CIS 6 :: Lab 03 - Numbers in Python

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Task 1: Definitions & Concepts

Instructions: Answer the questions below.

1. What are the two Python number types:
   => int for whole numbers, float for decimal numbers
2. List a few samples examples to above number types:
   => *100, -29, 0* are examples of integers. *0.12, 1.0, 15.6666* are examples of floats
3. List three Python math functions and explain what they are used for:
   => math.exp(x) gives the exponential of x, math.sqrt(x) gives the square root of x, math.sin(x) gives the sine of x
4. How many different numbers below bits can represent:
   a. 1 byte (8 bits): 2**8 = 256
   b. 2 bytes (16 bits): 2**16 = 65,536
   c. 4 bytes (32 bits): 2 ** 32 = 2,147,483,648
   d. 8 bytes (64 bits): 2 ** 64 18446744073709551615

5: Short Research

Computers can't really work with decimal numbers. What they do is an approximation of decimal numbers. Research and find out what that means. Briefly explain.

=> The length of a number that a computer can accurately give is limited by the amount of memory available. It's much more memory efficient to store approximate float values rather than assigning more bits of memory to each number

Task 2: Understanding Programming

1. Show the result of evaluating each expression and the types (int, float) or legal/illegal:

a. 4.0 / 10.0 + 3.5 * 2: 7.4, float

b. 10 % 4 + 6 / 2: 5.0, float

c. abs(4 - 20 // 3) ** 3: 8, int

d. sqrt(4.5 - 5.0) + 7 * 3: illegal

e. 3 * 10 // 3 + 10 % 3: 11, int

f. 3 ** 3: 27, int

2. Translate below math expressions into Python expressions:
   a. (3 + 4) / 5: (3+4) / 5
   b. $\frac{n(n-1)}{2}$: (n*(n-1))/2
   c. $4\pi 2^2$: 4*math.pi*2**2

d. $\sqrt{r(cos\ a)^2 + r(sin\ b)^2}$: math.sqrt(r*(math.cos(a))**2 + r*(math.sin(b))**2)

e. $\frac{y2-y1}{x2-x1}$: (y2 - y1) / (x2 - x1)

3. Show the sequence of numbers that would be generated by below range expressions:
   a. range(5): 0, 1, 2, 3, 4
   b. range(3, 5): 3, 4
   c. range(6, 20, 3): 6, 9, 12, 15, 18
   d. range(19, 6, -1): 19, 18, 17, 16, 15, 14, 13, 13, 12 ,11, 10, 9, 8, 7
   e. range(7, 8): 7
4. Assume that we execute the following assignment statements:

   width = 17

   height = 12.0

   For each of the following expressions, write the value of the expression and the type (of the value of the expression).

   1. width // 2: 8, int
   2. width / 2.0: 8.5, float
   3. height / 3: 4.0, float
   4. 1 + 2 * 5: illegal, the slash is facing the wrong way

Use the Python interpreter to check your answers.

