MYSTERY

MATH

Thomas Jefferson National Accelerator Facility - Office of Science Education
http://education.jlab.org/

Mystery Math

USE MATH TO FOOL YOUR FRIENDS!

1. To do this trick, you will need:
   - Instructions for the trick
   - How to find a number's Digital Root
   - A friend who doesn't know this trick
2. Use the **Mystery Math Rules Worksheet** to write down the instructions for this trick.
3. Look at the example below to learn how to find a number's Digital Root.

HOW DO I FIND A NUMBER'S DIGITAL ROOT?

Write down the number of which you want to find the Digital Root.	7943
Turn the number into an addition problem by putting plus signs between every digit.	7 + 9 + 4 + 3
Add the digits together to get a new number.	7 + 9 + 4 + 3 = 23
Is your answer a single digit number (from 1 to 9)? If it is, you're done! If not, keep adding the answer's digits together until the answer is a single digit number.	2 + 3 = 5

The digital root 7943 is 5.

CAN YOU FIND THE DIGITAL ROOTS OF THESE NUMBERS?

1. 164
2. 71
3. 10,123
4. 59,678

Mystery Math Rules Worksheet

Step #1: ______________________________

____

____

Step #2: ______________________________

____

____

Step #3: ______________________________

____

____

Step #4: ______________________________

____

____

Step #5: ______________________________

____

____

Step #6: ______________________________

____

____

Step #7: ______________________________

____

____

EXAMPLE:

Other Notes: ______________________________

____

____

____

____

____

____

Mystery Math

USE MATH TO FOOL YOUR FRIENDS!

1. To do this trick, you will need:
   - Instructions for the trick
   - How to find a number's Digital Root
   - A friend who doesn't know this trick
2. Use the **Mystery Math Rules Worksheet** to write down the instructions for this trick.
3. Look at the example below to learn how to find a number's Digital Root.

HOW DO I FIND A NUMBER'S DIGITAL ROOT?

Write down the number of which you want to find the Digital Root.	7943
Turn the number into an addition problem by putting plus signs between every digit.	7 + 9 + 4 + 3
Add the digits together to get a new number.	7 + 9 + 4 + 3 = 23
Is your answer a single digit number (from 1 to 9)? If it is, you're done! If not, keep adding the answer's digits together until the answer is a single digit number.	2 + 3 = 5

The digital root 7943 is 5.

CAN YOU FIND THE DIGITAL ROOTS OF THESE NUMBERS?

1. 164 **1 + 6 + 4 = 11 → 1 + 1 = 2**
2. 71 **7 + 1 = 8**
3. 10,123 **1 + 0 + 1 + 2 + 3 = 7**
4. 59,678 **5 + 9 + 6 + 7 + 8 = 35 → 3 + 5 = 8**

Mystery Math Rules Worksheet

		EXAMPLE:
Step #1:	***Write down a 5 digit number.***	***50398***
Step #2:	***Make a second 5 digit number by mixing up the first 5 digit number.***	***35089***
Step #3:	***Subtract the smaller 5 digit number from the larger 5 digit number.***	$$\begin{array}{r} 50398 \\ -\ 35089 \\ \hline 15309 \end{array}$$
Step #4:	***Cross out one digit, except for zero, from the answer.***	***1~~5~~309***
Step #5:	***Call out the digits that you did not cross out.***	***1, 3, 0, 9***
Step #6:	***Take the digital root of the digits that were called out.***	***1+3+0+9 = 13*** ***1+3 = 4***
Step #7:	***Subtract the digital root from 9. The answer is the number that was crossed out.***	***9 - 4 = 5***

Other Notes: ***What happens if they cross out a 0? 1 + 5 + 3 + 9 = 18 $\rightarrow$ 1 + 8 = 9 and 9 - 9 = 0. What happens if they cross out a 9? 1 + 5 + 3 + 0 = 9 and 9 - 9 = 0. Oops! You get the same answer! That's why you told them not to cross out any zeros - zeros give the same answer as nines!***

Mystery Math

This is an activity in which students find another's secret number.

Objectives:

In this activity students will:

- learn how to find a number's digital root
- follow a series of steps to solve a problem
- use addition and subtraction to calculate a student's secret number

Virginia State Standards of Learning

Math 6.23 Patterns, Functions, and Algebra

- by solving algebraic equations with one variable using digital roots

Mystery Math
Teacher Overview and Materials List

Background:

Before computers were common, accountants would use digital roots to quickly check their math. Today, your students can use digital roots to play a trick on their friends while working out math problems in their heads!

Pre-Activity Preparations:

Finding a Number's Digital Root

1. Add all of the digits of a number together. For example, 58174 becomes 5 + 8 + 7 + 1 + 4 = 25.
2. If the sum has more than one digit, add all of the sum's digits together. For example, 5874 becomes 5 + 8 + 7 + 1 + 4 = 25 which becomes 2 + 5 = 7.
3. Repeat this process with each subsequent sum until the answer contains only a single digit. This single digit is the original number's digital root.

Notes:

- This trick will work with any size number, not just those with five digits.

Detailed Directions:

1. Have each student write down a five digit number. For example, 81298.
2. Have each student write down a second five digit number by rearranging the order of the digits of their first number. For example, 21889.
3. Have each student subtract their smaller five digit number from their larger five digit number. For example, 81298 - 21889 = 59409.
4. The class doesn't know it, but the digital root of everyone's answer is 9. You will use this fact to do the trick.
5. Have every student cross out one of the digits from their answer. For example, 59~~4~~09.

   (This trick is much easier to do if they do not cross out a zero. The reason will become clear once you know how to do the trick.)
6. Have a student tell you the numbers that are left in their answer. For example, 5, 9, 0 and 9.
7. Calculate the digital root of the numbers they tell you. For example, 5 + 9 + 0 + 9 = 23 which becomes 2 + 3 = 5.
8. You know the digital root of their complete answer is 9 and you know the digital root of the numbers they gave to you is 5, so you know they must have crossed out a 4.

   If the student had crossed out a 9, they would have told you 5, 4, 0 and 9. The digital root of those numbers is 9. This tells you that they either crossed out a zero (9 + 0 = 9) or a nine (9 + 9 = 18 which becomes 1 + 8 = 9). Since it is not possible to distinguish a missing zero from a missing nine, you have to prevent the students from crossing out one of them. It has been our experience that saying something like “Cross out any number you like from your answer, except for zero, because zeros are too easy” goes over very well.