CRYPTARITHMS- Each number is replaced everywhere with the same letter. The sequence of digits for the key can be 9-0 as below, or 0-9, 1-0, or 0-1. These problems are more difficult than the SEND + MORE = MONEY you may have seen before. They have one advantage- there is only one solution.

You solve them by looking for patterns. There are other possible tools you can use. This is a problem solving opportunity for you to work in groups and develop a process. You will find that different types of problems may require different tools (or tricks). What is a pattern? 0 and 1 are the only numbers who are equal to their square. O and 1 are the additive and multiplicative identities respectively (they return the original number). You’ve probably heard or noticed that the digits multiples of 9 add to 9, 45, 63, etc.

For example look at the sample problem below. So L ^2 = MG. L can be 4, 7, 8, or 9. If L is 7 then G is 9. This would generate a carry when added to R which would require M+1 = M, so we can rule out L=7. A^2= N. Tells us nothing yet. N^2 = N so N must be 0, 1, 5, or 6. 0 is ruled out below.

There is a rule for creating them that the leading digit of any number cannot be 0, so that rules out L, M, R, and N. We can rule out A based on it’s square. G is ruled out as when it’s subtracted it doesn’t return the same value. Finally, in the last subtraction we have N-N=D so D must be 0.

A note about roots, square, cubic and possibly quad. This is an implementation of the old-school algorithm to calculate the roots. Even your instructor isn’t that old. No calculators but we did have tables in the backs of our math books. ☺ It is similar to writing out long division except there is no divisor. The digits are grouped by 2, 3 , or 4 digits separated by the apostrophe (for square, cube, or quad root). All you need to know for these puzzles is that the digit on top, L or A or N in this case is squared (or third or fourth power). In this example MG = L2, G is the last digit of A2, and N is the last digit of N2. So if L= 7, then M = 4 and G = 9. Since G = 9 then A must be 3. N can only be 1, 5, or 6, why? You don’t need to know how the remaining digits on each line are created. You actually can’t from the information given. It turns out these values are incorrect but you should get the idea.

Each pair of lines are just subtraction. You have N minus N so what must D be? Be careful though. If N wasn’t the least significant digit in each number then there is another possible value for D. What is it?

L A N 9876543210 the key has 3 words

MG

R GN

R AG

NI ON

NM GN

N PD

Solution for this problem:

8 2 1 OLIMPGRAND

9876543210

64

3 41 O LIMP GRAND<< KEY

3 24

17 91

16 41

1 50

A couple of sites to get you started.

<http://washburn.mpls.k12.mn.us/uploads/alphametics.pdf>

<http://cryptarithms.awardspace.us/primer.html>

Ask the instructor if you have any questions. Please include which set of problems you have.

SET 12

N C I S A A 0123456789 the key has 2 words

PI

S AN

N OC

NM CI

PN TP

TC MN PA

TC MN AT

CS TI ON

F O R 1234567890 the key has 2 words

AF

L RU

U UL

AL SH

RF UT

WR RW

LA IZ 9876543210 the key has no words

\* RM \* RM

OLD RNO

NEA ORM

OOND OLAO

AL 1234567890 the key has 2 words

GREY LARGE

GREY

AOLCE

AEGRK

RRSE

HEAD LOW 0123456789 the key has no words

TO - FAT

+ TOES SAE

TWOFF

SO 12