

>>> Python in 5 Problems

A Friendly Introduction
to Coding for Mathematics,
Grade 9 (MTH1W1)

Reference Guide

PROBLEM #1

The height of a ball (in metres), t seconds after it is thrown, is given by the equation $h = -4.9t^2 + 20t + 2$. Investigate how the ball's height changes over time.



Calculate and print a value.

- ★ Write a comment (#)
- ★ Define variables
- ★ Input exponents (**)
- ★ Print a string (text)
- ★ Print a variable

```
1 # Set value for time.
2 t=0
3
4 # Calculate height.
5 h=-4.9*t**2+20*t+2
6
7 # Print height.
8 print("The height is:")
9 print(h)
```



Round a value.

- ★ **round** function
- ★ Print variables and strings on same line

```
1 # Set value for time.
2 t=3.5
3
4 # Calculate height.
5 h=-4.9*t**2+20*t+2
6
7 # Round height value.
8 h_rounded=round(h,2)
9
10 # Print rounded height.
11 print("The height is",h_rounded,"metres.")
```



Use a **for** loop to calculate and print several values.

- ★ **for** loop
- ★ **range** function
- ! **range(10)** uses integers from 0 through 9

```
1 # Calculate and print several heights.
2 for t in range(10):
3     h=round(-4.9*t**2+20*t+2,1)
4     print(t,h)
```



Use a **while** loop to calculate and print several values.

- ★ **while** loop
- ★ **and** operator

```
1 # Set initial values.
2 t=0
3 h=0
4
5 # Calculate and print several heights.
6 while t>=0 and h>=0:
7     h=-4.9*t**2+20*t+2
8     print(round(t,1),"---",round(h,2))
9     t=t+0.1
```

PROBLEM #2

Investigate how changing a cylinder's dimensions affects its surface area.



Use the **math** library for π .

- ★ **math** library
- ★ Input π

```
1 # Import math library (for pi).
2 import math
3
4 # Set fixed radius value.
5 r=1
6
7 # Calculate and print surface area for several heights.
8 for h in range(20):
9     A=2*math.pi*r**2+2*math.pi*r*h
10    print(h,"---",A)
```



Create a user input prompt.

- ★ **input** function
- ★ **float** function

```
1 # Import math library (for pi).
2 import math
3
4 # Read values for radius and height.
5 r=float(input("Enter the radius: "))
6 h=float(input("Enter the height: "))
7
8 # Calculate and print the surface area.
9 A=2*math.pi*r**2+2*math.pi*r*h
10 print("The surface area is",round(A,2))
```

PROBLEM #3

Repeatedly calculate the average of several numbers.



Use a loop to collect several user inputs.

★ Dummy variable with **for** loop

```
1 # Set initial value for total.
2 total=0
3
4 # Read numbers and update total.
5 for x in range(5):
6     number=float(input("Please enter a number: "))
7     total=total+number
8
9 # Calculate average.
10 average=total/5
11
12 # Print average.
13 print("The average is",round(average,2))
```



Allow user to specify number of inputs.

★ **int** function

```
1 # Read number of values to be averaged.
2 values=int(input("How many values would you like to average? "))
3
4 # Set initial value for total.
5 total=0
6
7 # Read numbers and update total.
8 for x in range(values):
9     number=float(input("Please enter a number: "))
10    total=total+number
11
12 # Calculate average.
13 average=total/values
14
15 # Print average.
16 print("The average is",round(average,2))
```

PROBLEM #4

Repeatedly find unknown side lengths for right triangles.



Use the **math** library for square root.

- ★ **eval** function
- ★ Calculate a square root

```
1 # Import math library (for square root).
2 import math
3
4 # Read values for leg lengths.
5 leg1=eval(input("Please enter the length of leg 1: "))
6 leg2=eval(input("Please enter the length of leg 2: "))
7
8 # Calculate the length of the hypotenuse.
9 hyp=math.sqrt(leg1**2+leg2**2)
10
11 # Print hypotenuse length.
12 print("The length of the hypotenuse is",round(hyp,3))
```



Use an **if...else** statement to make a choice.

- ★ **if...else** statement
- ★ **or** operator
- ★ **==** operator

```
1 # Import math library (for square root).
2 import math
3
4 # Read type of question (finding hypotenuse or other leg).
5 type=input("Are you finding the hypotenuse? Enter Y or N. ")
6
7 # Find the unknown side length.
8 if type=="Y" or type=="y":
9     # Read values for leg lengths.
10    leg1=eval(input("Please enter the length of leg 1: "))
11    leg2=eval(input("Please enter the length of leg 2: "))
12
13    # Calculate the length of the hypotenuse.
14    hyp=math.sqrt(leg1**2+leg2**2)
15
16    # Print hypotenuse length.
17    print("The length of the hypotenuse is",round(hyp,3))
18
19 else:
20     # Read values for hypotenuse and leg lengths.
21     hyp=eval(input("Please enter the length of the hypotenuse: "))
22     leg1=eval(input("Please enter the length of the other leg: "))
23
24     # Calculate the unknown leg length.
25     leg2=math.sqrt(hyp**2-leg1**2)
26
27     # Print unknown side length.
28     print("The length of the unknown side is",round(leg2,3))
```

PROBLEM #5

Compare the growth of an investment with simple interest to that with compound interest.



Putting it all together.

★ **floor** function

```
1 # Import math library (for floor).
2 import math
3
4 # Read values from user.
5 principal=float(input("Enter the principal: $"))
6 rate_percent=float(input("Enter the annual interest rate (as a percent): "))
7 years_input=float(input("How many years? "))
8
9 # Convert years to integer for loop.
10 if math.floor(years_input)==years_input:
11     years=int(years_input)
12 else:
13     years=int(years_input)+1
14
15 # Set initial values.
16 rate_decimal=rate_percent/100
17 simple_total=principal
18 compound_total=principal
19
20 # Calculate and print yearly totals.
21 for x in range(years+1):
22     print(x,"years",("--- $",round(simple_total,2),"- $",round(compound_total,2)))
23     simple_total=simple_total+principal*rate_decimal
24     compound_total=compound_total+compound_total*rate_decimal
```