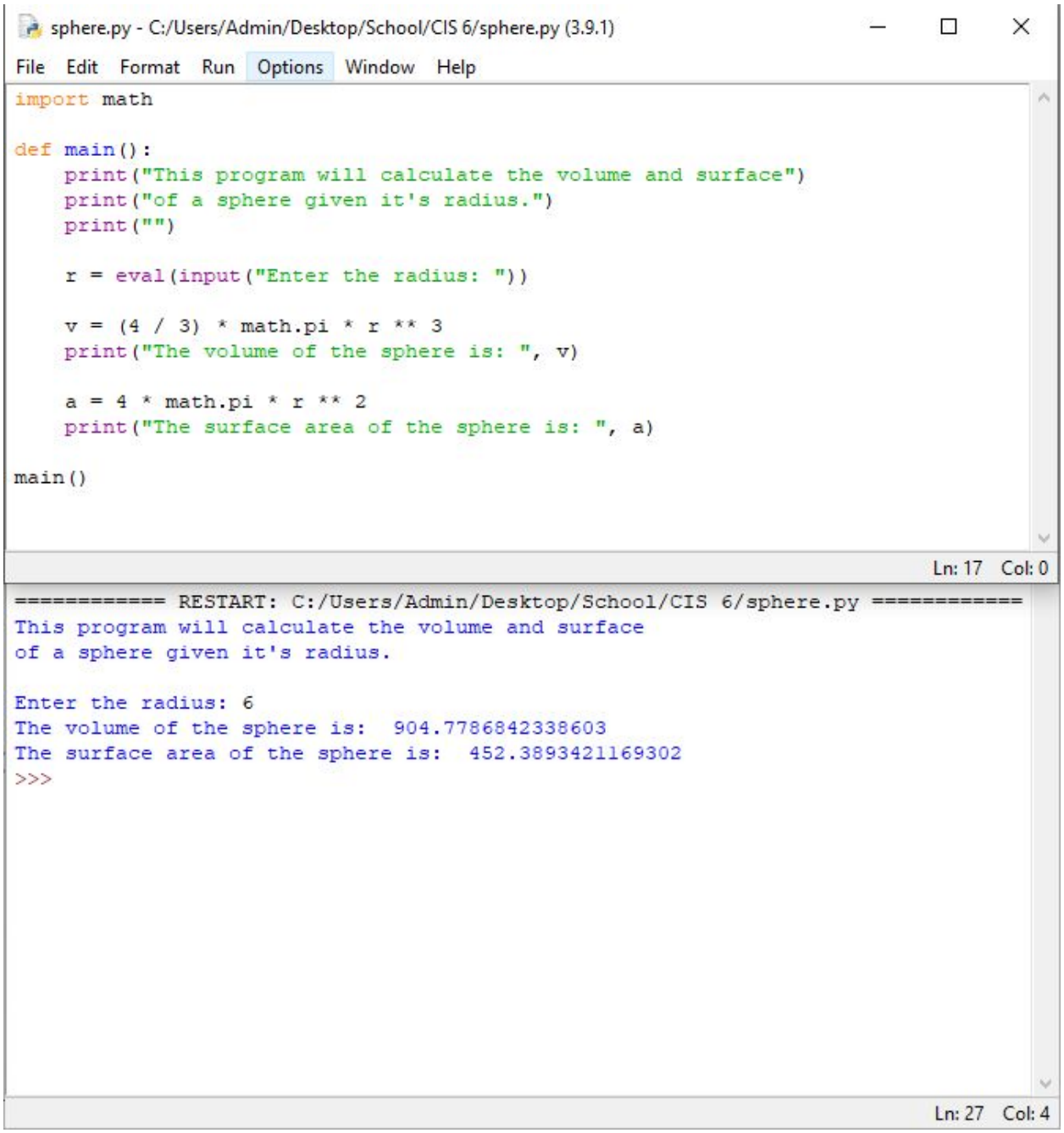
Task 3: Programming Exercises

Instructions: Use Python IDLE to write and execute below exercises from the book chapter 3. Attach Snipping photos of your source code and executions of the code in Python shell. Make sure to create separate files for each exercise. **Your screenshots must be legible.**

