Problem 1. If today is a Tuesday, what day will it be in:

(a) 8 days?

(b) 35 days?

(c) 72 days?

(d) Besides listing out the days until I get to 72, can you think of a faster way to solve this problem? Explain your answer to someone in your group. Together, write a short explanation.

Problem 2. If your birthday is on a Monday this year, what day will it be on next year? (assume both years are normal–not leap years!)

Problem 3. (a) If its 5 o clock, what time will it be in 8 hours? (Don't worry about am or pm)

(b) What time will it be in 50 hours?

(c) What time will it be in 500 hours?

Problem 4. If I start at 0° and turn around 400°, what angle will I end up at? (Remember that turning completely around once is 360°)

Problem 5. Sometimes, we only care about the remainder left over when we divide by a particular number. For example, when we want to know what day it will be after some time, we only care about the remainder we get when we divide by 7. If today is a Tuesday, then in 35 (5 weeks) days it will also be Tuesday, so that in 37 days it will be Thursday (2 days past Tuesday). We say that

$$37 = 2 \pmod 7$$

Since $37 \div 7 = 5$ **remainder 2**.

(a) Calculate 45 (mod 7) (Divide 45 by 7 and find the remainder).

(b) Calculate 103 (mod 7) (Divide 103 by 7 and find the remainder).

(c) Calculate 17, 59 and 70 (mod 10). Why is (mod 10) easy to calculate?

(d) Calculate 16, 3 and 93 (mod 2). Why is (mod 2) easy to calculate?

Problem 6. What are the possible remainders when dividing by 2? What about by 3? By 4? Is there a pattern?

Problem 7. The following chart was created by computing the row + the column (mod 2)

(mod 2) :

+	0	1
0	0	1
1	1	0

Can you fill out the following similar charts for addition (mod 3) and (mod 4)?

(mod 3) :

+	0	1	2
0			
1			
2			

(mod 4) :

+	0	1	2	3
0				
1				
2				
3				

Problem 8. We can do the same thing for multiplication. Fill in the following charts by multiplying row $\times$ column and then finding the value $\pmod 2$, $\pmod 3$ or $\pmod 4$.

$\pmod 2$:

$\times$	0	1
0		
1		

$\pmod 3$:

$\times$	0	1	2
0			
1			
2			

$\pmod 4$:

$\times$	0	1	2	3
0				
1				
2				
3				

Problem 9. Now let's see what happens when we add some number to itself over and over again. For example, let's look at multiples of 3 $\pmod 5$. For example, we have $1 \times 3 = 3 \pmod 5$ and

$$3 + 3 = 2 \times 3 = 6 = 1 \pmod 5$$

Can you compute $3 \times 3, 4 \times 3$, and $5 \times 3 \pmod 5$?

Problem 10. Now let's use a trick. We know $3+3=1 \pmod 5$, so to compute $3 \times 3 \pmod 5 = 3+3+3 \pmod 5$ we can write

$$3+3+3 = 3+(3+3) = 3+1 \pmod 5$$

In other words, we can compute $3+3+3 \pmod 5$ by using the fact that we already know part of this sum. We can do the same thing to find 4×3 and 5×3. Do you get the same answers?

$$1 \times 3 = 3 \pmod 5$$

$$2 \times 3 = 3+3 = 1 \pmod 5$$

$$3 \times 3 = 3+(3+3) = 3+1 = \_\_\_ \pmod 5$$

$$4 \times 3 = 3+\_\_\_\_\_ = 3+\_\_\_ = \_\_\_ \pmod 5$$

$$5 \times 3 = 3+\_\_\_\_\_ = 3+\_\_\_ = \_\_\_ \pmod 5$$

Problem 11. Let's try some more computations but this time (mod 6).

(a) Compute the multiples of each number (mod 6):

Multiples of 1:

$$1 \times 1 = \_\_\_ \pmod 6$$

$$2 \times 1 = \_\_\_ \pmod 6$$

$$3 \times 1 = \_\_\_ \pmod 6$$

$$4 \times 1 = \_\_\_ \pmod 6$$

$$5 \times 1 = \_\_\_ \pmod 6$$

$$6 \times 1 = \_\_\_ \pmod 6$$

Multiples of 2:

$$1 \times 2 = \_\_\_ \pmod 6$$

$$2 \times 2 = \_\_\_ \pmod 6$$

$$3 \times 2 = \_\_\_ \pmod 6$$
$$4 \times 2 = \_\_\_ \pmod 6$$
$$5 \times 2 = \_\_\_ \pmod 6$$
$$6 \times 2 = \_\_\_ \pmod 6$$

Multiples of 3:

$$1 \times 3 = \_\_\_ \pmod 6$$
$$2 \times 3 = \_\_\_ \pmod 6$$
$$3 \times 3 = \_\_\_ \pmod 6$$
$$4 \times 3 = \_\_\_ \pmod 6$$
$$5 \times 3 = \_\_\_ \pmod 6$$
$$6 \times 3 = \_\_\_ \pmod 6$$

Multiples of 4:

$$1 \times 4 = \_\_\_ \pmod 6$$
$$2 \times 4 = \_\_\_ \pmod 6$$
$$3 \times 4 = \_\_\_ \pmod 6$$
$$4 \times 4 = \_\_\_ \pmod 6$$
$$5 \times 4 = \_\_\_ \pmod 6$$
$$6 \times 4 = \_\_\_ \pmod 6$$

Multiples of 5:

$$1 \times 5 = \_\_\_ \pmod 6$$
$$2 \times 5 = \_\_\_ \pmod 6$$
$$3 \times 5 = \_\_\_ \pmod 6$$
$$4 \times 5 = \_\_\_ \pmod 6$$
$$5 \times 5 = \_\_\_ \pmod 6$$
$$6 \times 5 = \_\_\_ \pmod 6$$

(b) Do you notice any patterns? Explain your answer to someone in your group. Together, write a short explanation.