Exercises marked with a ⋆ involve writing programs. These exercises do not have accompanying solutions. You are encouraged to work them out on your own. If you need help with any of them, please reach out to the course staff.

Exercise 1. What is the value of each of the following expressions?

a. `"blah" + "blah" + "blah"`

b. `"12" + 3`

c. `Integer.parseInt("12") + 3`

d. `3 + Double.parseDouble("0.14159") < 4`

Exercise 2. If `int x = 5`, what is the value of `x` after each of the following statements is executed?

a. `x = x * 3` (alternatively as `x *= 3`)

b. `x = x / 3` (alternatively as `x /= 3`)

c. `x = x % 3` (alternatively as `x %= 3`)

d. `x = x + 3` (alternatively as `x += 3`)

e. `x = x - 3` (alternatively as `x -= 3`)

f. `x++` (alternatively as `++x` or `x = x + 1` or `x += 1`)

g. `x--` (alternatively as `--x` or `x = x - 1` or `x -= 1`)

Exercise 3. Give the value of `x` after the execution of each of the following code blocks:

a.

```java
int x = 1;
x += x;
x += x;
x += x;
```

b.

```java
boolean x = true
x = !x;
x = !x;
x = !x;
```

c.

```java
int x = 2;
x *= x;
x *= x;
x *= x;
```

Exercise 4. Write the following numbers using scientific notation in Java:

a. 37,000,000

b. 0.000059

Exercise 5. What is the value of each of the following expressions?

a. `4 + 6 / 2`

b. `(4 + 6) / 2`

c. `(3 + 6) * 6 - 9 / 3 + 20`

d. `4 + 3 * 2 / 3`

e. `(4 + 3) * 2 / 3`

f. `3 < 11 && 11 < 8 || 8 > 3`

g. `-Math.pow(5, 2) + 34 > 6 + 8 / 2 * 3`

Exercise 6 (⋆)**.** Write a program called `ReciprocalDivision.java` that receives two integers `x` and `y` as command-line inputs, and writes `true` as standard output if either number divides the other, and `false` otherwise.

```
$ java ReciprocalDivision 3 4
false
$ java ReciprocalDivision 6 3
true
```

Exercise 7 (⋆)**.** Write a program called `Distance.java` that receives two doubles `x` and `y` as command-line inputs, and writes as standard output the Euclidean distance of the point $(\mathtt{x}, \mathtt{y})$ to the origin $(0, 0)$, computed as $\sqrt{\mathtt{x}^2 + \mathtt{y}^2}$.

```
$ java Distance 3 4
5.0
$ java Distance 6 8
10.0
```

Exercise 8 (⋆)**.** Write a program called `SumOfSines.java` that receives an angle `t` (double) in degrees as command-line input, and writes as standard output the value of $\sin(2\mathtt{t}) + \sin(3\mathtt{t})$.

```
$ java SumOfSines 30
1.8660254037844386
$ java SumOfSines 60
0.8660254037844388
```

Exercise 9 (⋆)**.** Write a program called `Spring.java` that receives `m` (int) and `d` (int) as command-line inputs, and writes `true` if day `d` of month `m` is between 3/20 (inclusive) and 6/20 (inclusive), and `false` otherwise.

```
$ java Spring 3 19
false
$ java Spring 4 15
true
```

Exercise 10 (⋆)**.** Write a program called `Displacement.java` that accepts `x0` (double), `v0` (double), and `t` (double) as command-line inputs, and writes as standard output the value of $\mathtt{x0} + \mathtt{v0t} - \mathtt{gt}^2/2$, where `g` is the constant 9.80665. This value is the displacement in meters after `t` seconds when an object is thrown straight up from initial position `x0` at velocity `v0` meters per second.

```
$ java Displacement 1 50 5
128.416875
$ java Displacement 0 10 1
5.096675
```

Exercise 11 ($\star$)**.** Write a program called `CompoundInterest.java` that accepts `p` (double), `r` (double), and `t` (double) as command-line inputs, and writes as standard output the amount of money you would have after `t` years if you invested `p` dollars at an annual interest rate `r` compounded continuously. The desired value is computed as $\texttt{p}e^{\texttt{rt}}$.

```
$ java CompoundInterest 1000 0.04 1
1040.8107741923882
```

Exercise 12 ($\star$)**.** Write a program called `RandomGaussian.java` that writes as standard output a random number `r` drawn from the Gaussian distribution. One way to do so is to use the Box-Muller formula $\texttt{r} = \sin(2\pi\texttt{v})(-2\ln\texttt{u})^{1/2}$, where `u` and `v` are real numbers between 0 and 1 generated using the `StdRandom.uniform()` function.

```
$ java RandomGaussian
0.6986415851817234
$ java RandomGaussian
1.5489791006972236
```

Exercise 13 ($\star$)**.** Write a program called `OrderCheck.java` that receives three doubles `x`, `y`, and `z` as command-line inputs, and writes `true` as standard output if the values are in strictly ascending ($\texttt{x} < \texttt{y} < \texttt{z}$) or descending ($\texttt{x} > \texttt{y} > \texttt{z}$) order, and `false` otherwise.

```
$ java OrderCheck 3 2 1
true
$ java OrderCheck 1 3 2
talse
```

Solutions

Solution 1.

a. `"blahblahblah"`

b. `"123"`

c. `15`

d. `true`

Solution 2.

a. `15`

b. `1`

c. `2`

d. `8`

e. `2`

f. `6`

g. `4`

Solution 3.

a. `8`

b. `false`

c. `256`

Solution 4.

a. `3.7e7`

b. `5.9e-5`

Solution 5.

a. `7`

b. `5`

c. `71`

d. `6`

e. `4`

f. `true`

g. `false`

Solution 6. Discuss with course staff.

Solution 7. Discuss with course staff.

Solution 8. Discuss with course staff.

Solution 9. Discuss with course staff.

Solution 10. Discuss with course staff.

Solution 11. Discuss with course staff.

Solution 12. Discuss with course staff.

Solution 13. Discuss with course staff.