# Introduction to Computer Programming

## 1.2 Variables

# Variables

- We need a way to store and use values, e.g. numbers, within a program
- We can *assign* a value to a variable.
- The `print` function displays whatever is between the parenthses `(...)`

In [37]:

```
A = 1
print(A)
```

```
1
```

In [8]:

```
A = 1.0
B = 4.0
```

```
True
```

In [4]:

```
A, B = 1.0, 4.0
```

# Data Types

Every variable has a type ( `int` , `float` , `string` ....).

**Basic Data Types** (not exhaustive)

- `int` integer
- `float` floating point number (number with decimal point)
- `str` string: text data enclosed within quotation marks
  e.g. `'text'` or `"text"`
  (including number represented as text data)
- `bool` boolean: True or False

A type is automatically assigned when a variable is created.

Python's `type()` function returns the type of a variable within the parentheses `(...)` .

**Example:** Create some variables and display their type

In [39]:

```
A = 1
print(A, type(A))

B = 1.0
print(B, type(B))

C = '1'
print(C, type(C))

D = True
print(D, type(D))
```

```
1 <class 'int'>
1.0 <class 'float'>
1 <class 'str'>
True <class 'bool'>
```

### Casting

The data type of a variable can be converted by *casting* ( `int(variable_name)` , `float(variable_name)` ....) **Example:** Convert from a floating point number to an integer

In [26]:

```
B = 1.0
E = int(B)
print(E, type(E))
```

```
1 <class 'int'>
```

# Arithmetic Operators

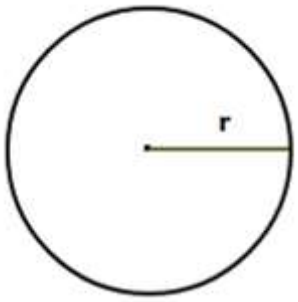
Python can be used like a calculator.

**Arithmetic operators** (+, -, /, * ....) are used with numeric values to perform common mathematical operations.

Operators are listed ib order of operator precedence

| | |
|---|---|
| ** | Exponent |
| * | Multiplication |
| / | Division |
| // | Floor division (round down to the next integer) |
| % | Modulo `a % b = a - b * (a // b)` (remainder) |
| + | Addition |
| − | Subtraction |

**Example:** Find the area of a circle with diameter 2 metres




$$A = \pi r^2$$

In [3]:

```
pi = 3.142

r = 2

A = pi * r ** 2

print(A, 'm2')
```

```
12.568 m2
```

## Arithmetic operators - a word of warning!

**Question**: What will the output of the following code be?

```
A = 2
B = '2'

print(A + A)

print(A + B)

print(B + B)
```

```
A = 2
B = '2'
```

**Answer**: Numbers represented as strings are not recognised as numerical values.
Arithmetic Operators behave differently on numerical and non-numerical values.

```
print(A + A)
```

```
2
```

```
print(A + B)
```

> Error.
> Cannot add numerical and non-numerical value

```
print(A + A)
```

> 22
> Adding string (text) data connect the two strings

In [43]:

```
A = 2

B = '2'

print (A + A)

# print (A + B) # generates an error

print (B + B) # strings are connected using +
```

```
4
22
```

**Comments:**
Comment are notes in the program that are not be run as code.
The hash `#` symbol is used to add a *comment* to a line of code.

When you complete the in-class exercises today you can choose to:

- save your answers to each exercise as separate .py (Python) files
- *comment out* some of your code to allow you to store it all in one file, but only run certain (*uncommented*) blocks of code

# Strings

Strings behave differently from numerical data.

We can return the Nth character(s) of a string with `string[N]` :

In [6]:

```
x = 'Hello'

print(x[0])   # first letter

print(x[4])   # last letter
print(x[-1])

print(x[0:3]) # first 3 letters
print(x[:3])

print(x[2:5])  # last three letters
print(x[2:])
print(x[-3:])
```

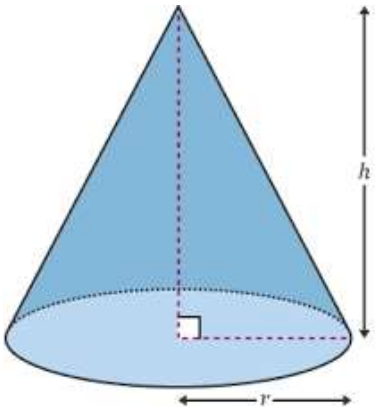
```
H
o
o
Hel
Hel
llo
llo
llo
```

# In-class Demos

**Example 1:** Find the volume of a cone.

Base radius = 2 cm
Height = 10 cm

Volume of a cone: $V = \frac{Ah}{3}$
where $A =$ base area




In [5]:

```

```

```
41.89333333333333 cm3
```

**Example 2:** Create a varibale `Name` and assign it a `string` value.
Use the variable to print the output: `My name is` followed by the value of `Name` . e.g.

```
    My name is Hemma
```

In [10]:

```

```

```
My name is Hemma
```