All questions are worth 8 points each, except the first, which is worth 4.

1. What would be the exact result of executing the following statements, using your own name?

```
System.out.print("Please enter your last name: ");
Scanner kb = new Scanner(System.in);
String name = kb.nextLine();
System.out.println("The length of your last name is "
                   +name.length() + " characters.");
```

Please enter your last name: Carroll
The length of your last name is 7 characters.

2. Write the following mathematical expression in Java (use `Math.PI` for π):

$$G = 4\pi^2 \frac{a^3}{p^2\,(m1+m2)}$$

```
G = 4*Math.PI*Math.PI*a*a*a / (p*p*(m1 + m2));
```

or

```
G = 4*Math.pow(Math.PI,2) * Math.pow(a,3) / (Math.pow(p,2)*(m1 + m2));
```

3. What would be printed after executing the following statements?

a.
```
int x, y;
x = 12;
y = x + x;
System.out.println(y);
```
24

b.
```
String x, y;
x = "12";
y = x + x;
System.out.println(y);
```
1212

4. Write the code (just what would be inside the *main* method) for an automobile program that asks a user to input
   * the number of gallons of gas in the tank
   * the fuel efficiency in miles per gallon
   * the price of gas per gallon

   Then print the cost per 100 miles and how far the car can go with the gas in the tank.

```
Scanner kb = new Scanner(System.in); System.out.println("Please enter
size of tank in gallons: "); int gas = kb.nextInt();
System.out.println("Please enter efficiency in miles per gallon: ");
double mpg = kb.nextDouble();
System.out.println("Please enter price of gas per gallon: ");
double price = kb.nextDouble();
double costFor100 = 100. * price / mpg;
double range = gas * mpg;
System.out.println("Cost for 100 miles is " +costFor100);
System.out.println("Range is " +range);
```

5. Implement a class **Sphere** that has one instance variable of type double for the *radius* of the sphere. Do not include any getters or setters. However, implement the method *getSphereVolume(),* where the volume of a sphere is $4/3\pi\ r^3$ for radius `r`.

```
public class Sphere {
  private double radius;

  public double getSphereVolume() {
       return 4.0 * Math.PI * radius * radius * radius * radius / 3.0;
  }
}
```

6. The class Coin has two instance variables: one is of type String that represents the face that is showing, either "Heads" or "Tails", and the other is an int that keeps track of how many times a coin has been flipped. Implement this class (you can assume it has getters and setters, but you do not need to write these). Also implement the method *flip()* that turns the coin over to show the opposite face and increments the number of times the coin has been turned over.

```
public class Coin {
  private String face;
  private int count;

  public void flip() {
    if (face.equals("Heads"))
      face = "Tails";
    else
      face = "Heads";
    count++;
  }
}
```

7. Convert the following *for*-loop into a *while*-loop:

```
Scanner kbd = new Scanner(System.in);
for (String ask = kbd.nextLine(); ask != null; ask = kbd.nextLine()) {
  if (ask.contains("stop"))
    System.exit(0);
  else
    replyTo(ask);
}
```

```
Scanner kbd = new Scanner(System.in);
String ask = kbd.nextLine();
while (ask != null) {
  if (ask.contains("stop"))
    System.exit(0);
  else
    replyTo(ask);
  ask = kbd.nextLine();
}
```

8. Suppose the value of boolean variable `b` is false and the value of integer `x` is 0. What is the value of each of the following expressions?

a. `b && x == 0` **false**

b. `!b && x == 0` **true**

c. `b && x != 0` **false**

d. `!b || x != 0` **true**

9. What do these code fragments print?

a.
```
int n = 5;
int m = -5;
if (-n >= m)
      System.out.println("n = " +n);
else
      System.out.println("m = " +m);
```
n = 5

~~b.~~
```
~~double x = Math.sqrt(2.0);~~
~~double y = 2.0;~~
~~if (x * x == y)~~
~~      System.out.println("x = " +x);~~
~~else~~
~~      System.out.println("y = " +y);~~
```

~~y = 2.0~~ **Dropped, I thought it was a bit too complex.**

10. The original U.S. income tax of 1913 was the following:
* 1% on the first $50,000
* 2% on the amount over $50,000 up to $75,000
* 3% on the amount over $75,000 up to $100,000
* 4% on the amount over $100,000 up to $250,000
* 5% on the amount over $250,000 up to $500,000
* 6% on the amount over $500,000

Write a method whose only input parameter is an amount of income and which returns the income tax owed.

```
public double incomeTax(double amount) {
  double tax = 0.0;
  if (amount <= 50000)
   tax = 0.01 * amount;
  else if (amount <= 75000)
   tax = 0.02 * amount;
  else if (amount <= 100000)
   tax = 0.03 * amount;
  else if (amount <= 250000)
   tax = 0.04 * amount;
  else if (amount <= 500000)
   tax = 0.05 * amount;
  else
tax = 0.06 * amount;
return tax;
}
```
This question will be dropped. Add the points back into your score then divide by 92 for your grade.

11. How many iterations do the following loops carry out? Assume that variable n is not changed inside the loop body.

    a. `for (int n = 10; n > 0; n--) { }` **10**

    b. `for (int n = -10; n <= 10; n = n + 2) { }` **11**

12. Write a loop that computes the sum of all **even** numbers between 7 and 89.

```
int sum = 0;
for (int n = 7; n < 89; n++)  // you could also have done n+=2 instead of n++
  if (n % 2 == 0) sum = sum + n;
```

13. Write a void method called `passwordCheck` that repeatedly asks a user to enter a password until the user enters the password "secret".

```
public void passwordCheck() {
   Scanner kb = new Scanner(System.in);
   String word = kb.nextLine();
   while (!word.equals("secret")) {
         System.out.println("Enter password: ");
         word = kb.nextLine();
   }
}
```