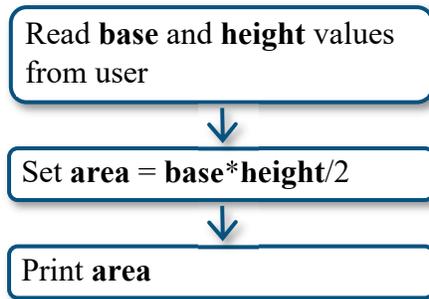


## PART A

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 left.

- What is the purpose of this program?
- Explain what is happening in each block of code.
- What data type(s) would likely be used for the **base** and **height** variables in this program?
- 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  $x$ .

- Explain the purpose of line #2.
- Why is the *float* function used in line #2?
- 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)
  
```

## PART B

```

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)
  
```

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

- Explain what is happening on line #2. Why is this step necessary for this program?
- Explain the meaning of *math.pi* in lines #8 and #9.
- Modify the program so that the user enters the circle's diameter instead of its radius.

- 5) Consider the snippet of Python code shown on the right.

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

- What is the purpose of the `int` function in this code?
- 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.



- When using the above formula in Python, why are the brackets important?
- Use Python to create the program.
- 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.

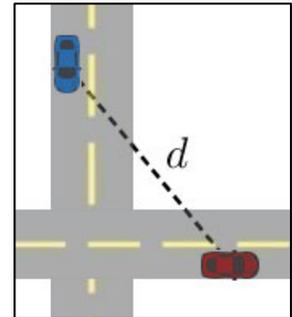
- 7) When looking out to sea, the approximate distance to the horizon can be found using the equation  $d = 3.6\sqrt{h}$ , where  $h$  is the height of the observer's eyes (in metres) and  $d$  is the distance to the horizon (in kilometres).



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

- Create a Python program that calculates the distance between the cars for a time entered by the user.
- Use your program to determine the minimum distance between the two cars to the nearest tenth of a kilometre.



## PART C

- 9) A rectangle has an area of 812.25 m<sup>2</sup>.
- Write a Python program that calculates the perimeter of the rectangle based on the length entered by the user.
  - Use your program to determine the minimum perimeter of a rectangle with has an area of 812.25 m<sup>2</sup>. What are the dimensions of this rectangle?

## ANSWERS

- 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  $\pi$  (pi) is used in the calculations.  
b) *math.pi* is the syntax used for entering an accurate value for  $\pi$  (pi). The *math* part indicates that we are using the math library and the *pi* part indicates that we are accessing the  $\pi$  (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)
```
- 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)

```

1 # Read values from user.
2 E=float(input("Enter the elevation (in feet): "))
3 G=float(input("Enter the temperature at ground level (in degrees Celsius): "))
4 A=float(input("Enter the desired altitude above sea level (in feet): "))
5
6 # Calculate the air temperature at the desired altitude.
7 T=G-(A-E)/500
8
9 # Round T to one decimal place.
10 T_rounded=round(T,1)
11
12 # Print the temperature at the desired altitude.
13 print("The temperature at",A,"feet is",T_rounded,"degrees Celsius.")

```

c) 19.0 °C

7) a)

```

1 # Import math library.
2 import math
3
4 # Read height from user.
5 h=float(input("Please enter the height (in metres): "))
6
7 # Calculate the distance to horizon.
8 d=3.6*math.sqrt(h)
9
10 # Round the distance to two decimal places.
11 d_rounded=round(d,2)
12
13 # Print distance to horizon.
14 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)

```

1 # Import math library.
2 import math
3
4 # Read time from user.
5 t=float(input("Please enter the number of minutes: "))
6
7 # Calculate the distance between the cars.
8 d=math.sqrt(5*t**2-20*t+25)
9
10 # Print the distance between the cars.
11 print("The distance between the cars is",d,"km.")

```

b) 2.24 km

9) a)

```

1 # Import math library.
2 import math
3
4 # Read length from user.
5 l=float(input("Please enter the length of the rectangle (in metres): "))
6
7 # Calculate the width.
8 w=812.25/l
9
10 # Calculate the perimeter.
11 P=2*l+2*w
12
13 # Print the perimeter.
14 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).