

Amanda Walsh
Wals8000@fredonia.edu

Wesley Tubbs
Tubb2359@fredonia.edu

Deenah Simchick
Simc4705@fredonia.edu

Riddle Me This!

Introduction:

A brainteaser is a problem in the form of a riddle. Solving such problems normally requires a lot of conventional thinking. Sometimes riddles and brain teasers really require 'out of the box' thinking. This captures the students' attention and engages them to want to figure out the various solutions. Brain teasers can be used in any classroom as a warm-up activity, problem of the week, extra credit or just for fun to pass a little time by. Students will love working on brain teasers, and they really do make them "think outside the box".

New York State Standards

NCTM

Standard 4: Knowledge of Mathematical Connections

- 4.1 Recognize and use connections among mathematical ideas.
- 4.2 Recognize and apply mathematics in contexts outside of mathematics.

Standard 9: Knowledge of Number and Operation

- 9.1 Develop the mathematics that underlies the procedures used for operations involving whole numbers, integers, and rational numbers.

NYS MST

Standard 3: Mathematical Reasoning

- 1. Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Number & Numeration

- 2. Students use number sense and numeration to develop an understanding of the multiple uses of numbers in the real world, the use of numbers to communicate mathematically, and the use of numbers in the development of mathematical ideas.

Objectives:

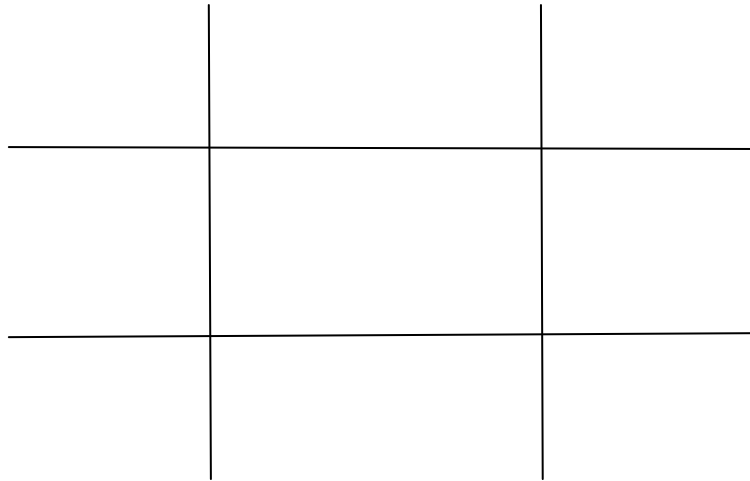
This lesson encourages students to "look outside the box". Students will be eager to solve the problems correctly, and they will be "racing" their classmates to the finish line. All the students will fully participate in this lesson enhancing their learning experience.

Instructional Protocol/Itinerary:

When presenting this lesson, the instructor should guide the students through the material, then stop at the beginning of each question, and introduce each problem. Students may be permitted to work alone, or in small groups to complete the lesson. The instructor should periodically check in on the groups, facilitating participation, and give hints to groups who require further assistance. At the completion of each problem, the instructor should select a volunteer(s) to present the solution to the problem on the board to the entire class. This will ensure that every student will see the correct answer and an explanation as to how they solved it. In addition, if some student solved the problem in a different manner, students will see multiple representations as to how problems can be solved. This lesson will spark interest in students, and indeed promote "thinking outside the box".

Lets play a little Tic Tac Toe

Arrange the numbers 1 through 9 on a tic tac toe board such that the numbers in **each** row, column, and diagonal add up to 15. (Try to use the trial and error method)



One possible Solution:

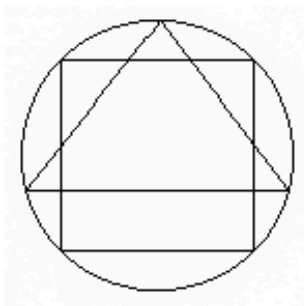
4	3	8
9	5	1
2	7	6

Solution strategies: Make one row, column or diagonal add up to 15, and then see if you can place the "left over" numbers in the empty spaces to see if they can all add up to 15. If not, then try to start again, adding up 15 in a different way. (Hint: as long as you have the same sequence of numbers, you can have several different solutions.)

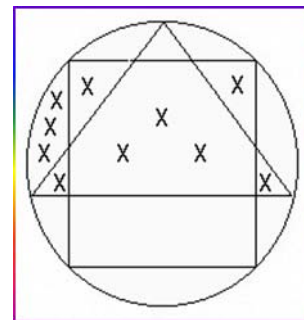
X Marks the Spot

A triangle and a square are drawn inside a circle so that the circle passes through all the corners of the square and all the vertices of the triangle. Place Xs on the drawing so that:

- (1) exactly two Xs are within the triangle and circle only,
- (2) exactly two Xs are within the square and circle only,
- (3) exactly five Xs are in the triangle, and
- (4) there are a total of ten Xs within the circle.



Solution: →



Remark: This problem is a great introduction to unions and intersections. The students can easily answer these questions without even noticing that they involve them.

Die Hard Math

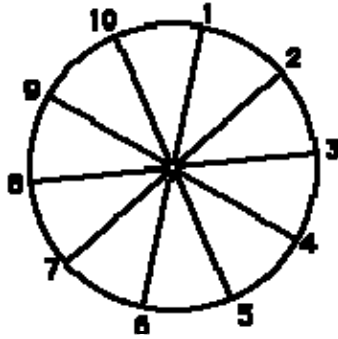
Using two containers, one with a capacity of five gallons, and the other with a capacity of three gallons, can you measure exactly four gallons? Keep in mind that there are no measurement markings on the containers, and you have an unlimited supply of water.

