Section 1 - Expressions and Tracing Code

1. (14points) For each of the following Java expressions, write the *type* of the expression as well as the resulting value. An example is provided:

	Java Expression	Type	Value
Example 1:	`11.0 + 11.0`	double	22.0
Example 2:	`11 + 11`	int	22
Example 3:	`"2" + "2"`	String	"22"

	Java Expression	Type	Value
A	`(1 / 2) + (1/2)`		
B	`true || 3 < 4`		
C	`3.0 * Math.PI`		

2. For the next question, consider the class `ReferenceTest` defined below. In the main method, an array is created in the first line. You will be asked several questions about the array referenced by coolArray. (You should look at the questions first before reading every line of code).

   Here is the class:

```
1  public class ReferenceTest
2  {
3    public static void main(String[] args)
4    {
5      int[] myArray = {5,3,1};
6      int[] anotherArray = myArray;
7      methodOne(anotherArray);
8      methodTwo(myArray);
9    }
10
11   public static void methodOne(int[] original)
12   {
13     original[1] = 20;
14   }
15
16   public static int methodTwo(int[] original)
17   {
18     original = new int[10]];
19     original[1] = 40;
```

```
20      return original[1];
21    }
22
23  }
```

Remember that the variable `myArray` is stores the address of an array. For each of the following, write the values stored in the array at that address *after* the completion of the method call. These all refer to the calls in the main method above.

Note that if you make a mistake on an early part of this question, the remaining questions will be graded as if the previous part had been right. In other words, if you say the values of the array are {1,2,3,4,5} but it should be {5,2,3,4,5} and at the next step the first value is increased by 1, then you will get full marks for writing {2,2,3,4,5} and no marks for {6,2,3,4,5}

	Contents of array referred to by myArray
`methodOne(anotherArray);`	
`methodTwo(myArray);`	

Programming Questions

Answer the following questions.
Even if you are short of time, do not leave any questions blank. You will get points for things such as class headers, method headers, etc if you write them. But if you leave the question blank you will get a 0 for the question.
If a question asks you to write a method and you are unable to do so successfully, *you still can and should call the method as if it does what is specified*

3. In number theory, a $perfectnumber$ is a number that equal to the sum of all its factors other than itself. (Recall that x is a factor of y whenever y is an even multiple of x)

   For example, the number 6 has the factors 1,2 and 3 (other than itself) Since $1 + 2 + 3 = 6$, 6 is considered a perfect number.

   Another perfect number is 28. The factors of 28 are 1,2,4,7,and 14. $1 + 2 + 4 + 7 + 14 = 28$

   Write a class `PerfectNumberCalculator` which has two methods (described below), `isPerfectNumber` and a `main` method.

   Write a method `isPerfectNumber` which takes as input a `long n` and returns a `boolean` value representing whether the number is perfect or not. Note that if n is non-positive, your method should simply return false.

4. Write a main method that prints the first 8 perfect numbers on different lines. Because the 8th perfect number is 19 digits(!), you will have use a `long` datatype instead of `int` as part of your method.

   The output of your program should look roughly like the following:

   ```
   6
   28
   496
   8128
   33550336
   ...
   ```

5. Write a method `reverseArray` that takes as input an `double[]` and returns a *new* array, which is the reverse of the original array. In otherwords, if your original array is {1,2,3,4,5} the array returned by calling this method should give you {5,4,3,2,1}

6. What changes could you make to the method `reverseArray` so that it modified the original array instead of returning a new one?