Math Circle @ Racquet Up Detroit

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Racquet Up Detroit (RU, http://racquetup.org/) is a 501(c)3 after school program, serving Detroit Public School students (grades 5-12) in Northwest Detroit.

- The program offers the game of squash, academic enrichment support, community service, and mentoring.
- Almost 100 students. ~60% female, ~40% male overall.
- ~96% of the students are African-American.

Math Circle @ Racquet Up Detroit

Quick Facts
- Started in Summer 2017, funded by Tensor-SUMMA.
- 13 Math Circles so far, organized by LTU faculty and students.
- RU students mostly attend math circles on a voluntary basis.
- The student numbers at each session ranged from 31 to a low of 5.
- Mainly 7th and 8th graders, some 6th graders; a few high schoolers.
- Meetings are split into 2 or 3 sessions, as students spend half time at squash and half at academics.

Math Circle @ Racquet Up Detroit

Objective

We aimed to offer RU students who would not get opportunities for math enrichment the chance to discover the joy of problem-solving and the beauty of math in an environment where they would be supported by the group, group leaders, parents and teachers.

Some of the topics covered

- 3-D Sierpinski tetrahedron (fractals)
- The Penny Game (winning strategies)
- String art valentine cards (construct curves using tangent lines)
- Snowboard and figure skating rotations (degrees and radians)
- Code breaking and code making
- Spaghetti and marshmallow bridges (stability)

Lessons Learned

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   ● attracting flyers

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- refreshments (pies, cookies, candies, marshmallows...)

You're invited …

Pie DAY @ RU
MATH CIRCLE

Wednesday, March 14 (3.14)

Fun stuff with Pi
Then get to eat pie

Pi and the Olympics:
halfpipe snowboard
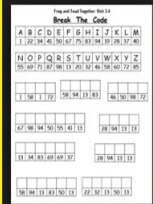
Racquet Up Detroit

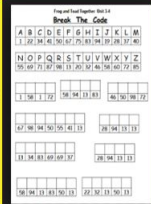**Cryptography Math Circle**

Wed., April 25, 2018

Break the code!

Make the code!

Racquet Up Detroit

**Build a Bridge
Math Circle**

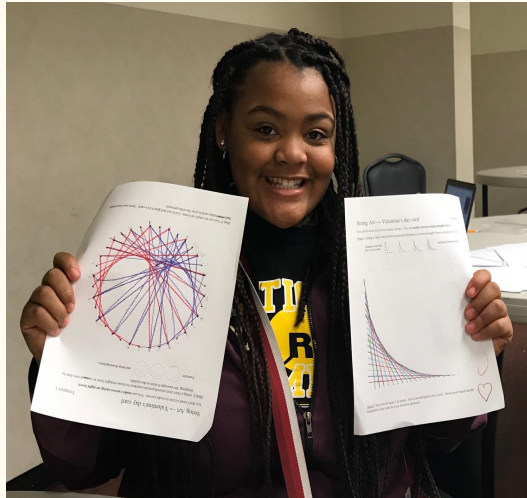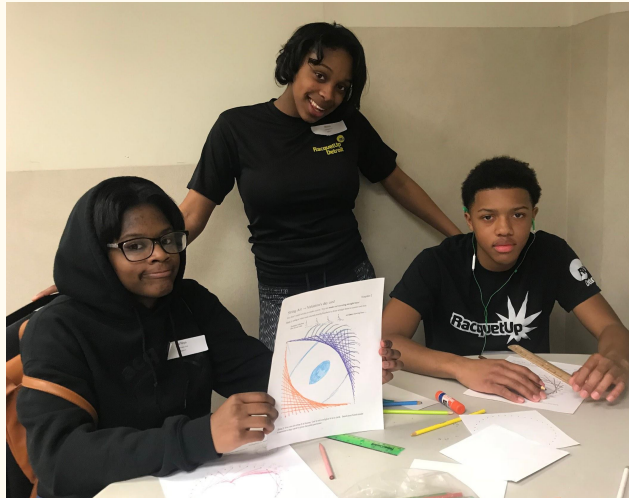**Wed., May 23, 2018**

What makes a stable structure?

**Build with spaghetti and
marshmallows!**

Lessons Learned

1. "Hook" the students with effective "baits".

- attracting flyers
- refreshments (pies, cookies, candies, marshmallows...)
- something they can keep (Valentine cards, Spaghetti bridges...)

