

Exploring Volume with Coding

Part A: Volume of a Prism

What happens to the volume of a prism when its height is doubled?

About the Code: Different computer languages might use different keyboard characters for math calculations, but all languages follow the order of operations (BEDMAS) in their calculations. In Python, one asterisk (*) is used for multiplication.

1. Copy this exact code into a Python console, such as [Google Colab](https://cscircles.cemc.uwaterloo.ca/console/) or <https://cscircles.cemc.uwaterloo.ca/console/> to calculate the volume of a rectangular based prism as its height doubles each time.

```
length = 5
width = 5
height = 10

print ("Height  Prism Volume")

for i in range (0,10):
    baseArea = length * width
    prismVolume = round(baseArea * height)
    print (height, "\t", prismVolume)
    height = height * 2
```

About the Code:

- The values for the length and width both start at 5, and the value for height starts at 10.
- The title for each column of data that will be output are: **Height, Prism Volume**.
- A “for” loop is used to repeat the indented code below it 10 times.

Select *Run* to execute the code.

- a) What does the output look like?
- b) What happens to the volume of a prism each time the height is doubled?

Measurement
Unit 3 Line Master 2b**Exploring Volume with Coding (cont'd)****Part B: Volume of a Pyramid**

What happens to the volume of a pyramid as its height is doubled?

Let's alter the code from Part A so that it displays the volume of a pyramid with the same base and starting height as the prism.

Recall that the volume of a pyramid is $\frac{1}{3}$ the volume of a prism with the same base and height. So, you just need to divide the volume from Part A by 3.

2. Alter the code for the prism in Part A as shown below.

```
length = 5
width = 5
height = 10

print ("Height  Pyramid Volume")

for i in range (0,10):
    baseArea = length * width
    pyramidVolume = round((baseArea * height)/3)
    print (height, "\t", pyramidVolume)
    height = height * 2
```

a) What does the output look like?

b) What happens to the volume of the pyramid each time the height is doubled?

Exploring Volume with Coding (cont'd)**Part C: Volume of a Cylinder**

What happens to the volume of a cylinder as its height is doubled?

Alter the code again to determine the volume of a cylinder.

Recall that the volume of a cylinder, like the volume of a prism, is:
area of base \times height.

The area of the base of a cylinder is the area of a circle:

Area of a circle = πr^2

About the Code:

In Python, two asterisks (**) are used for an exponent.

3. Copy this exact code to calculate the volume of a cylinder as its height doubles each time.

```
radius = 5
height = 10

print ("Height  Cylinder Volume")

for i in range (0,10):
    baseArea = 3.14 * radius**2
    volumeCylinder = round(baseArea * height)
    print (height,"\t", volumeCylinder)
    height = height * 2
```

a) What does the output look like?

b) What happens to the volume of the cylinder each time the height is doubled?

Exploring Volume with Coding (cont'd)

What happens to the volume of a cylinder as its radius is doubled?

4. Alter the code in question 3 so that the radius doubles rather than the height:

```
radius = 5
height = 10

print ("Height Cylinder Volume")

for i in range (0,10):
    baseArea = 3.14 * radius**2
    volumeCylinder = round(baseArea * height)
    print (height, "\t", volumeCylinder)
    radius = radius * 2
```

a) Before running the code, predict what will happen to the volume of the cylinder as the radius is doubled.

b) Execute the code. What does the output look like?

c) What happens to the volume of the cylinder each time the radius is doubled? Why does this happen?

Exploring Volume with Coding (cont'd)**Part D: Volume of a Cone**

Recall that the volume of a cone is $\frac{1}{3}$ the volume of a cylinder with the same base and height.

5. Alter the code in Part C to see what happens to the volume of a cone when its radius is doubled.

```
radius = 5
height = 10

print ("Height Cone Volume")

for i in range (0,10):
    baseArea = 3.14 * radius**2
    volumeCone = round((baseArea * height)/3)
    print (height, "\t", volumeCone)
    radius = radius * 2
```

a) What does the output look like?

b) What happens to the volume of a cone as the radius is doubled?

Exploring Volume with Coding (cont'd)

Reflect and Connect

6. Predict what will happen to the volume of a prism or pyramid when its height is tripled.
7. Predict what will happen to the volume of a cylinder or cone when its height is tripled.
8. Predict what will happen to the volume of a cylinder or cone when its radius is tripled.
9. Alter the code to explore how changing dimensions affects the area or volume of other 2-D shapes and 3-D objects.