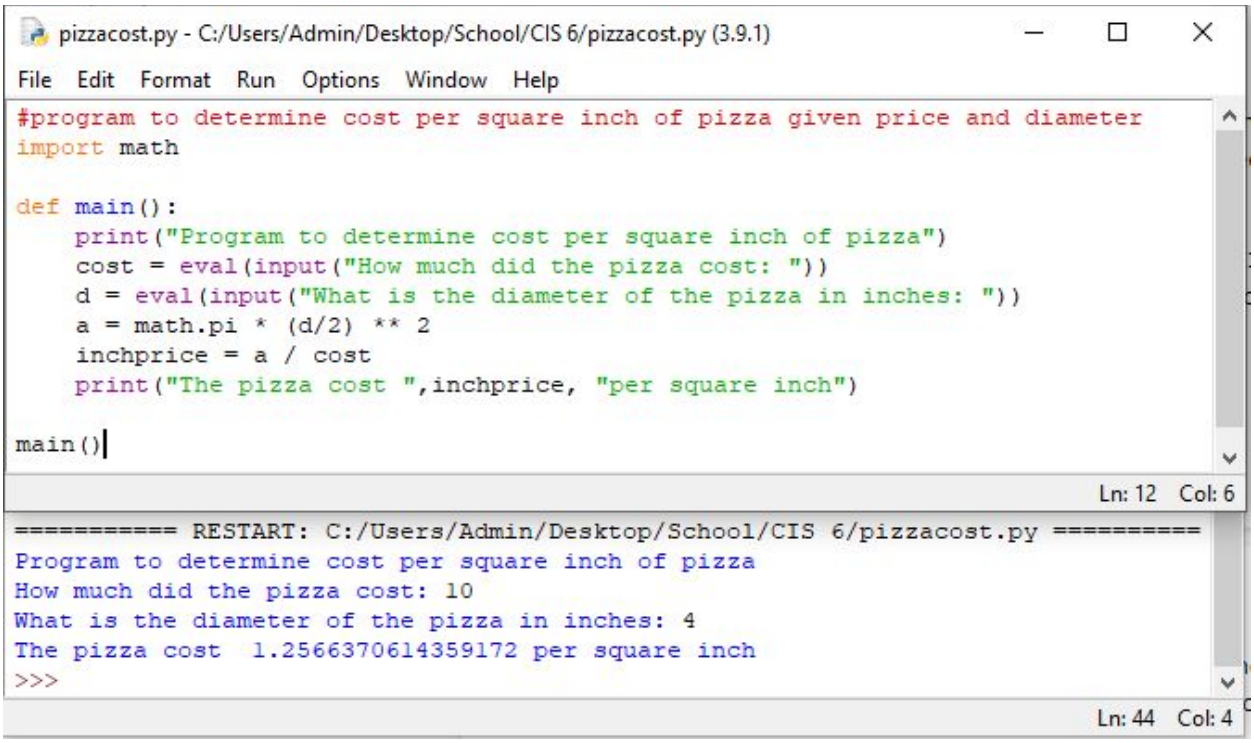
Exercise 1: Write a program to calculate the volume and surface area of a sphere from its radius, given as input. Here are some formulas that might be useful:

