1. (40pts) Fill out the following table. Evaluate the Java expression in the first column and put the result in the second column. Assume that each expression is evaluated independently (ie, not in sequence). In the third column indicate the datatype of the result. The first row has been done for you.

(Note: you can answer these questions using the Java compiler, and if you do this, you will miss out on a chance to learn. You will be asked to do similar problems on the midterm and you will not have access to a Java compiler. I do recommend you write these statements inside a Java program after you have done the homework. You can check your answers --- if you have errors, understand why.)

You have the following variables declared and initialized:

```java
double a = 11.0, b = 4.0;
int i = 11, j = 4;
```

Scoring: 2 pts each datatype; 2 pts each correct result

<table>
<thead>
<tr>
<th>Java expression</th>
<th>Result</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>i + j</td>
<td>15</td>
<td>int</td>
</tr>
<tr>
<td>a - b * 2 - j</td>
<td>-1.0</td>
<td>double</td>
</tr>
<tr>
<td>a / b</td>
<td>2.75</td>
<td>double</td>
</tr>
<tr>
<td>a / i</td>
<td>1.0</td>
<td>double</td>
</tr>
<tr>
<td>i / j</td>
<td>2</td>
<td>int</td>
</tr>
<tr>
<td>i % j</td>
<td>3</td>
<td>int</td>
</tr>
<tr>
<td>1.0 * i / j</td>
<td>2.75</td>
<td>double</td>
</tr>
<tr>
<td>b - j / a - i</td>
<td>-7.3636..</td>
<td>double</td>
</tr>
<tr>
<td>(i - 1) / j + + a</td>
<td>13.0</td>
<td>double</td>
</tr>
<tr>
<td>i % 5 + a % 2</td>
<td>2.0</td>
<td>double</td>
</tr>
<tr>
<td>(++a) + (++b)</td>
<td>17.0</td>
<td>double</td>
</tr>
</tbody>
</table>
Note: Java has the the **unary + operator** that returns the same value (identity operation). E.g.: +3 evaluates to 3

2. (10 pts) The Java Language Documentation
   a) Access the Java API documentation from the class website. It is linked in the left hand sidebar.
   b) In the Java docs, look in the top left corner of the page for a list of packages. For each package listed below, write down the first sentence of the package description, and report how many classes it contains. (Just count classes, not interfaces, exceptions, or whatever else.)

   - Example: `java.awt.color`: Provides classes for color spaces.
     5 classes (ColorSpace, ICC_ColorSpace, ICC_Profile, ICC_ProfileGray and ICC_ProfileRGB --- you don't need to list them. I did it to show you what to look for to find the correct answer).
   - `java.lang`:
     Provides classes that are fundamental to the design of the Java programming language.
     35 classes

   - `java.math`:
     Provides classes for performing arbitrary-precision integer arithmetic (BigInteger) and arbitrary-precision decimal arithmetic (BigDecimal).
     3 classes

   - `java.util`:
     Contains the collections framework, legacy collection classes, event model, date and time facilities, internationalization, and miscellaneous utility classes (a string tokenizer, a random-number generator, and a bit array).
     54 classes

   - `java.io`:
     Provides for system input and output through data streams, serialization and the file system.
     51 classes

1 pt each correct description; 1 pt each correct count of classes
3. (30 pts) Question3 Program: Write a Java program that reads in a double typed number and print its cube (i.e., multiplies the number with itself twice). Name your program Question3.

One possible answer:

```java
import java.util.Scanner;
public class Question3 {
    public static void main(String args[]) {
        double d;
        Scanner in = new Scanner(System.in);
        //prompt our user for the input
        System.out.print("Please enter a double number: ");

        //get user input and treat it as a double
        a = in.nextDouble();

        d = d * d * d;
        //print out cube
        System.out.println(d);
    }
}
```

Scoring:
Note that the import statement is necessary, but no points were deducted for omitting it.
+4 class declaration
+4 main method
+3 variable declaration
+4 construct Scanner w/ System.in
+4 read double from Scanner
+4 store double value into variable
+4 calculate cube correctly
+3 prints cube
4. (20 pts) Look up the `java.lang.Math` class in the Java documentation.

a) (5 pts) List all the methods named `min` (give the method signatures/headers).

```
double min(double a, double b)
float min(float a, float b)
int min(int a, int b)
long min(long a, long b)
```

1.25 pts each for correct header

b) (5 pts) Why is there more than one method?

*In Java, datatypes must match. Java provides more than one method so it can deal with 4 different datatype comparisons: doubles, floats, ints, and longs.*

c) (10 pts) You are given 3 `int` typed variables named `x`, `y`, and `z`.

The expression: `Math.min(x, y)` will return the minimum (smallest) of the two values stored in `x` and `y`.

Using the `min` method, write a single Java expression whose value is the maximum of `x`, `y`, and `z`.

Hint: You can nest functions so that the output of one function is the input to another function. For example: the square root of the square root of 2 would be

```
Math.sqrt( Math.sqrt( 2.0 ) )
```

```
Math.min(x, Math.min(y, z))
```

or similar

*Variables can be in different order*

```
eg Math.min(y, Math.min(x,z))
```

-1 for each syntax error