Division

Multiplicative inverses are important when dividing two numbers in a modulus base. Numbers cannot be divided if there is no multiplicative inverse of the denominator in the modulus base. To divide, multiply by the multiplicative inverse.

Mod 7

$$\frac{5}{4} = 5 * 4^{-1} \equiv 5 * 2 = 10 \equiv 3 (\mathrm{mod}\, 7)$$

Use the multiplicative inverse from the table above to help determine the following examples in modulus 7.

Example:

1. $\frac{3}{5} \equiv$ _____

2. $\frac{1}{2} \equiv$ _____

3. $\frac{10}{3} \equiv$ _____

Mod 5

List multiplicative inverses in mod 5
Remember, two numbers multiplied together that equal 1 (mod 5)

_____, _____, _____

Examples:

4. $\frac{1}{4} \equiv$ _____

5. $\frac{5}{2} \equiv$ _____

6. $\frac{2}{3} \equiv$ _____

With a partner:

1. Choose a different modulus than we have worked with in class. (The best results will occur when you choose a modulus that is a prime number.)
2. Determine the additive and multiplicative inverses for your modulus.
3. Create three problems in that modulus for each of the operations: Addition, Subtraction, Multiplication, and division.

Modulus Algebra
Combine all the operations that we have learned so far and incorporate it into solving an algebraic equation.

Solve in Modulus 5 $3x+4\equiv 2$

[Use the additive inverse fact: 4 + 1 ≡ 0 (mod 5)]

$$3x+4+1\equiv 2+1$$

[Combine like terms]

$$3x\equiv 3$$

[Use multiplicative Inverse fact: 3 * 2 ≡ 1 (mod 5)]

$$3x(2)\equiv 3(2)$$

[6 ≡1 (mod 5)]

$$1x\equiv 1$$

Check answer: 3(1) + 4 ≡ 3 + 4 ≡ 7 ≡ 2 (mod 5)

Algebra examples:

1. Modulus 7: $4x-3\equiv 6$

2. Modulus 7: $5x+1\equiv 2$

Practice:

1) $2x+6\equiv 3(\mathrm{mod}\,7)$

2) $5x-6\equiv 2(\mathrm{mod}\,7)$

3) $4x+1\equiv 5(\mathrm{mod}\,7)$

4) $6x-3\equiv 1(\mathrm{mod}\,7)$

Modular Arithmetic on the TI-83+/TI-84+ calculator

Let N = the number that corresponds to the letter in the coded alphabet (clock addition)
Let L = the number that corresponds to the letter in the decoding process

Alpha- coding (Usually (mod) is 26)
Buttons
Math → NUM ↓ 4: fpart

Syntax: fpart (N / (mod) * (mod)

Alpha – decoding (Usually (mod) is 26)
N + (additive inverse) = L
If L > (mod) then fpart (L / (mod) * (mod), result is the corresponding number to alphabet
If L < (mod) then L = corresponding number to letter in the alphabet