1. Introduction to Python programming projects

1.1 Area of a Room

Write a program that asks the user to enter the width and length of a room. Once the values have been read, your program should compute and display the area of the room. The length and the width will be entered as floating point numbers. Include units in your prompt and output message; either feet or meters, depending on which unit you are more comfortable working with.

1.2 Area of a Field

Create a program that reads the length and width of a farmer's field from the user in feet. Display the area of the field in acres.

Hint: There are 43,560 square feet in an acre.

1.3 Bottle Deposits

In many jurisdictions a small deposit is added to drink containers to encourage people to recycle them. In one particular jurisdiction, drink containers holding one liter or less have a $0.10 deposit, and drink containers holding more than one liter have a $0.25 deposit.
Write a program that reads the number of containers of each size from the user. Your program should continue by computing and displaying the refund that will be received for returning those containers. Format the output so that it includes a dollar sign and always displays exactly two decimal places.

1.4 Sum of the First n Positive Integers

Write a program that reads a positive integer, n, from the user and then displays the sum of all of the integers from 1 to n. The sum of the first n positive integers can be computed using the formula:

Formula: $$\text{sum} = \frac{n*(n+1)}{2}$$

1.5 Compound Interest

Pretend that you have just opened a new savings account that earns 4 percent interest per year. The interest that you earn is paid at the end of the year, and is added to the balance of the savings account. Write a program that begins by reading the amount of money deposited into the account from the user. Then your program should compute and display the amount in the savings account after 1, 2, and 3 years. Display each amount so that it is rounded to 2 decimal places.

1.6   Fuel Efficiency

In the United States, fuel efficiency for vehicles is normally expressed in miles-pergallon (MPG). In Canada, fuel efficiency is normally expressed in liters-per-hundred kilometers (L/100 km). Use your research skills to determine how to convert from MPG to L/100 km. Then create a program that reads a value from the user in American units and displays the equivalent fuel efficiency in Canadian units.

1.7   Distance Between Two Points on Earth

The surface of the Earth is curved, and the distance between degrees of longitude varies with latitude. As a result, finding the distance between two points on the surface of the Earth is more complicated than simply using the Pythagorean theorem.

Let (t1, g1) and (t2, g2) be the latitude and longitude of two points on the Earth's surface. The distance between these points, following the surface of the Earth, in kilometers is:

Formula: Distance = 6371.01 × arccos(sin(t1) × sin(t2) + cos(t1) × cos(t2) × cos(g1 − g2))

The value 6371.01 in the previous equation wasn't selected at random. It is the average radius of the Earth in kilometers

Create a program that allows the user to enter the latitude and longitude of two points on the Earth in degrees. Your program should display the distance between the points, following the surface of the earth, in kilometers.

Hint: Python's trigonometric functions operate in radians. As a result, you will need to convert the user's input from degrees to radians before computing the distance with the formula discussed previously. The math module contains a function named radians which converts from degrees to radians.

1.8   Height Units

Many people think about their height in feet and inches, even in some countries that primarily use the metric system. Write a program that reads a number of feet from the user, followed by a number of inches. Once these values are read, your program should compute and display the equivalent number of centimeters.

Hint: One foot is 12 inches. One inch is 2.54 centimeters.

1.9   Distance Units

In this project, you will create a program that begins by reading a measurement in feet from the user. Then your program should display the equivalent distance in inches, yards and miles. Use the Internet to look up the necessary conversion factors if you don't have them memorized.

1.10 Area and Volume of a Circle

Write a program that begins by reading a radius, r, from the user. The program will continue by computing and displaying the area of a circle with radius r and the volume of a sphere with radius r. Use the pi constant in the math module in your calculations.

Hint: The area of a circle is computed using the formula area = πr^2. The volume of a sphere is computed using the formula volume = $\frac{4}{3}\pi r^3$.