Pick four numbers, put positive difference in middle, keep going…

Q: How many rounds can you do?
Bringing Math Circle Problem Solving into the Central Convergence REU

Dr. Brandy Wiegers
Now: College of Idaho

Previously: Central Washington University
Kittitas Valley Math Circle
Pick four numbers, put positive difference in middle, keep going...

Q: How many rounds can you do?
The feeling when having a thought and wondering if you’re the first person to ever think it!
I lost this feeling in grad school.

Math Circles is what gave it back and made me feel like a mathematician.
Meeting students where they are and supporting their progression and growth

Giving students time to figure it out

In Math Circles
In Class
In Research
Math Circles across US
Math Circles...
- Exploring worthwhile mathematical tasks,
- Fostering problem-solving habits of mind
- Building communities of mathematical thinkers and problem solvers
When Ellensburg seems like a big city…

Location in the state of Washington
Math Circles...

- Exploring worthwhile mathematical tasks,
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Let’s move from

What I think my community needs

Finding out what my community needs.
Creating KVMC- Using Resources Wisely

Small Rural Town (19,786)
- Sports
- Bible Study
- Other outreach projects
- Driving distance

Comprehensive (non-R1) University
- Undergraduate Mentors
- Quarters (10 weeks)
- Supportive STEM outreach

Elementary Math Circle:
2nd- 6th grade students
Topic blocks
(5 weeks, one topic per quarter)

Parents/guardians are invited to attend a specific adult session for the 1st two weeks of each topic block.
1. The Julia Robinson Mathematics Festival: An American Artifact in an International World
2. Math Unbounded: A Transcultural Experiment
3. The Global Math Project: Uplifting Mathematics for All
4. The International Mathematics Enrichment Project: Enhancing Teacher Preparation Through International Community Engagement
5. Creating Community-Responsive Math Circle Programs
6. The Alliance of Indigenous Math Circles: From Invitations to Partnerships
7. BEAM: Opening Pathways to STEM Excellence for Underserved Students in Urban Settings
8. Mathematics, Computational Thinking, and Coding for Middle and High School African American Girls in the Deep South
9. Math Instructors’ Critical Reflections on Teaching in Prison
10. “No Fractions”: Math in Prison for the Common Good
11. Advising Undergraduate Research in Prison
How to make a community responsive program.

1. Complete an assessment of strengths and areas of needs so you can use resources wisely.
2. Have hard conversations
3. Find community partners
4. Cycle through this until you CAN DO IT RIGHT
5. Run the program
6. KEEP ASKING YOUR COMMUNITY HOW IT CAN GET BETTER
Central Convergence
Research Experience
for Undergraduates

The 2021–2023 CC-REU is currently funded by the NSF (DMS-2050692)
Creating Community Responsive REUs

CWU Student Needs

- Local programming
- First experiences to build confidence...

UR students aren’t typically doing research
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CCREU program schedule/experience

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- Project wrap up and report.
- Discussion of post-REU conference
## Welcome: REU Schedule

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Pick four numbers, put difference in middle, keep going...
Q: How many rounds can you do?

http://www.math.kent.edu/~soprunova/64091s15/four_numbers_Prendergast
The puzzle is updated daily at 12:00 am PST.
Denny’s Hexagon

- Please get into groups of three and introduce yourselves.
- Distribute the white paper clue cards to group members, one at a time.
  - Do not show your clue to anyone.
  - If there are more cards than people in your group, a few people will need to take extras.
- You may now read the clue card as many times as you wish and share the information on the clue with your group. You may not show the card to anyone else in the group.
- The entire group must bring together all the cards to solve the problem.
  - Please be prepared to share your solution with the group.
Build Denny’s Hexagon!

- The only pattern blocks your group is allowed to use in the problem are trapezoids, triangles, and diamonds.
- Denny’s hexagon is made from a total of 9 pattern blocks, 3 of which are diamonds.
- Denny’s hexagon uses twice as many triangles as it does trapezoids.
- Denny’s hexagon is equilateral, but it is NOT equiangular.
- In Denny’s hexagon, the diamonds are all arranged to form a hexagon, and so are the trapezoids.
- In this pattern, each triangle shares a side with another triangle. Triangles are allowed to share a side with non-triangles.

http://bfc.sfsu.edu/PRIME/DennysHexagon.pdf
Denny’s Hexagon

Discussion Questions:
● Is there only one answer?
● What were effective techniques for working together?

From Get it together – Lawrence Hall of Science
Denny’s Hexagon

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Initial Question...

Tomorrow you are graduating from high school.

You open one of your graduation cards from a friend and find that they have given you a gift of rabbits from Heifer International.

This is what your card says:
Rabbits Get Results

A gift of rabbits to a family with little land and few resources yields remarkable results. From Chicago to Haiti to North Korea, families with Heifer rabbits are raising them on the back porch -or even in the kitchen. So long as they are warm and dry, rabbits thrive, and they love to eat leftover vegetables. In turn, families get nitrogen-rich manure to use on gardens or to sell as fertilizer. And since rabbits have up to 40 offspring a year, they provide families with steady sources of protein and income.

