	2
1	4	5	3	8	6	2	9	7
8	3	9	1	7	2	4	5	6
2	6	7	5	9	4	8	1	3

brainfreezepuzzles.com

Solution to sudoku from Issue 9.2

Sudoku

☆☆☆☆☆

	4	1	8					
		6						3
			2				6	4
				9		5		8
			5		8			
4		5		7				
1	6				7			
9						1		
					5	6	7	

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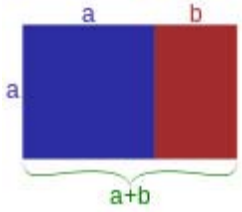
Rules: Fill in the grid so that each row, column, and 3x3 block contains 1–9 exactly once.

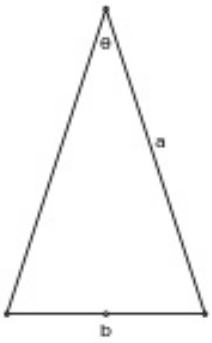
Overheard in Peckham Hall:

"[This is] the best mathematics newsletter in the world that no one knows about."



This issue brought to you by the Golden Ratio

A Golden Rectangle is a rectangle in which, if you chop a square off the end, the rectangle piece that's left has the same proportions as the original. Using the image at the left, the ratio of $(a+b)$ to a [long side to short side] is the same as the ratio of a to b [long side to short side]. You can compute this ratio [long side to short side], which is called the Golden Ratio. And if you make an isosceles triangle with two sides of a and one side of b it's called...you guessed it... the Golden Triangle!



The Golden Rectangle is Creative Commons from Dave3457
https://commons.wikimedia.org/wiki/File:Golden_Rectangle_..svg

The Golden Triangle is Creative Commons from Krishnavedala
https://en.wikipedia.org/wiki/Golden_triangle_(mathematics)#/media/File:Golden_Triangle.svg

Problems

Solutions to Problems 10.1:

10.1.1: 10
10.1.2: 10
10.1.3: 11

Problem 11.1.1: Suppose you have 11 GOLD coins that are identical in every way except for one which is lighter. The only way to distinguish the lighter coin is by using a balance. What is the least number of weighings necessary to identify the lighter coin?

Problem 11.1.2: A tenant in an apartment discovers they have no money, but they do have a GOLD chain consisting of 100 links, each link of which is enough to pay for one day's rent. What is the fewest number of links that must be cut in order to be able to pay rent for any number of days up to 100 days?

Send solutions, articles, pieces of eight, eyepatches, peg legs, parrots, treasure maps, NP-complete problems, PV numbers, PVC pipe, or suggestions to Heather (hlewis5@naz.edu) or Matt (mkoetz1@naz.edu).

Problem 11.1.3: There are 11 perfectly rational pirates who have found 100 GOLD pieces. They must decide how to split them up. There is a strict seniority among the pirates: $A > B > C > \ldots > K$. The rules of distribution are:

1. The most senior pirate remaining suggests a distribution of coins.
2. The pirates, including the proposer, then vote on whether to accept this distribution. In case of a tie vote, the proposer has the deciding vote.
3. If the distribution is accepted, the coins are distributed. If not, the proposer is thrown overboard from the pirate ship, and the next most senior pirate starts the process over again.

Pirates base their decisions on three factors, in the following order:

1. Each pirate wants to survive.
2. Given survival, each pirate wants to maximize the number of gold coins each receives.
3. All else being equal, each pirate would prefer to throw another overboard.

What distribution should the captain (Pirate A) propose to guarantee survival and maximize their coins received?