RAFT IDEAS

Topics: Addition, Number Patterns, Casting Out Nines

Materials List
- ✓ Activity sheet,
- ✓ Optional: tiles and permanent marker, or foam and stickers, or access to a laminator
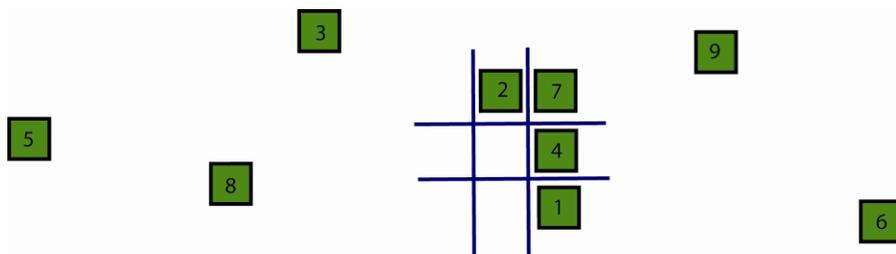
This activity can be used to teach:
- Addition and Subtraction (Common Core Math Standards: Number and Operations in Base Ten, Grade 3, 2; Grade 4, 4)
- Problem Solving and Reasoning (Common Core Math Standards: Mathematical Practices Grades 3 -8)

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9 Digits in a 3X3 Matrix
Finding solutions to an addition problem

Students explore addition problems with two 3 digit numbers and discover patterns that help find solutions and double check arithmetic answers.

Assembly
1. Each student needs a set of manipulatives with the digits 1 to 9.
   Possible creation methods:
   a. Label a set of 9 small tiles with the digits 1 to 9. Write directly on the tile with a permanent marker or use small stickers to label tiles.
   b. Copy matrix of digits (page 2) (optional: laminate) and cut apart.
   c. Attach a sticker or a piece of paper with each digit on 9 pieces of foam.

To Do and Notice
1. Arrange the 9 digits in a 3 x 3 matrix in the form of an addition problem of two 3 digit numbers (i.e., the first row added to the second row equals the third row.) It may take a bit of trial and error to find the first answer that works.
2. Continue to find additional unique solutions. Look for patterns to help find solutions more quickly.
3. Record the solutions found using the **small** 3 x 3 matrix patterns on page 2.
4. Discover the **one big** pattern in the answer which helps find solutions – do not suggest this to students until after some time (maybe another day) (Hint: Look at the sum of the digits.)

The Math Behind the Activity
There are over 300 unique solutions to the problem of the 3 x 3 matrix set up as an addition problem. The patterns that help find solutions is related to the rule of "casting out nines" which is sometimes used to check addition problems by finding the sum of the digits of the addends and comparing to the sum of the digits of the answer. If the results are different, an error has been made; if the result is the same, it is likely that the answer is correct (although if two digits have been reversed a false positive would occur).

Taking it Further
- Using the 9 digits and the 3 x 3 matrixes, find arrangements that work for **subtraction** problems.
- Explore "casting out nines" and how it relates to multiplication and division as well as addition and subtraction.

Web Resources (Visit www.raft.net/raft-idea?isid=268 for more resources!)
- More on "casting out nines" - mathforum.org/library/drmath/view/55926.html
- Teacher designed math courses – https://njctl.org/courses/math

1	2	3
4	5	6
7	8	9

The following matrix boxes are for recording solutions found