Name ______________________ Date ______________ Time ______________

PROJECT 3

An Ancient Multiplication Method

Thousands of years ago, the Egyptians developed one of the earliest multiplication methods. Their method uses an idea from number theory.

Every positive whole number can be expressed as a sum of powers of 2.

2^0	2^1	2^2	2^3	2^4	2^5	2^6
1	2	4	8	16	32	64

Write a number sentence to show each of the numbers below as the sum of powers of 2. For example, 13 = 1 + 4 + 8.

1. 19 = ______________________ **2.** 67 = ______________________

Follow the steps below to use the Egyptian method to multiply 19 * 62.

19 * 62 =	
1	62
2	124
4	248
8	496
16	992

Step 1 List the powers of 2 that are less than the first factor, 19.

Step 2 List the products of the powers of 2 and the second factor, 62. Notice that each product is double the product before it.

Step 3 Put a check mark next to the powers of 2 whose sum is the first factor, 19.

Step 4 Cross out the remaining rows.

Step 5 Add the partial products that are not crossed out.
62 + 124 + 992 = 1,178
So 19 * 62 = 1,178

19 * 62 = 1,178	
✓ 1	62
✓ 2	124
~~4~~	~~248~~
~~8~~	~~496~~
✓ 16	992

3. Explain why you don't have to multiply by any number other than 2 to write the list of partial products when you use the Egyptian method.

____

____

____

____

____

____

____

Name Date Time

PROJECT 3

An Ancient Multiplication Method *cont.*

4. Try to solve these problems using the Egyptian method.

85 * 14 = ________	38 * 43 = ________	45 * 29 = ________

Try This

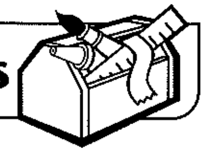
5. Here is another ancient multiplication method, based on the Egyptian method. People living in rural areas of Russia, Ethiopia, and the Near East still use this method. See whether you can figure out how it works. Then try to complete the problem in the third box, using this method.

13 * 25 = 325		38 * 43 = 1,634		45 * 29 = ________	
13	25	~~38~~	~~43~~	45	29
~~6~~	~~50~~	19	86	~~22~~	~~58~~
3	100	9	172	11	116
1	200	~~4~~	~~344~~	5	232
	325	~~2~~	~~688~~	~~2~~	~~464~~
		1	1,376	1	928
			1,634		________

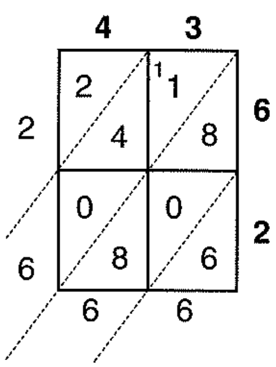
Name ______________________ Date ______________ Time ______________

PROJECT 3

Comparing Multiplication Algorithms



Think about the advantages and disadvantages of each multiplication method that you know. Record your thoughts in the chart below.

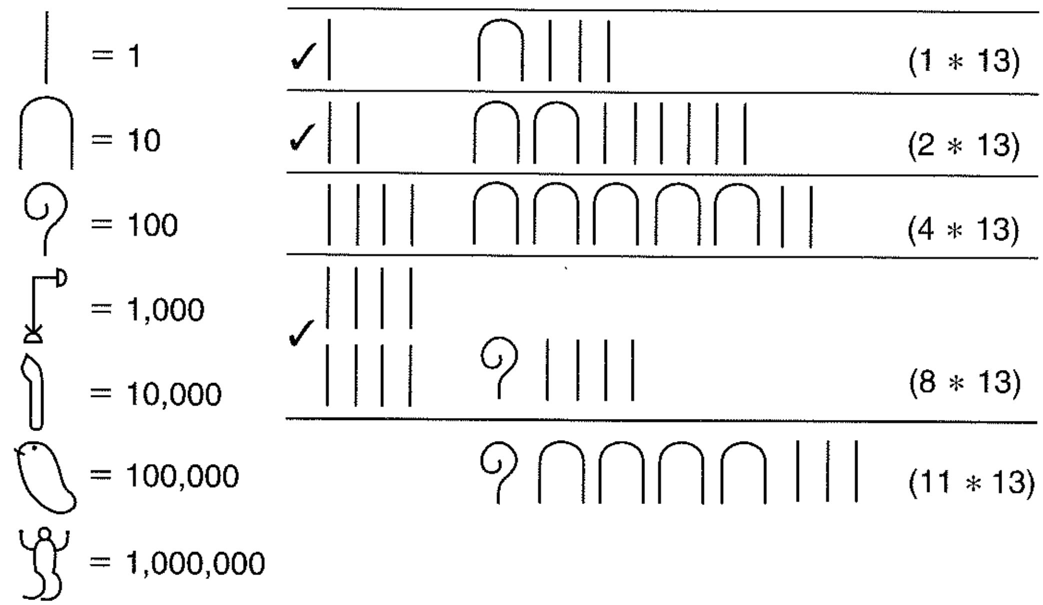
Algorithm	Advantages	Disadvantages
Partial Products 43 * 62 60 [40s] = 2,400 60 [3s] = 180 2 [40s] = 80 2 [3s] = 6 2,666		
Lattice 		
Egyptian 43 * 62 ✓ 1 62 ✓ 2 124 ~~4 248~~ ✓ 8 496 ~~16 992~~ ✓ 32 1,984 2,666		

Name Date Time

PROJECT 3

Ancient Math Symbols

1. The ancient Egyptians used picture symbols, called hieroglyphs, to write numbers. Here is how they might have multiplied 11 * 13 using the algorithm you learned in this project.



On the back of this sheet, try to multiply 21 * 16 using the Egyptian algorithm and Egyptian numerals.

2. Do you know any Roman numerals? They were used in Europe for centuries until Hindu-Arabic numerals replaced them. Today, Roman numerals appear mainly in dates on cornerstones and in copyright notices.

It is sometimes said that "multiplication with Roman numerals was impossible." Is that true? See whether you can multiply 12 * 15 using Roman numerals and the Egyptian algorithm. Use the back of this sheet.

Examples of Roman Numerals:

I = 1	II = 2	III = 3
IV = 4	V = 5	VI = 6
IX = 9	X = 10	XX = 20
XL = 40	L = 50	LX = 60
C = 100	D = 500	M = 1,000