BEAM

Bridge to Enter Advanced Mathematics

BEAM Alumni Newsletter

October 2017

BEAM 7 Had Another Wonderful Summer!

This year BEAM 7 took place at two sites: Bard College and Union College. Course options included "Cryptography," "Knot Theory," "Aviation and the Wonder of Flight," and "The Royal Family, Evil Guy, and Evolution of Number Kingdoms." The Bard site saw a great debate contest between students and staff, the Union site was visited by an ice cream truck that provided unlimited free ice cream (that was unhealthy...), and both sites experienced beautiful hikes, a very rainy day at Six Flags, a visit to Zoom Flume Water Park, and awesome Field Days!

For the first time, students from BEAM 6 continued on to BEAM 7. Twenty-six students and three counselors from BEAM 6 last year returned for BEAM 7 this year at Bard.

Please welcome these 82 students to the BEAM family!








Photos by Efua Peterson and Lynn Cartwright-Punnett

BEAM 6 returned for its second year!

This summer BEAM 6 was at Bard High School Early College in Queens, and had 95 students. BEAM alumni Zavier Jenkins and Fatimatou Diallo (both BEAM 2011) were counselors, and 11 of the junior counselors were also BEAM alumni! Course options included "Data Science," "Crazy Coincidences and Dopplegangers," and "The Solar System and the Galaxy." There were outings to Madison Square Garden to see a NY Liberty women's basketball game, as well as Dave & Busters!

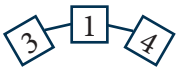
Photos by Kristen Izquierdo

Challenge Problem Solution

Congratulations to Jossiel Falfan, Kenneth Fernandez, Andy Reyes, Stephanie Fulcar, Jahsiah Montrevil, and Ilona Lameka, who solved the last problem:

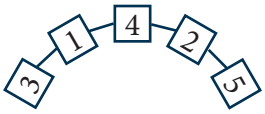
Put each of the numbers 1-12 along each side of a dodecagon (12-sided polygon) so that any two numbers that are next to each other differ by either 2 or 3. For example, 8 can be next to 11, 10, 6, or 5, but it can't be next to any other numbers.

The only numbers that can be next to 1 are 3 and 4, so we must have:

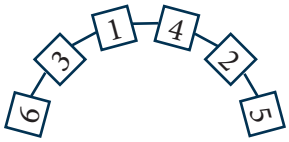


You could rotate this or reflect it, but that just rotates or reflects the result.

Because 2 can only be next to 4 and 5, we must have:

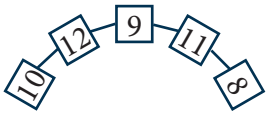


The only remaining number that can be next to 3 is 6:

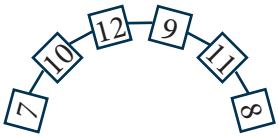


Now let's look at 12. The only numbers that can be next to 12 are 9 and 10, so we must have:

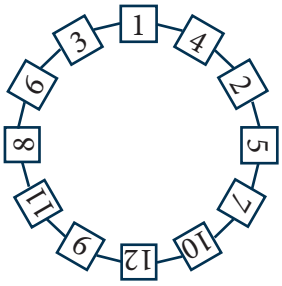
Because 11 can only be next to 9 and 8:



The only number remaining that can be next to 10 is 7:



So we know how to fill in the two halves of the dodecagon. The only way to paste these together and solve the problem is:



You can rotate or reflect this solution, but it is the only solution.

Dan's Challenge Problem

Send in the solution to this problem to have it printed and win a free book!

An arithmetic sequence is a sequence of numbers where each entry is the previous entry plus a fixed number called the *common difference*. For example,

9, 13, 17, 21, 25, ...

is an arithmetic sequence with common difference 4.

10, 1, -8, -17, -26, ...

is an arithmetic sequence with common difference -9.

Find a way to fill in the blanks below with digits so that the resulting 3-digit numbers form an arithmetic sequence:

1 _ _, _ _ 9, 2 _ 2, _ 6 _, 2 _ _, _ 3 _

Source: MATHCOUNTS

How to submit: Email your answer to info@beammath.org, text a photo to (217) 649-1100, or hand it in at our next event! *The deadline for submissions is October 31, 2017.*

Note: Challenge problem solutions will now come two months after each challenge problem!

Gravitational Waves Rock Scientists

by Dan Zaharopol

The Nobel Prize in physics was just announced for 2017, and the winners are three physicists who found proof of something called "gravitational waves," which were predicted by Albert Einstein a hundred years ago. They found these gravitational waves being generated by two black holes colliding a billion light years from Earth. Want to learn what they did and how? Read on!

The History

A hundred years ago, Albert Einstein developed the Theory of General Relativity. It said that the force of gravity, which holds us to the surface of the Earth and keeps the Earth orbiting around the sun (and, really, makes the whole universe work) is actually because massive objects literally *bend* space. If you put a bowling ball on your bed, the mattress will drop down. Roll a marble along the bed, and it will fall towards the bowling ball. That's how gravity works, too.

