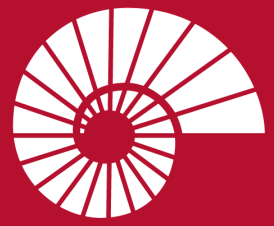

KOÇ
ÜNİVERSİTESİ

# Lab02 – Quadratic Equation

COMP 125  Programming with Python

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# Find the roots of the quadratic equation

## Version 1

- Given a quadratic equation of the form:

$$y = ax^2 + bx + c$$

- Calculate the discriminant

$$\Delta = b^2 - 4ac$$

- Find the roots

$$x_1 = \frac{-b+\sqrt{\Delta}}{2a} \qquad x_2 = \frac{-b-\sqrt{\Delta}}{2a}$$

- You can assume that the discriminant is positive, i.e. the roots are real
- The coefficients will be directly defined in the code. Let $a = 1, b = 1, c = -6$
- Write the pseudocode

# Pseudocode for version 1

```
#import the sqrt function
from math import sqrt
#Define the coefficients
a=1
b=1
c=-6
#Calculate the discriminant
dis=b**2-4*a*c
#Check the sign of the discriminant
print("Discriminant is: ",dis)
#Roots
x1=(-b+sqrt(dis))/(2*a)
print("First root: ",x1)
x2=(-b-sqrt(dis))/(2*a)
print("Second root: ",x2)
```

# Write the code

You will need the square root function. Use the following statement:

```
In [1]: from math import sqrt

In [2]: sqrt(4)
Out[2]: 2.0
```

# Python code for version 1

```
 8  # Find the roots of the quadratic equation
 9  # ax^2+bx+c=0
10
11  #import the sqrt function
12  from math import sqrt
13
14  #Define the coefficients
15  a=1
16  b=1
17  c=-6
18
19  #Calculate the discriminant
20  dis=b**2-4*a*c
21
22  #Check the sign of the discriminant
23  print("Discriminant is: ",dis)
24
25  #Roots
26  x1=(-b+sqrt(dis))/(2*a)
27  print("First root: ",x1)
28  x2=(-b-sqrt(dis))/(2*a)
29  print("Second root: ",x2)
```

```
In [10]: runcell(0, 'C:/Users/
Discriminant is:  25
First root:  2.0
Second root:  -3.0
```

# Find the roots of the quadratic equation

## Version 2

- Given a quadratic equation of the form:

$$y = ax^2 + bx + c$$

- Calculate the discriminant

$$\Delta = b^2 - 4ac$$

- Find the roots

$$x_1 = \frac{-b+\sqrt{\Delta}}{2a} \qquad x_2 = \frac{-b-\sqrt{\Delta}}{2a}$$

- You can assume that the discriminant is positive, i.e. the roots are real
- The coefficients should be received from the user input

# Modify the first version

You will need the square root function. Use the following statement:

```
In [1]: from math import sqrt

In [2]: sqrt(4)
Out[2]: 2.0
```

Use the input function to receive user input.

```
In [11]: input("Please enter coefficient a: ")

Please enter coefficient a: 1
Out[11]: '1'
```

# Python code for version 2

```
8   # Find the roots of the quadratic equation
9   # ax^2+bx+c=0
10
11  #import the sqrt function
12  from math import sqrt
13
14  #Get the coefficients
15  a=float(input("Please enter coefficient a: "))
16  b=float(input("Please enter coefficient b: "))
17  c=float(input("Please enter coefficient c: "))
18
19  #Calculate the discriminant
20  dis=b**2-4*a*c
21
22  #Check the sign of the discriminant
23  print("Discriminant is: ",dis)
24
25  #Roots
26  x1=(-b+sqrt(dis))/(2*a)
27  print("First root: ",x1)
28  x2=(-b-sqrt(dis))/(2*a)
29  print("Second root: ",x2)
```

```
In [12]: runfile('C:/Users/msayar/
wdir='C:/Users/msayar/Documents/CO

Please enter coefficient a: 1

Please enter coefficient b: 1

Please enter coefficient c: -6
Discriminant is:  25.0
First root:  2.0
Second root:  -3.0
```

# Find the roots of the quadratic equation

## Version 3

- Given a quadratic equation of the form:

$$y = ax^2 + bx + c$$

- Calculate the discriminant

$$\Delta = b^2 - 4ac$$

- Find the roots

$$x_1 = \frac{-b+\sqrt{\Delta}}{2a} \qquad x_2 = \frac{-b-\sqrt{\Delta}}{2a}$$

- You can assume that the discriminant is positive, i.e. the roots are real
- The coefficients should be received from the user input
- Check the discriminant, if it is less than zero print a warning message

# Modify the second version

You will need the square root function. Use the following statement:

```
In [1]: from math import sqrt

In [2]: sqrt(4)
Out[2]: 2.0
```

