CODING – PART 2

BIG IDEAS:

- Different **data types** (integer, floating point number, string, etc.) are used to store different types of information
- Programs can be designed to accept and utilize **user inputs**
- Specific functions can be accessed through imported **libraries** or **modules**

LEARNING GOALS AND SKILL DEVELOPMENT:
You know you have met the goals for this lesson when you can:

EMERGING

LEARNING GOALS	ANCHOR QUESTIONS	SKILL BUILDING QUESTIONS			
Differentiate between data types used in computer programming	1, 2	1	2	3	
Identify appropriate data types for a program	2, 3				
Explain how a user input affects a program's output	2, 3				

EVOLVING

LEARNING GOALS	ANCHOR QUESTIONS	SKILL BUILDING QUESTIONS			
Identify when a library is needed for a function in a program	4	4	5	6	7
Explain the importance of using correct data types	5				
Write a program that accepts and manipulates a user input	6				
Write a program that requires a function from a library	7				

EXTENDING

LEARNING GOALS	ANCHOR QUESTIONS	SKILL BUILDING QUESTIONS			
Write and use a program containing a function from a library to solve a problem based on values entered by the user	8	8	9		
Write and use a program that uses a library and user input to solve a problem for which an algebraic model is not provided	9				

BUILD YOUR SKILLS

1. Briefly describe each of the following data types.

a) integer b) floating point number c) string

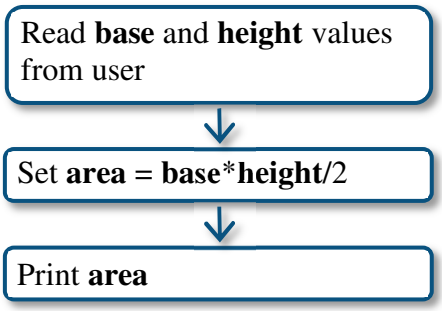
2. Consider the blocks of code shown on the right.

a) What is the purpose of this program?

b) Explain what is happening in each block of code.

c) What data types(s) would likely be used for the **base** and **height** variables in this program?

d) If this program was implemented using Python, what data type would be used for the **area** variable? Explain.



3. Consider the Python program shown on the right, in which a value of *y* is calculated based on a value of *x*.

a) Explain the purpose of line #2.

b) Why is the *float* function used in line #2?

c) If *x* is assigned a value of 4, what output will the program return?

```
1  # Read value of x from user.
2  x=float(input("Enter the value of x: "))
3
4  # Calculate y.
5  y=x**2+5*x-7
6
7  # Print y.
8  print("The value of y is",y)
```

4. Consider the Python program shown on the right, which can be used to calculate a circle's circumference and area.

a) Explain what is happening on line #2. Why is this step necessary for this program?

b) Explain the meaning of *math.pi* in lines #8 and #9.

c) Modify the program so that the user enters the circle's diameter instead of its radius.

```
1  # Import math library.
2  import math
3
4  # Read radius value from user.
5  radius=float(input("Enter the radius: "))
6
7  # Calculate the circumference and area.
8  C=2*math.pi*radius
9  A=math.pi*radius**2
10
11 # Print the circumference and area.
12 print("The circumferece is",C)
13 print("The area is",A)
```

5. Consider the snippet of Python code shown below.

```
x=int(input("What's your favourite integer? "))
```

a) What is the purpose of the *int* function in this code?

b) What would happen if a user entered a value of 2.3 at this prompt? Explain.

6. Aaron would like to write a Python program for quickly calculating air temperatures (in °C) at various altitudes. He would like the program to perform the following steps, in order:

- Prompt the user to input the elevation (E) of the desired location in feet.
- Prompt the user to input the temperature at ground level (G) in degrees Celsius.
- Prompt the user to input the desired altitude (A) above sea level.
- Calculate the temperature at the desired altitude (T) using the formula $T = G - (A - E) \div 500$ and display the result, rounded to one decimal place.

a) When using the above formula in Python, why are the brackets important?

b) Use Python to create the program.

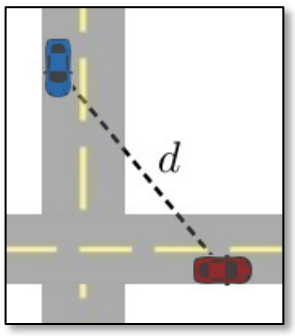
c) Use your program to determine the air temperature over the town of Simcoe, which has an elevation of 735 feet, at an altitude of 5500 feet above sea level on a day when the temperature at ground level is 28.5 °C.

