Lesson 2: Basic_Arithmetic

2.1 Introduction

In this lesson we will introduce you, the student to computation on a computer. Computers can calculate complex arithmetic problems at lightning speed. This has proven to be supremely useful with the widespread use of calculators. There are four basic arithmetic operations we will introduce in this lesson: Addition (+), Subtraction (-), Multiplication (*), and Division (/). Computers follow the same order of operations that we learned in our elementary schooling, so it is important to remember:

- Parentheses
- Multiplication
- Division
- Addition
- Subtraction

Notice how exponents are left out of the above. This is intentional because squaring, cubing, or any other exponentiation is a more complicated topic for another lesson.

As we did in Lesson 1, create a new Java Project, and lets call this one "Basic Arithmetic". Name the class "Basic_Arithmetic" and lets get started! If you need a refresher, check Lesson 1 for how to set up a project and class.

2.2 Printing a Number

In Hello World we printed a short phrase. Printing a number is almost identical to printing a phrase, but without the quotes. Try printing your favorite number.

```
System.out.println("1");
System.out.println(1);
```

```
1
1
```

Above are two lines of code and their corresponding output. At first glance these seem identical, however our computer treats them differently. The first line treats "1" as a phrase, so we can't perform mathematical operations on it. The second line treats 1 as a number. When doing arithmetic, we always want to treat numbers as, well, numbers!

2.3 Adding, Subtracting and Multiplying

Addition, Subtraction and Multiplication are performed with the symbols +,-, and * respectively. Try manipulating a few numbers with these operators.

```
System.out.println(3+5);    8
System.out.println(8-2);    6
System.out.println(3*7);    21
System.out.println(4-2*3);  -2
```

Above are four lines of code and their corresponding output. These are simply calculations that you can do in your head or on a calculator to verify that the computer was right. Notice how the fourth line of code performs the 2*3 portion first, just like the order of operations.

2.4 Division

The behavior of division is slightly more complicated than the other operations. So far, we have dealt only with whole numbers, or "integers". Sometimes, the result of a division operation is a fraction. What does the computer do in this situation?

```
System.out.println(4/2);    2        2.0
System.out.println(5/2);    2        2.5
System.out.println(6/3);    2        2.0
System.out.println(7/3);    2        2.3333333
System.out.println(8/3);    2        2.6666667
```

Above are five different cases of division. Although computers are very powerful, only the first case results in the correct answer. On the far right, I included what the answers should have been. Notice how no matter what, the computer rounds down, even for the last example when 2.66 is clearly closer to three. This is called floor division and when working with whole numbers, Java always does floor division.

Of course, there is a simple fix to get around this issue, but I will save that for the next lesson. Maybe you can figure out on your own. All it takes is a adjusting how a number is formatted.