$$V = 4/3\pi r^3$$

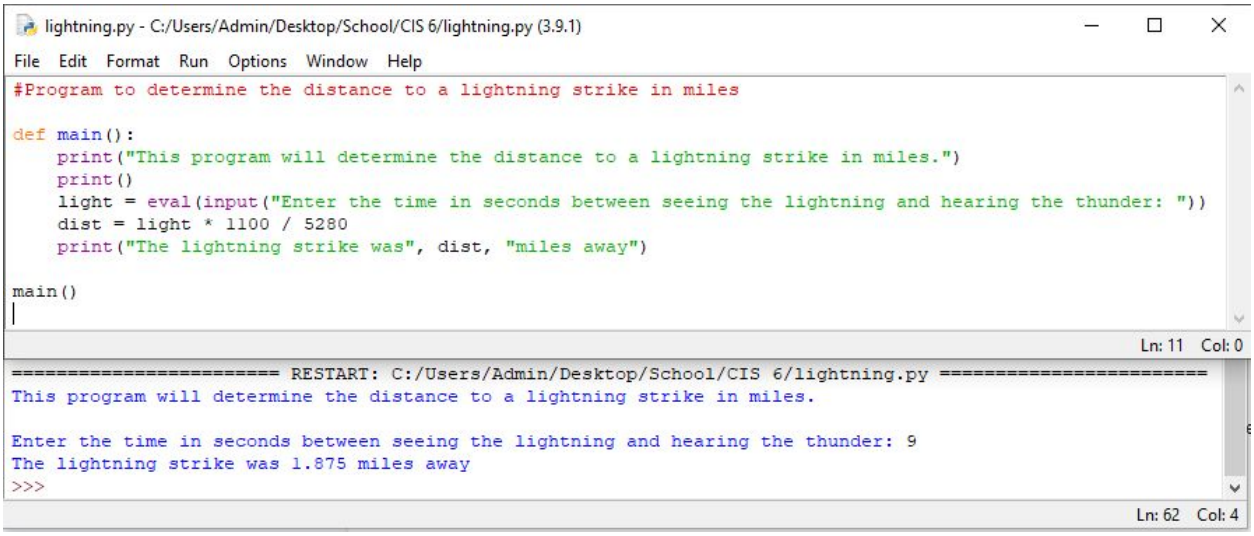
$$A = 4\pi r^2$$



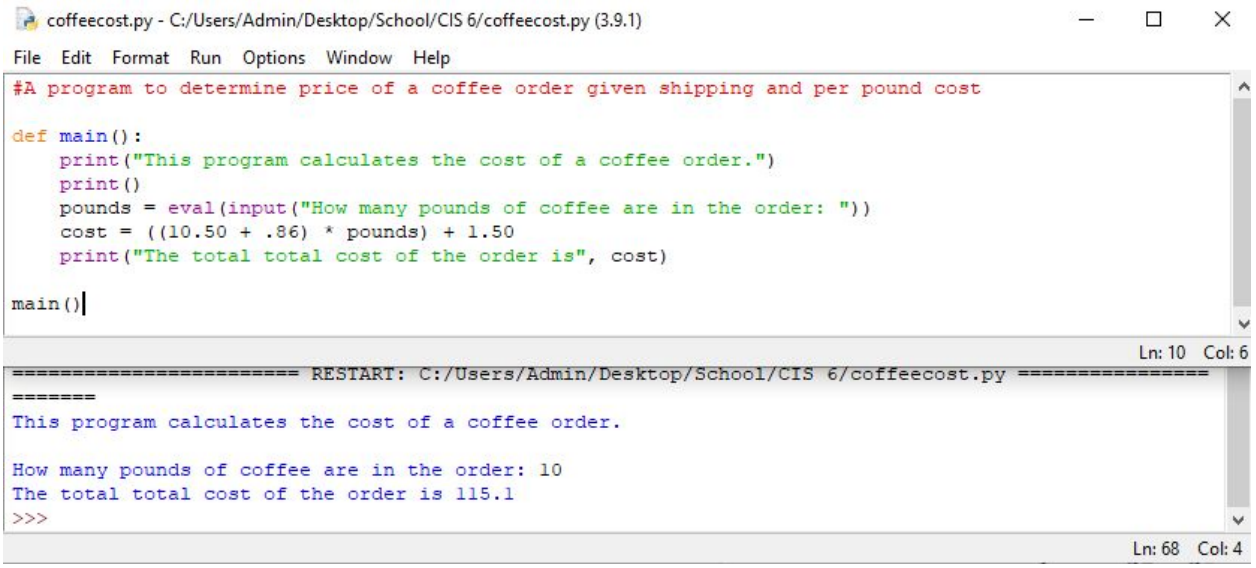
Exercise 2: Write a program that calculates the cost per square inch of a circular pizza, given its diameter and price. The formula for area is $A = \pi r^2$.



Exercise 4: Write a program that determines the distance to a lightning strike based on the time elapsed between the flash and the sound of thunder. The speed of sound is approximately 1100 ft/ sec and 1 mile is 5280 ft.