7. When looking out to sea, the approximate distance to the horizon can be found using the equation $d = 3.6\sqrt{h}$, where h is the height of the observer's eyes (in metres) and d is the distance to the horizon (in kilometres).

a) Create a Python program that calulates the distance to the horizon for a height entered by the user. Round the distance to the nearest hundredth of a kilometre.
Note: To calculaute the square root of h, use `math.sqrt(h)`

b) Use your program to estimate the distance to the horizon for heights of 1.5 m and 175 m.

8. Distance between two cars travelling on different roads at different speeds is modelled by the equation $d = \sqrt{5t^2 - 20t + 25}$, where t represents the number of minutes passed and d represents the distance between the cars (in kilometres).



a) Create a Python program that calculates the distance between the cars for a time entered by the user.

b) Use your program to determine the minimum distance between the two cars to the nearest tenth of a kilometre.

9. A rectangle has an area of 812.25 m^2.

a) Write a Python program that calculates the perimeter of the rectangle based on the length entered by the user.

b) Use your program to determine the minimum perimeter of a rectangle with has an area of 812.25 m^2. What are the dimensions of this rectangle?

CHECK YOUR UNDERSTANDING

1. a) An *integer* data type represents an integer $(..., -3, -2, -1, 0, 1, 2, 3, ...)$.

b) A *floating point number* data type represents a real number (decimals, fractions, etc.).

c) A *string* data type represents a string of characters (text).

2. a) The program computes the area of a triangle for base and height values entered by the user.

b) Block #1: The variables **base** and **height** are defined with values input by the user.
Block #2: The variable **area** is defined as **base***__height__/2.
Block #3: The value of **area** is displayed.

c) Either integers or floating point numbers.

d) Floating point number, since the definition of **area** involves division, which always returns a floating point number in Python.

3. a) The purpose of line #2 is to define the variable **x** with a value that the user enters when prompted.

b) The *input* function stores the user input as a string. The *float* function is needed to convert the input to a floating point number that can be used for calculation in line #5.

c) `29`

4. a) In line #2, the *math library* is imported. The math library is a collection of mathematical functions and constants that can be used in programs once imported. The math library is needed for this program since π (pi) is used in the calculations.

b) *math.pi* is the syntax used for entering an accurate value for π (pi). The *math* part indicates that we are using the math library and the *pi* part indicates that we are accessing the π (pi) constant from that library.

c)

```
1  # Import math library.
2  import math
3
4  # Read diameter value from user.
5  diameter=float(input("Enter the diameter: "))
6
7  # Calculate the radius.
8  radius=diameter/2
9
10 # Calculate the circumference and area.
11 C=2*math.pi*radius
12 A=math.pi*radius**2
13
14 # Print the circumference and area.
15 print("The circumferece is",C)
16 print("The area is",A)
```

ANSWERS

ANSWERS

5. a) The *input* function stores the user input as a string. The *int* function converts the input to an integer data type so that it can be used in calculations.

b) The program would return an error since 2.3 is not an integer.

6. a) The brackets are needed to specify that the difference between A and E is to be divided by 500. Without the brackets, only E would be divided by 500.

b)

```
# Read values from user.
E=float(input("Enter the elevation (in feet): "))
G=float(input("Enter the temperature at ground level (in degrees Celsius): "))
A=float(input("Enter the desired altitude above sea level (in feet): "))

# Calculate the air temperature at the desired altitude.
T=G-(A-E)/500

# Round T to one decimal place.
T_rounded=round(T,1)

# Print the temperature at the desired altitude.
print("The temperature at",A,"feet is",T_rounded,"degrees Celsius.")
```

c) 19.0 °C

7. a)

```
# Import math library.
import math

# Read height from user.
h=float(input("Please enter the height (in metres): "))

# Calculate the distance to horizon.
d=3.6*math.sqrt(h)

# Round the distance to two decimal places.
d_rounded=round(d,2)

# Print distance to horizon.
print("The distance to the horizon is approximately",d_rounded,"km.")
```

b) For a height of 1.5 m, the distance to the horizon is approximately 4.41 km.
For a height of 150 m, the distance to the horizon is approximately 47.62 km.

8. a)

```
# Import math library.
import math

# Read time from user.
t=float(input("Please enter the number of minutes: "))

# Calculate the distance between the cars.
d=math.sqrt(5*t**2-20*t+25)

# Print the distance between the cars.
print("The distance between the cars is",d,"km.")
```

b) 2.24 km

9. a)

```
# Import math library.
import math

# Read length from user.
l=float(input("Please enter the length of the rectangle (in metres)): "))

# Calculate the width.
w=812.25/l

# Calculate the perimeter.
P=2*l+2*w

# Print the perimeter.
print("The perimeter is",P,"m." )
```

b) The minimum perimeter is 114 m when the length and width are both 28.5 m (a square).