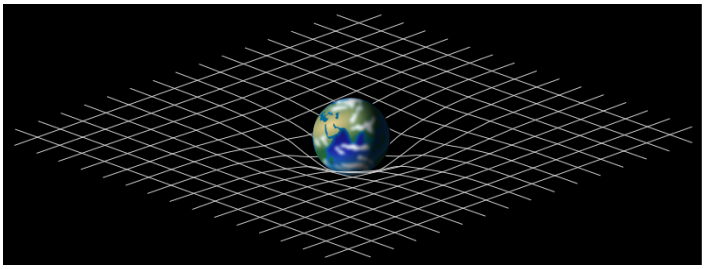


Photo Credit: Mysid, License: CC BY-SA 3.0, creativecommons.org/licenses/by-sa/3.0/us/.

Einstein did a whole bunch of mathematical calculations and discovered something else: that if objects were speeding up or slowing down, or changing direction, then they'd also give off gravitational waves. In other words, space wouldn't just bend in a curve like the bowling ball, but you would actually get tiny ripples, like when you throw a pebble into water.

The problem is that those ripples are really small, so nothing could detect them. There wasn't anything massive enough nearby to make gravitational waves we could detect, and because the waves get weaker the farther away you get, all the massive stuff was too far for us to detect.

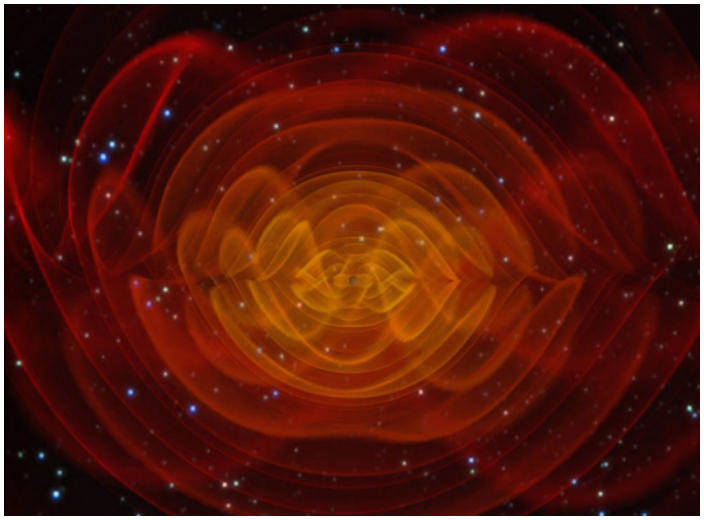


Photo Credit: By NASA [Public domain]

The Detector

To fix this, scientists developed LIGO, the Laser Interferometer Gravitational-Wave Observatory, funded to the tune of a *billion* dollars by the National Science Foundation, and put together by MIT and Caltech.

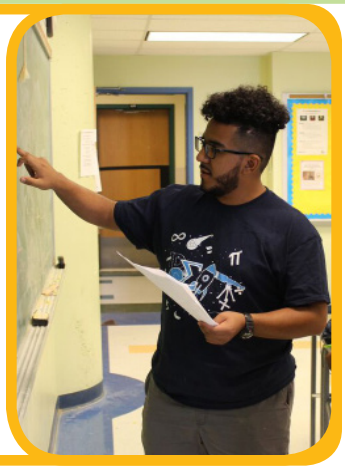
Here's the challenge: We have to somehow detect the fact that space is contracting and getting bigger between two objects - the two objects are getting just a tiny bit closer or farther away *even though they're not moving*. But the amount they're getting closer together is way too small: the two objects might get closer by 0.00000000000000000001%. You didn't read that wrong. That's one part in 10^15. You'd never be able to see that!

However, the farther apart two objects are, the more space there is between them. So they built LIGO to have tubes that are *two and a half miles long*. (Can you imagine that? In Manhattan, this building wouldn't even fit east to west!)

To learn about what was discovered and what it means for us, read the entire article at the following the website:
http://www.beammath.org/news/gravitational

Meet Jacob, Sarah, and Amanda!

Jacob Castaneda is the new Executive Director of LA Programs. His role is to expand BEAM into Los Angeles, beginning with BEAM 6. Prior to joining BEAM, he taught high school mathematics in South Central LA. He is looking forward to bringing the success of BEAM in NYC to Los Angeles!



Sarah Hunt joined BEAM this summer as the High School Programs Assistant. She will be running BEAM's new Saturday program for 9th/10th graders, BEAM Next. Her background is in engineering, and she will be teaching academic and life skills, as well as programming. She's really looking forward to meeting all of BEAM's students!

BEAM
Bridge to Enter Advanced Mathematics
55 Exchange Place, Suite 603
New York, NY 10005

Amanda Cooper has been the Director of Residential Life for BEAM 7 at Bard College for the past three summers. Now she has joined BEAM as a freelance writer. She will be writing the alumni newsletter and helping out with other projects whenever she can. She is excited to be getting more involved with BEAM year-round!

We're Back!

After a very busy past year, the newsletter has returned!

What have we been up to? Well, BEAM 6 and College Prep Week (for 11th and 12th graders to work on college applications) have both continued; we started BEAM Next, a Saturday program for 9th and 10th graders; and BEAM is opening in Los Angeles next year! With so much happening this year, the newsletter got a bit sidelined, but now that Amanda is on the team to write it, the newsletter is returning.

Enjoy!

Editor: Amanda Cooper