Your Name:____ **Room:**___________________________

Grade:______________________________________ **Teacher:**_________________________________

Montlake Math Challenge

Montlake Elementary School

February 7, 2008

Problem 1: Fill in the (mod 5) addition table below:

	0	1	2	3	4
0					
1					
2					
3					
4					

Problem 2: Fill in the (mod 8) addition table below:

	0	1	2	3	4	5	6	7
0								
1								
2								
3								
4								
5								
6								
7								

Problem 3: Fill in the blanks.

a) $8 \pmod{3} =$ ________

b) $17 \pmod{8} =$ ________

c) $8 \pmod{4} =$ ________

d) $7 \pmod{5} =$ ________

e) $6 \pmod{5} =$ ________

f) $7 + 6 \pmod{5} =$ ________

g) $2+1 \pmod{5} =$ ________

h) $20 \pmod{11} =$ ________

i) $35 \pmod{11} =$ ________

j) $20 + 35 \pmod{11} =$ ________

k) $9 + 2 \pmod{11} =$ ________

l) $7 \pmod{3} =$ ________

m) $5 \pmod{3} =$ ________

n) $7 \times 5 \pmod{3} =$ ________

o) $5 \pmod{4} =$ ________

p) $5 \times 5 \pmod{4} =$ ________

q) $5 \times 5 \times 5 \pmod{4} =$ ________

r) $10 \pmod{6} =$ ________

s) $9 \pmod{6} =$ ________

t) $10 \times 9 \pmod{6} =$ ________

u) $4 \pmod{5} =$ ________

v) $4 \times 4 \pmod{5} =$ ________

w) $4 \times 4 \times 4 \pmod{5} =$ ________

x) $4 \times 4 \times 4 \times 4 \pmod{5} =$ ________

Problem 3: Fill in the blanks.

1. gcd(4,6) = ________

2. gcd(21, 12) = ________

3. gcd(50, 60) = ________

4. gcd(9, 27) = ________

5. gcd(7, 9) = ________

6. gcd(9, 33) = ________

Problem 4: A *prime number* is a number p whose only divisors are 1 and p. For technical reasons, we do not allow 1 to be a prime number.

Problem 4a: Write the first eight prime numbers.

Problem 4b: If p is a prime number and n is any other number, what are the possible values for gcd(p,n)?

Problem 5: In the following table, fill in the gcd of the listed number with 12:

Number n	gcd(n,12)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Problem 6: Given a number n, we say its **order** (mod 12) is the smallest number of times we can add n to itself to get a number that is divisible by 12. For example, if n=8, we have

$$8 + 8 = 16, \text{ which is not divisible by } 12$$
$$8 + 8 + 8 = 25, \text{ which is divisible by } 12$$

so the order of 8 is 3. Fill in the table below with the orders of each listed number (mod 12).

Number n	Order of n (mod 12)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Problem 7: Fill in the following table using problems 5 and 6. What do you notice?

Number n	$\gcd(n,12)$	Order of n (mod 12)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		