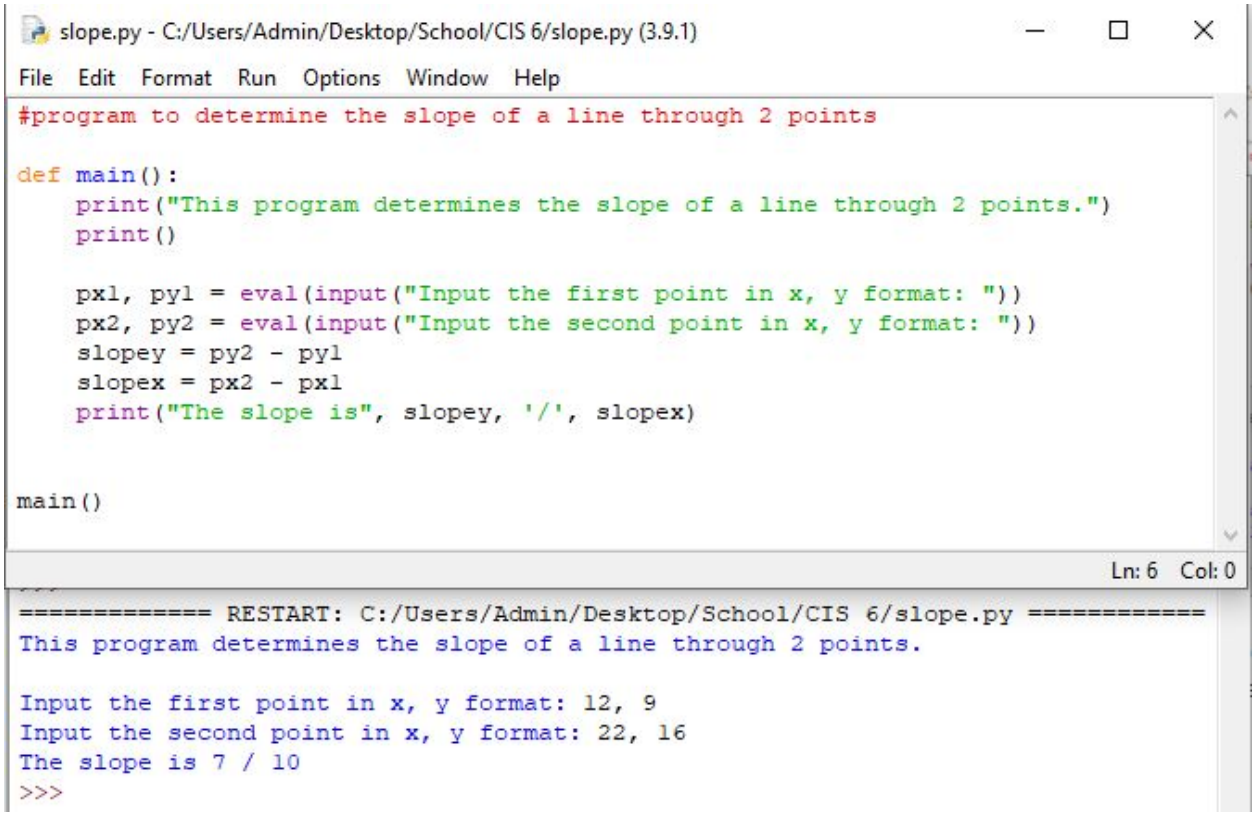


Exercise 5: The Konditorei coffee shop sells coffee at $10.50 a pound plus the cost of shipping. Each order ships for $0.86 per pound + $1.50 fixed cost for overhead. Write a program that calculates the cost of an order.