If you’re tired of spending a lot for gifts that don’t mean much to the recipient, think about a gift of Heifer rabbits that multiply many times over. You’ll be making a statement that will capture the imagination of your friends and family.
Rabbits Get Results

My Question: Let’s think about how a high school graduation gift of rabbits will grow by the time you graduate from college. How many people will benefit from the single gift?

To start... How would we model the growth of the rabbit population from a single gift from Heifer International?

State any assumptions that you make and provide a visual.
Lesson Plan A

start → finish

Lesson Plan B

start → finish

Presented by Paul Zeitz in SIGMAA-MCST 2009 JMM presentation
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**Disease Challenge [1]**

Problem Contact: Dr. Brandy Wiegers, brandy.wiegersoncwu.edu
The World Medical Association has announced that their new medication could stop Measles and cure patients whose disease is not advanced. Build a realistic, sensible, and useful model that considers not only the spread of the disease, the quantity of the medicine needed, possible feasible delivery systems (sending the medicine to where it is needed), geographical locations of delivery, speed of manufacturing of the vaccine or drug, but also any other critical factors your team considers necessary as part of the model to optimize the eradication of Measles in Northern America, or at least its current strain. Reference Resource:

**Optimizing the Passenger Throughput at an Airport Security Checkpoint [2]**

Problem Contact: Dr. Loke, SooieHoe.Loke@cwu.edu
Following the terrorist attacks in the US on September 11, 2001, airport security has been significantly enhanced throughout the world. Airports have security checkpoints, where passengers and their baggage are screened for explosives and other dangerous items. The goals of these security measures are to prevent passengers from hijacking or destroying aircraft and to keep all passengers safe during their travel. However, airlines have a vested interest in maintaining a positive flying experience for passengers by minimizing the time they spend waiting in line at a security checkpoint and waiting for their flight. Therefore, there is a tension between desires to maximize security while minimizing inconvenience to passengers.

**Kafka Inc.**

Problem Contact: Dr. Montgomery, Aaron.Montgomery@cwu.edu
Welcome to your new position as an efficiency expert with the Kafka Inc. (informally, Kafka®). Kafka® is a company employing the finest bureaucrats, each with a devotion to the completion of paperwork. Each of the bureaucrats at Kafka® has equal authority (this is a completely egalitarian system). Upon being hired at Kafka®, each employee is assigned an office along the infinite hallway. At any given time, these offices form a sequence of consecutive integers. For example, if Kafka® currently has 5 employees, they could be in offices -2, -1, 0, +1, +2 or -5, -4, -3, -2, -1, but they could not be in offices -2, -1, +3, +5, +6.
CC-REU Problem Challenge   Due: Friday, July 2, 2021

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I didn’t tell you... YOU FIGURED IT OUT
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How were we ready to do this?

- Start smaller
  - McNair students
  - NREUP
- Training
  - UR-SIGMAA
  - CUR MCS
  - CURM
- Use our regional network
Ideas for community support

Communities:
- CUR MCS, https://curmcs.org/
- CURM, http://urmath.org/curm/
- REU Leadership, REULeadership@listserv.csufresno.edu

Networks:
- MAA
- OURFA²M²: Online Undergraduate Resource Fair for the Advancement and Alliance of Marginalized Mathematicians
Central Convergence
Research Experience for Undergraduates

Brandy S. Wiegers
College of Idaho
Department of Mathematics
bwiegens@collegeofidaho.edu
@drbrandymath

email: reu@cwu.edu

The 2021–2023 CC-REU is currently funded by the NSF (DMS-2050692) and will expand on the previous programs funded by the MAA National Research Experience for Undergraduates Program (NSF DMS–1652506). CC-REU program is directed by Dr. Brandy Wiegers and Dr. Sooie-Hoe Loke.
Write for us!

Double-blind peer review process
- 4 weeks per round of reviews (min. 2 reviewers)

Evidence-based reflective commentary
- Take attendance
- Collect written artifacts
  - Participant mathematical work
- Document observations
  - Pictures/videos of participants in action
  - Keep a journal observation notes
    - Session implementation, participant reactions
- Interview, survey participants
- Obtain consent/assent

TeX template, Overleaf link, article samples on website
- Please use TeX!

https://digitalcommons.cwu.edu/mathcirclesjournal/
3 article types

**Lesson Plans.** These papers are intended to support leaders of a Math Circle session or progression of sessions.

**Outreach Programs.** These papers are intended to support individuals or organizations in starting or sustaining Math Circle outreach programs.

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Special Issue Call for Papers
Honoring Robert and Ellen Kaplan
Special Issue Editors: Amanda Serenevy, Rodi Steinig
https://digitalcommons.cwu.edu/mathcirclesjournal/aimsandscope.html

The Journal of Math Circles is pleased to announce a call for papers for a special issue honoring Bob and Ellen Kaplan.

This special issue will appear in Spring 2024