3.8 Exercises

1. Write a program that generates and prints 50 random integers, each between 3 and 6.
2. Write a program that generates a random number, x, between 1 and 50, a random number y between 2 and 5, and computes x^y.
3. Write a program that generates a random number between 1 and 10 and prints your name that many times.
4. Write a program that generates a random decimal number between 1 and 10 with two decimal places of accuracy. Examples are 1.23, 3.45, 9.80, and 5.00.
5. Write a program that generates 50 random numbers such that the first number is between 1 and 2, the second is between 1 and 3, the third is between 1 and 4, ..., and the last is between 1 and 51.
6. Write a program that asks the user to enter two numbers, x and y, and computes $\frac{|x-y|}{x+y}$.
7. Write a program that asks the user to enter an angle between $-180°$ and $180°$. Using an expression with the modulo operator, convert the angle to its equivalent between $0°$ and $360°$.

8. Write a program that asks the user for a number of seconds and prints out how many minutes and seconds that is. For instance, 200 seconds is 3 minutes and 20 seconds. [Hint: Use the `//` operator to get minutes and the `%` operator to get seconds.]

9. Write a program that asks the user for an hour between 1 and 12 and for how many hours in the future they want to go. Print out what the hour will be that many hours into the future. An example is shown below.

```
Enter hour: 8
How many hours ahead? 5
New hour: 1 o'clock
```

10. (a) One way to find out the last digit of a number is to mod the number by 10. Write a program that asks the user to enter a power. Then find the last digit of 2 raised to that power.

    (b) One way to find out the last two digits of a number is to mod the number by 100. Write a program that asks the user to enter a power. Then find the last two digits of 2 raised to that power.

    (c) Write a program that asks the user to enter a power and how many digits they want. Find the last that many digits of 2 raised to the power the user entered.

11. Write a program that asks the user to enter a weight in kilograms. The program should convert it to pounds, printing the answer rounded to the nearest tenth of a pound.

12. Write a program that asks the user for a number and prints out the factorial of that number.

13. Write a program that asks the user for a number and then prints out the sine, cosine, and tangent of that number.

14. Write a program that asks the user to enter an angle in degrees and prints out the sine of that angle.

4.5 Exercises

1. Write a program that asks the user to enter a length in centimeters. If the user enters a negative length, the program should tell the user that the entry is invalid. Otherwise, the program should convert the length to inches and print out the result. There are 2.54 centimeters in an inch.

2. Ask the user for a temperature. Then ask them what units, Celsius or Fahrenheit, the temperature is in. Your program should convert the temperature to the other unit. The conversions are $F = \frac{9}{5}C + 32$ and $C = \frac{5}{9}(F - 32)$.

3. Ask the user to enter a temperature in Celsius. The program should print a message based on the temperature:

   - If the temperature is less than -273.15, print that the temperature is invalid because it is below absolute zero.
   - If it is exactly -273.15, print that the temperature is absolute 0.
   - If the temperature is between -273.15 and 0, print that the temperature is below freezing.
   - If it is 0, print that the temperature is at the freezing point.
   - If it is between 0 and 100, print that the temperature is in the normal range.
   - If it is 100, print that the temperature is at the boiling point.
   - If it is above 100, print that the temperature is above the boiling point.

4. Write a program that asks the user how many credits they have taken. If they have taken 23 or less, print that the student is a freshman. If they have taken between 24 and 53, print that they are a sophomore. The range for juniors is 54 to 83, and for seniors it is 84 and over.

5. Write a program that asks the user to enter a number and prints the sum of the divisors of that number. The sum of the divisors of a number is an important function in number theory.

6. A number is called a *perfect number* if it is equal to the sum of all of its divisors, not including the number itself. For instance, 6 is a perfect number because the divisors of 6 are 1, 2, 3, 6 and $6 = 1+2+3$. As another example, 28 is a perfect number because its divisors are 1, 2, 4, 7, 14, 28 and $28 = 1+2+4+7+14$. However, 15 is not a perfect number because its divisors are 1, 3, 5, 15 and $15 \neq 1+3+5$. Write a program that finds all four of the perfect numbers that are less than 10000.

7. An integer is called *squarefree* if it is not divisible by any perfect squares other than 1. For instance, 42 is squarefree because its divisors are 1, 2, 3, 6, 7, 21, and 42, and none of those numbers (except 1) is a perfect square. On the other hand, 45 is not squarefree because it is divisible by 9, which is a perfect square. Write a program that asks the user for an integer and tells them if it is squarefree or not.

8. Write a program that swaps the values of three variables x, y, and z, so that x gets the value of y, y gets the value of z, and z gets the value of x.

9. Write a program to count how many integers from 1 to 1000 are not perfect squares, perfect cubes, or perfect fifth powers.

10. Ask the user to enter 10 test scores. Write a program to do the following:

    (a) Print out the highest and lowest scores.

    (b) Print out the average of the scores.

    (c) Print out the second largest score.

    (d) If any of the scores is greater than 100, then after all the scores have been entered, print a message warning the user that a value over 100 has been entered.

    (e) Drop the two lowest scores and print out the average of the rest of them.