Part I
Math Fundamentals (Pre-Algebra)

1 Numbers and negative numbers

There are identity numbers for addition and multiplication: $x + 0 = x$ and $x * 1 = x$ therefore 0 is the identity number for addition and 1 is the identity number for multiplication. Adding/multiplication by the respective identity number will always result in the origin value value.

The opposite of a number is the number multiplied by -1. An even number of negative signs is equal to a positive sign and an odd number of negative signs is equal to a negative sign: $1 + - - 1 = 2$ (or $1 - -1 = 2$) and $1 - - - 1 = 0$. The sign of a number shows in which direction you'd have to go on the number line. Multiplication of *two* numbers that have two different signs will result in a negative number, when both signs are the same the result will be positive. Dividing a negative number by a negative number will result in a positive number, dividing a positive by a negative will result in a negative number. When more than two numbers are divided an odd number of negative signed numbers will have a negative result and an even number of negative numbers will have a positive result: $\frac{6}{-3} = -\frac{6}{3}$ and $-\frac{-6}{3} = \frac{-1}{-1} * \frac{6}{3} = \frac{1}{1} * \frac{6}{3}$

An absolute value is referring to the distance from the origin (0): $|2| = 2$ and $|-2| = 2$ so it will always be positive since absolute is just the units of distance.

2 Factors and multiples

2.1 Divisibility

A number is evenly divisible by 2 if the last number of it is even $(0, 2, 4, 6, 8)$: $120 \div 2 = 60, 126 \div 2 = 63, 128 \div 2 = 64$

To find out if a number is evenly by 3 you have to add all of it individual numbers together and see if that is divisible by 3: $120 \div 3 = 40$ is evenly divisible because: $1 + 2 + 0 = 3$

To see if a number is evenly by 4 you have to check if the last two numbers are evenly divisble by 4: $120 \div 4 = 30$ is evenly divisible because: $20 \div 4 = 5$

To see if a number is evenly by 5 you have to check if the last number is either 0 or 5: $120 \div 5 = 24$ is evenly divisible by 5 because the last number is a 0, $126 \div 5$ is not.

The divisibility rule for 6 is achieved by testing if the number is divisble by 2 *and* 3: $120 \div 6 = 20$

To find out if a number is evenly divisble by 7 you have to multiply the last number of it by 5 and then add the result to the rest of the numbers and

check if that is evenly divisble by 7. $120 : 0 * 5 = 0 + 12 = 12 \div 7$↯(not even) $126 : 6 * 5 = 30 + 12 = 42 \div 7 = 6$✓

The divisibility for 8 is more attractive for larger numbers because you have to check the last 3 digits and see if they as a whole number are evenly divisible by 8: $120 \div 8 = 15$✓

For 9 you sum up all the individual digits and if the sum is divisble by 9 then the whole number is divisible by 9. For 120: $1 + 2 + 0 = 3 \div 9$↯, for 126: $1 + 2 + 6 = 9 \div 9 = 1$✓

A number is evenly divisible by 10 if it ends with 0.

The multiples of a number are just the numbers that can be evenly divided by the number. To find for example the first 3 multiples of a number just multiply the number with 1, with 2, and with 3.

2.2 Prime and composite numbers