Exercise 6: Two points in a plane are specified using the coordinates (x1, y1) and (x2, y2). Write a program that calculates the slope of a line through two (non-vertical) points entered by the user

$$slope = \frac{y2 - y1}{x2 - x1}$$



Exercise 7: Write a program that accepts two points (see previous problem) and determines the distance between them.

$$distance = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

distance.py - C:\Users\Admin\Desktop\School\CIS 6\distance.py (3.9.1)

File Edit Format Run Options Window Help

```
#program to determine the distance between 2 points
import math

def main():
    print("This program determines the distance between 2 points.")
    print()

    px1, py1 = eval(input("Input the first point in x, y format: "))
    px2, py2 = eval(input("Input the second point in x, y format: "))
    slopey = py2 - py1
    slopex = px2 - px1
    print("The slope is", slopey, '/', slopex)
    dis = math.sqrt(slopex + slopey)
    print("The distance between the points is", dis)

main()
```

Ln: 16 Col: 6

```
>>>
========== RESTART: C:\Users\Admin\Desktop\School\CIS 6\distance.py ==========
This program determines the distance between 2 points.

Input the first point in x, y format: 8, 13
Input the second point in x, y format: 15, 22
The slope is 9 / 7
The distance between the points is 4.0
>>>
```

Exercise 9: Write a program to calculate the area of a triangle given the length of its three sides - a, b, and c - using these formulas:

$$s = \frac{a+b+c}{2} \quad A = \sqrt{s(s-a)(s-b)(s-c)}$$

triangleareа.py - C:/Users/Admin/Desktop/School/CIS 6/triangleareа.py (3.9.1)

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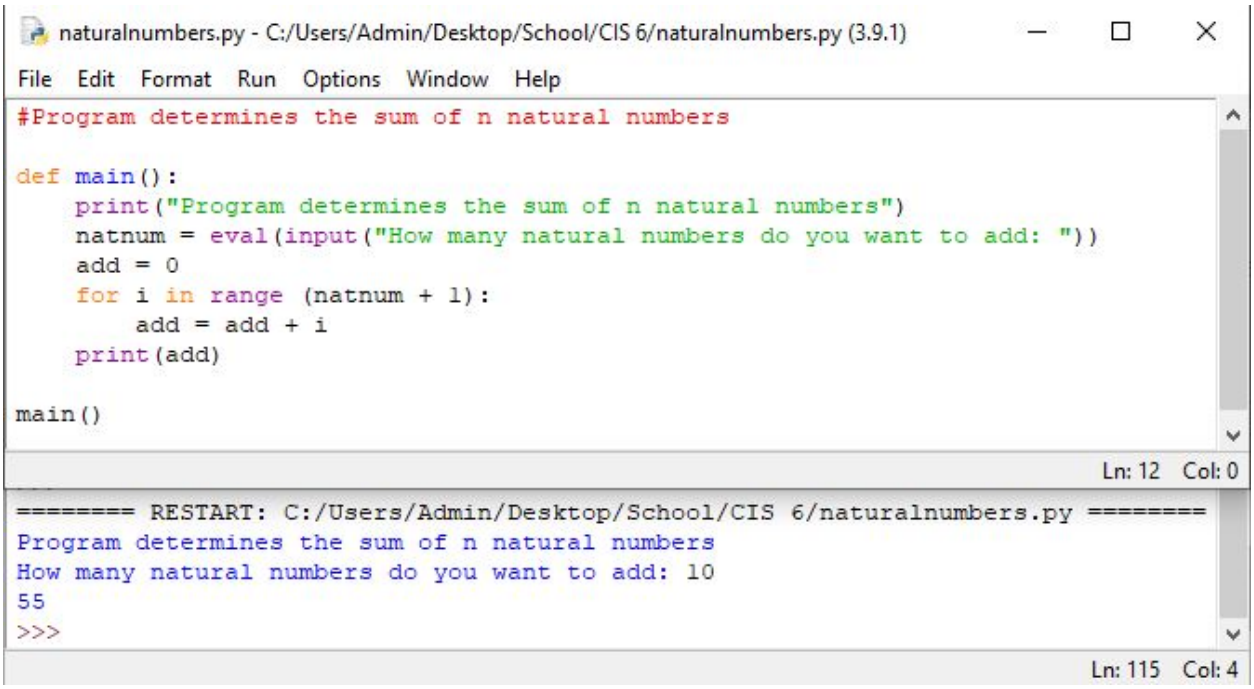
```
import math

def main():
    print("Program to calculate the area of a triangle.")
    print("")
    a, b, c = eval(input("Enter the length of each side seperated by commas: "))
    s = (a + b + c)/2
    area = math.sqrt(s *(s - a)*(s - b)*(s - c))
    print("The area of the triangle is ", area)

main()
```