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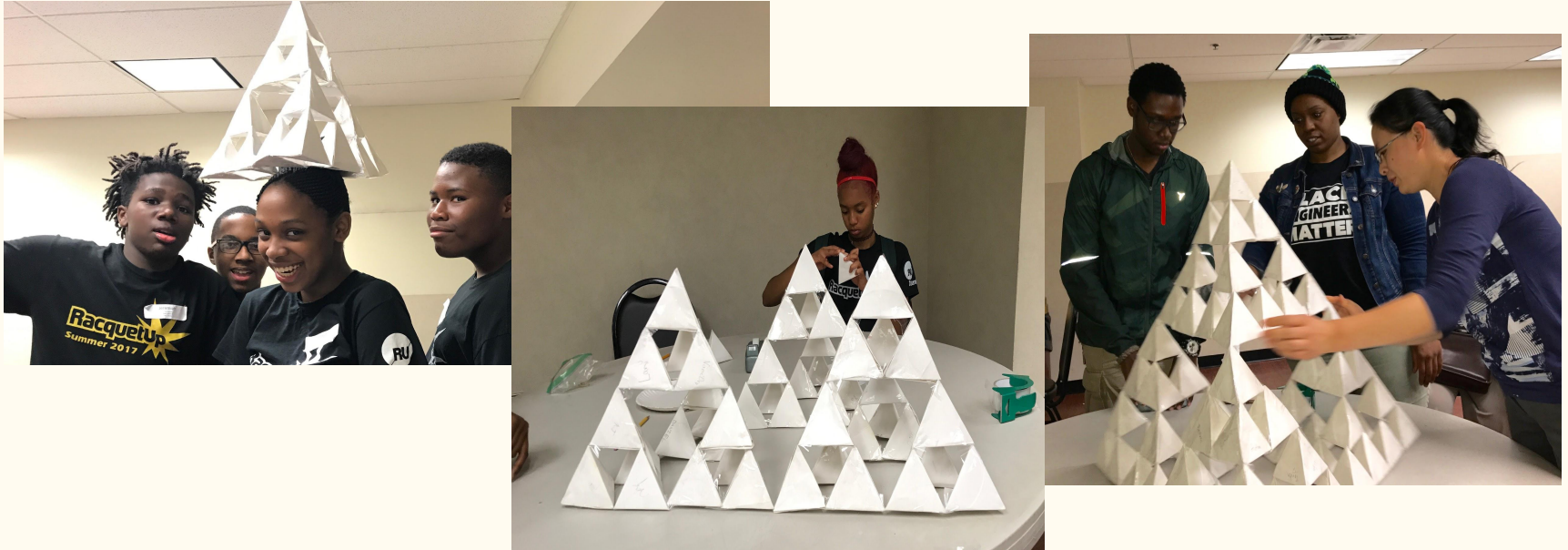
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Lessons Learned

3. **Short sessions (some 30 minutes)**
   Session times dictated by RU schedule, leaving time for homework.
   - suitable with the attention span of middle-school students
   - need focused planning (time arrangement, worksheets and etc.)

Sample student worksheet at Pi-Day Math Circle
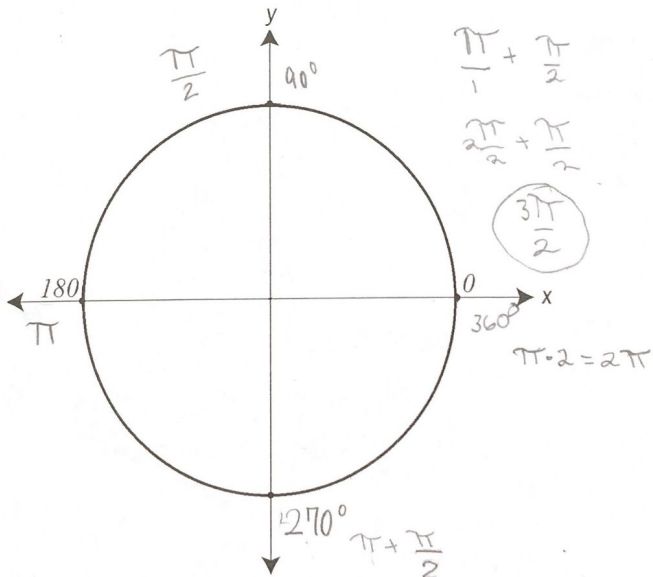
Racquet Up Math Circle   Pi Day, 3.14 (2018)   Name: Lawrence Edison Eddie

How do the snowboarders and slopestyle skiers do those multiple turns?

How many turns in the air can they do? How do these rotations relate to Pi?

First, **degrees** (due to the ancient Babylonians)

Next, **radians** (due to the ancient Greeks)

$\frac{\pi}{2}$ 90°

180   π

270°

$\frac{\pi}{1} + \frac{\pi}{2}$

$\frac{2\pi}{2} + \frac{\pi}{2}$

$\boxed{\frac{3\pi}{2}}$

0   360

$\pi \cdot 2 = 2\pi$

$\pi + \frac{\pi}{2}$

(1) If one measure of an angle is given, can you find the other measure for it?

Degrees	Rotations	Radians
180	$\frac{1}{2}$ or 0.5	π
360	1	2π
540	$1\frac{1}{2}$	3π
720	2	4π
900	$2\frac{1}{2}$	5π
1080	3	6π
1260	$3\frac{1}{2}$	7π

$360 \times 2 = 0$

$\frac{1}{360} + 180 = 540$

$720 + 180 = 900$

(2) The announcer says excitedly "Shaun White just did a 1440!"

How many turns in the air did he do? ___4___

What is the radian measure of the rotation? ___8π___

$\frac{1260}{+180} = 1440$

(3) Challenge problem!

Degrees	Rotations	Radians
90	$\frac{1}{4}$ or 0.25	$\frac{\pi}{2}$
180	$\frac{2}{4}$ or 0.50	$\frac{\pi}{2}$ or 0.5π
270	$\frac{3}{4}$ or 0.75	
360	$\frac{4}{4}$	$\frac{5\pi}{2}$ or 2.5π
540	3.25	

$180 \times 90 = 270$

Sample student worksheet at Cryptography Math Circle

Lessons Learned

3. **Short sessions (some 30 minutes)**
    Session times dictated by RU schedule, leaving time for homework.
    - suitable with the attention span of middle-school students
    - need focused planning

4. **Student-Facilitator ratio.**
    Having enough facilitators for one-on-one help was good.

Assessments

Original aim was to offer both high school and middle school circles. We will work with RU staff to schedule high school sessions in addition to middle school.

Student surveys from fall and spring show that students got the math behind the projects, thought them challenging and fun, and thought the time was adequate. (One student wanted to do it every week.)

Acknowledgement

- Tensor-SUMMA grants (Strengthening underrepresented Minority Mathematics Achievement)
- Faculty and student facilitators from Lawrence Technological University
- Staff members and volunteers from Racquet Up Detroit
- Thank you, too!