Solution:

- Fill the 5 gallon container first, then pour that into the 3 gallon container, leaving us with 2 gallons in the 5 gallon container
- Empty out the 3 gallon container, then pour the 2 gallons from the 5 gallon container into the 3 gallon container
- Refill the 5 gallon container, and pour a fraction of that into the 3 gallon container (which already has 2 gallons in it)
- Then you have 3 gallons in the 3 gallon container and 4 gallons in the 5 gallon container.
- Done!

Piece of Cake

The diagram shows the numbers 1 through 10 (in order) at the tips of 5 diameters. Only once does the sum of two adjacent numbers equal the sum of the opposite two numbers:



$$10+1 = 5+6$$

Elsewhere, for example,

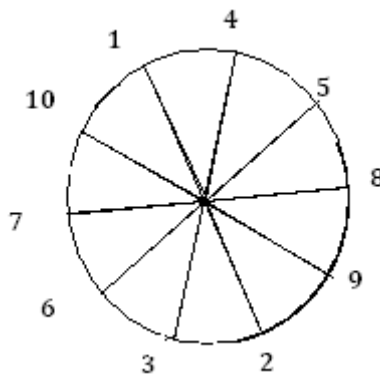
$$1+2 \neq 6+7$$

$$2+3 \neq 7+8$$

Rearrange the numbers so that all **sums** are equal.

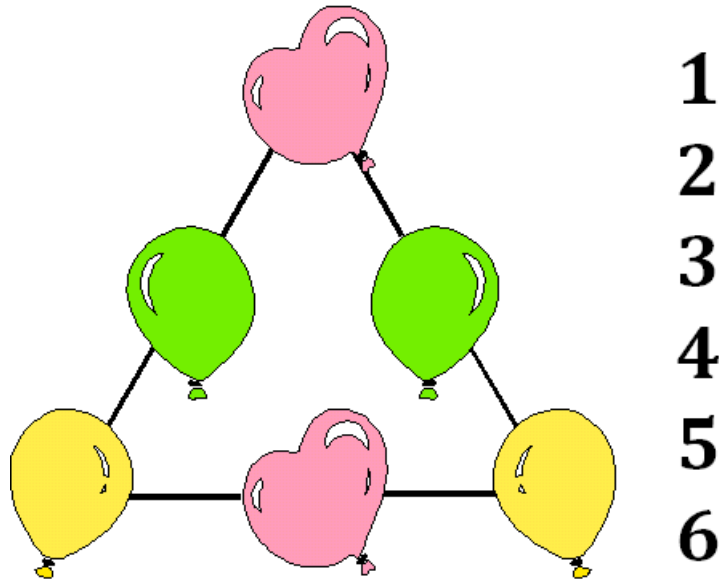
Solution:

Starting at the top of the circle:

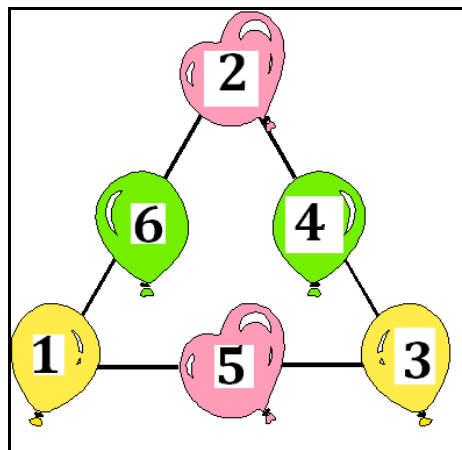


Start Clownin' Around

Use the numbers on the right to fill in the balloons such that the total of the numbers (on the sides) equals 9. You can also complete this exercise so that the sums of the sides add up to 10, 11 and also 12.



Here is one solution, although there are many...



Solution Strategies: Much like the previous example (Tic Tac Toe), you want to arrange the numbers 1-6 in such a way that they add up to 9, so start with one line, fill in the numbers to add up to 9, and then see if there is a way that you can use the remaining numbers to fill in the rest of the balloons, so they all add up to 9.

Who Flunks?

Ms. Smith, the math teacher, has finished grading the math papers at West High School. The class size is *under* 30. One third of the class got a `B`, one fourth got a `B-` and one sixth got a `C`. One eighth of the class flunked and the remainder of the class received an `A`, and the students who received an `A` will get a sticker on their test.

How many students in the class received a sticker?

Solution:

Find a common denominator for 3, 4, 6 and 8. The only common denominator smaller than 30 is 24. Therefore, the class size was 24 and the grades were:

B: 8

B-: 6

C: 4

D or F: 3

The number of students who received stickers was $3(24 - 21) = 9$

Five Fives:

$$5\ 5\ 5\ 5\ 5 = 37$$

Can you make a target number 37 by using five 5s?

You can use any math operator or group the 5s (as in 555)

There are at least two different ways.

Solution:

Since the sum of the 5's is 25, we have to choose an operator which can make a larger number.

The multiplication operator is not good enough. We chose the factorial operator!

$$((5!+5!)-55)/5 = (120+120-55)/5 = 185/5 = 37$$

$$5!/(5+5)+5*5 = 120/10 + 25 = 12 + 25 = 37$$

A third solution uses "raising to the 5th power"

$$((5+5)/5)^5 + 5 = 37$$

If you are looking for some websites to use in your classroom, here are a few that I found:

www.braingle.com/brainteasers

www.vtaide.com/png/puzzles.htm

www.pen.k12.va.us/Div/Winchester/jhhs/math/puzzles/nums.html