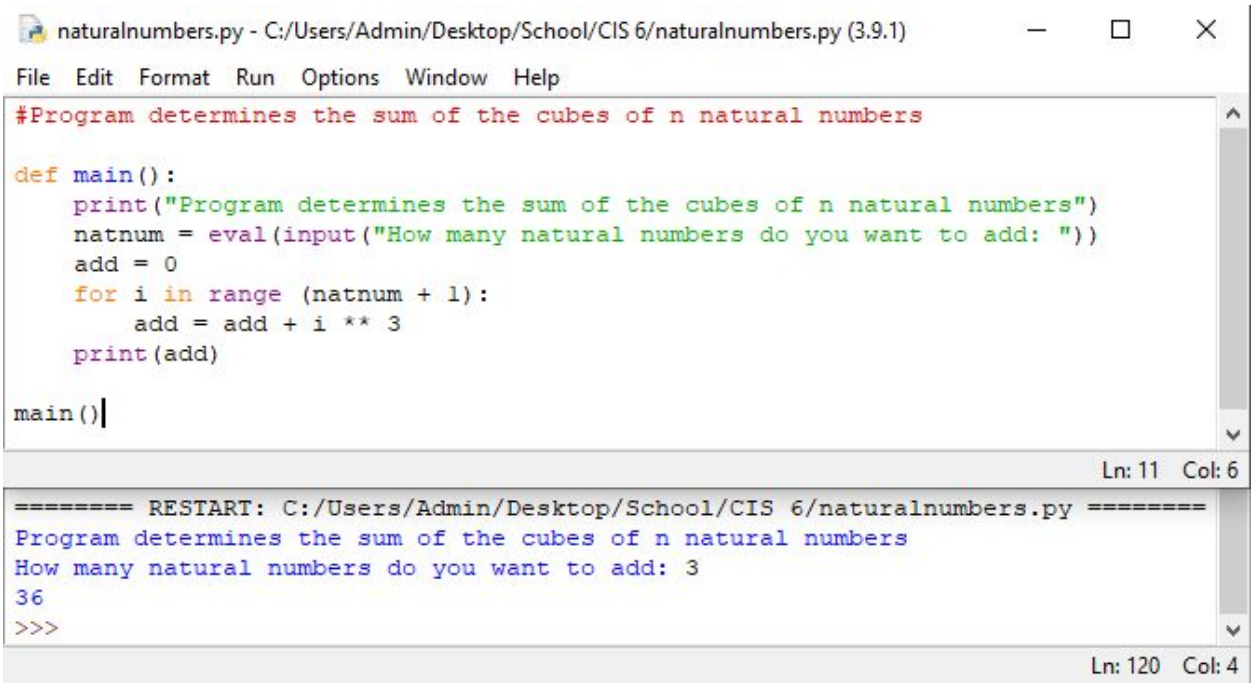
Ln: 12 Col: 0

```
========= RESTART: C:/Users/Admin/Desktop/School/CIS 6/triangleareа.py =========
Program to calculate the area of a triangle.

Enter the length of each side seperated by commas: 7, 12.5, 8
The area of the triangle is  25.828082463667332
>>>
```

Exercise 11: Write a program to find the sum of the first n natural numbers, where the value of n is provided by the user.



Exercise 12: Write a program to find the sum of the cubes of the first n natural numbers where the value of n is provided by the user.



Exercise 13 (optional):

Exercise 14 (Optional):