Part I

Addition

1) The sum of two numbers is the combined total number of objects from putting together two collections of objects of the given sizes.
2) Putting two or more groups together to see how many there are total.
3) __ - B = A → B+A=?

Standard Algorithm

- This is the process of adding from right to left, one place-value column at a time, regrouping as necessary. You must regroup and carry when you have too many singles to put underneath. This works because when you add 15+17, you start by adding 5+7 and you get 12. You cannot write 12 underneath so we regroup 10 and carry it left to the tens place and you have two singles left over. The 12 represents 1 group of 10 and 2 singles. This works for any positional notation.

Properties:

- **Commutative**: When two numbers are added, the sum is the same regardless of the order.
  Ex: 4 + 3 = 3 + 4
- **Associative**: when three or more numbers are added, the sum is the same regardless order.
  Ex: 2 + (5 + 7) = (2 + 5) + 7
- **Additive identity**: the sum of any number and 0 is the original number.
  Ex: 6 + 0 = 6
- **Distributive**: the sum of two numbers times a third number is equal to the sum off each number times the third number.
  Ex: 3 * (4 + 2) = 3*4 + 3*2

Subtraction

1) The process of taking away a smaller sum from a larger sum.

Standard Algorithm

- This is the process of subtracting from right to left, one place-value column at a time, regrouping as necessary. Take 932-356, we can't take 6 ones away from 2 ones, so we regroup the 3 tens and the 2 ones to 2 tens and 12 ones. We can now take 6 away from 12 and have 6 ones left over. We can't take 5 tens away from 2 tens so we must borrow from the left and regroup the 9 hundreds and 2 tens to 8 hundreds and 12 tens. You can now take 5 away from 12 and get 7 left over. We're left with 8-3 which is possible and we get 5. This works because if there is too much on the bottom to take away from the top, we can borrow and regroup as necessary and this works for any positional notation.

Properties:

- **Subtractive identity**: the different of zero taken away from any number is the original number.
  Ex: 5 – 0 = 0

Subtraction cannot be commutative or associative because the order you write it in does matter

Multiplication

1) A x B = {a+a+a+a} b times
2) A x B = {b+b+b+b} a times
3) A x B = the number of elements in a groups a b
4) A x B is the area of a rectangle with A units on the outside and B units on the next.

Standard Algorithm

- We start with the ones place and multiply these and write the product underneath. For example 34*5, when we multiply these, we can write 20 underneath. When we multiply the 3*5, it is really like we are multiplying 5*30 so we must shift over one place value to the left. So when we add these it is really like we are adding 150+20 and we get 170. Every time we multiply we must be aware of place values and shift when needed. This works because whether you are multiplying two digits by two digits or two by three, it doesn't matter, every time you multiply two new numbers you must shift over one place value to the left.

Properties

- **Commutative**: When two numbers are multiplied, the product is the same regardless of the order.
  Ex: 4*3 = 3*4
- **Associative**: when three or more numbers are multiplied, the product is the same regardless order.
  Ex: 2 * (5*7) = (2*5) * 7
- **Multiplicative Identity:** the product of any number and 1 is that number.
  Ex: 6*1 = 6
- **Distributive**: the sum of two numbers times a third number is equal to the sum off each number times the third number.
  Ex: 3 * (4 + 2) = 3*4 + 3*2
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Division

1) How many times B can go into A
2) How many times you can subtract B from A
3) How many collections of B objects make "A" objects
4) How many objects are in each group if A objects are equally separated into B groups.
5) The number C so that B x C = A

Standard Algorithm

- We break up previous number into smaller unit which change the place value. For example if we have 132 divided by 4, we want to see how many times 4 can evenly go into 132. We start out by seeing 1 divided by 4 which we cannot do so we look add the. The 13 represents 13 groups of 10 and 4 can go into 13 three times with one left over so we write 3 above the 2 (not the 1) and have 1 left over or 1 group of 10 left. When we bring down the 2 we can think of it as adding 2 singles to the group of 10 that we already have so we have 12. Four can go into 12 three times so we write the 3 above the 2. So 4 can go into 132 an even 33 times with no remainder.

Properties

- **Divisive Property**: any number divided by 1 will stay the same.
  Ex: 5 / 1= 5
- **Zero Property**
  - Rule 1: if you divide zero by any number you have zero (nothing to divide by).
    Ex: 4 / 0 = 0
  - Rule 2: if any number is divided by zero then the problem cannot be solved. You cannot take something from nothing.
    Ex: 0 / 2 = undefined

Division cannot be commutative or associative because the order you write it in does matter. It cannot be distributive either

PART II

1) 3 people had a group project to do. It took them 5 hours, 14 minutes and 24 seconds to complete it. If they each spent the same amount of time on the project, how long did each take to do their part.
   - In this problem you would need to use division because you are trying to see how much time each person equally worked on the project.
2) 4 people each ran 1 hour, 47 minutes and 58 seconds. What is their total time all together?
   - In this problem you would need to use multiplication because you want to know how much all of their times equal. You could use addition but it would take longer so multiplication is the best option.
3) There were three girls selling Girl Scout cookies. Girl one sold 135 boxes, girl 2 sold 73, and girl 3 sold 187 boxes. How many boxes did all 3 girls sell together?
   - In this problem addition would be the best operation to use because you want to see how many boxes they sold all together.
4) If Kelsey had 18 chapsticks and Kelly had 7, how many more chapsticks did Kelsey Have than Kelly?
   - In this problem subtraction is the best operation to use because you want to know how many more Kelsey has than Kelly so you take 7 away from 18 and get your answer.

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PART III

1) If Grace has 4 book and Tyler has 5 books, how many books do they both have in total? Solve and explain each step using the standard algorithm for addition.

2) Katie and her friends are raising money for their Girl Scout troop. They have a goal of $500 and have raised $280 so far. How much more do they need to collect in order to reach their goal? Solve and explain using the standard algorithm for subtraction.

3) Ryan goes fishing with his dad and catches 9 small fish. His dad caught six times as many fish as he did. How many fish did Ryan's dad catch? Solve and explain using the standard algorithm for multiplication.

4) Susie baked 60 cookies for her class holiday party. She puts them into 15 bags; one for each classmate. If the same number of cookies goes into each bag, how many cookies should be placed in each bag? Solve and explain using the standard algorithm for division.

5) Perform the following addition problem using manipulatives. Explain how this follows the standard algorithm for addition.

#@!
+ &E#

6) Perform the following subtraction problem using manipulatives. Explain how this follows the standard algorithm for subtraction.

&! @
- ! E#

7) Perform the following multiplication problem using manipulatives. Explain how this follows the standard algorithm for multiplication.

#&
x E!

8) Perform the following division problem using manipulatives. Explain how this follows the standard algorithm for division.

!E)!@@E

9) If 13 people had and individual budget of $735, what would be the total amount of all 13 people? Solve and explain using the standard algorithm for multiplication.

10) If the coffee pot in the teacher's lounge makes 104 cups of coffee, how many cups of coffee would each of the 26 staff members get? Solve and explain using the standard algorithm for division.