Use the input function to receive user input.

```
In [11]: input("Please enter coefficient a: ")

Please enter coefficient a: 1
Out[11]: '1'
```

Check the sign of the discriminant:

```
#Check the sign of the discriminant
if dis<0:
    print("This equation has complex roots.")
else:
    print("Discriminant is: ",dis)
```

# Python code for version 3

```
8   # Find the roots of the quadratic equation
9   # ax^2+bx+c=0
10
11  #import the sqrt function
12  from math import sqrt
13
14  #Get the coefficients
15  a=float(input("Please enter coefficient a: "))
16  b=float(input("Please enter coefficient b: "))
17  c=float(input("Please enter coefficient c: "))
18
19  #Calculate the discriminant
20  dis=b**2-4*a*c
21
22  #Check the sign of the discriminant
23  if dis<0:
24      print("This equation has complex roots.")
25  else:
26      print("Discriminant is: ",dis)
27
28      #Roots
29      x1=(-b+sqrt(dis))/(2*a)
30      print("First root: ",x1)
31
32      x2=(-b-sqrt(dis))/(2*a)
33      print("Second root: ",x2)
```

```
In [13]: runcell(0, 'C:/Users/msayar/Doc

Please enter coefficient a: 1

Please enter coefficient b: 1

Please enter coefficient c: -6
Discriminant is:  25.0
First root:  2.0
Second root:  -3.0

In [14]: runcell(0, 'C:/Users/msayar/Doc

Please enter coefficient a: 1

Please enter coefficient b: 1

Please enter coefficient c: 6
This equation has complex roots.
```

# Lets try another equation

```
8   # Find the roots of the quadratic equation
9   # ax^2+bx+c=0
10  #import the sqrt function
11  from math import sqrt
12
13  #Define the coefficients
14  a=1
15  b=-1e5
16  c=1
17
18  #a=1e-30
19  #b=-1e30
20  #c=1e30
21
22  #Calculate the discriminant
23  dis=b**2-4*a*c
24
25  #Check the sign of the discriminant
26  print("Discriminant is: ",dis)
27
28  #Roots
29  x1=(-b+sqrt(dis))/(2*a)
30  print("First root: ",x1)
31  x2=(-b-sqrt(dis))/(2*a)
32  print("Second root: ",x2)
33
34  print()
35  print("Lets test x1= ",x1)
36  print("y=",a*x1**2+b*x1+c)
37  print("Lets test x2= ",x2)
38  print("y=",a*x2**2+b*x2+c)
```

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in *Preferences > Help*.

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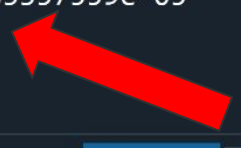
Console 1/A

```
In [32]: runcell(0, 'C:/Users/msayar/Documents/COMP125/quadratic_v4.py')
Discriminant is:  9999999996.0
First root:  99999.99999
Second root:  1.0000003385357559e-05

Lets test x1=  99999.99999
y= 0.0
Lets test x2=  1.0000003385357559e-05
y= -3.384357558644524e-07

In [33]:
```



# Let's try another equation

```
8   # Find the roots of the quadratic equation
9   # ax^2+bx+c=0
10  #import the sqrt function
11  from math import sqrt
12
13  #Define the coefficients
14  #a=1
15  #b=-1e5
16  #c=1
17
18  a=1e-30
19  b=-1e30
20  c=1e30
21
22  #Calculate the discriminant
23  dis=b**2-4*a*c
24
25  #Check the sign of the discriminant
26  print("Discriminant is: ",dis)
27
28  #Roots
29  x1=(-b+sqrt(dis))/(2*a)
30  print("First root: ",x1)
31  x2=(-b-sqrt(dis))/(2*a)
32  print("Second root: ",x2)
33
34  print()
35  print("Lets test x1= ",x1)
36  print("y=",a*x1**2+b*x1+c)
37  print("Lets test x2= ",x2)
38  print("y=",a*x2**2+b*x2+c)
```

Usage

Here you can get help of any object by pressing **Ctrl+I** in front of it, either on the Editor or the Console.

Help can also be shown automatically after writing a left parenthesis next to an object. You can activate this behavior in *Preferences > Help*.

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Console 1/A

```
In [33]: runcell(0, 'C:/Users/msayar/Documents/COMP125/quadr
Discriminant is:  1.0000000000000001e+60
First root:  1e+60
Second root:  0.0

Lets test x1=  1e+60
y= 1e+30
Lets test x2=  0.0
y= 1e+30

In [34]:
```

IPython console | History

# Floating Point Arithmetic

- Floating point arithmetic is not always exact !!!
- Floating point system is finite and discrete, unlike real numbers !!!
- Make sure to check your results.
- For more check out:

  https://en.wikipedia.org/wiki/Floating-point_arithmetic