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📁 Numerical Methods

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In this, you will learn how to find the roots of equations using Secant Method in Python Programming.

Secant Method

The second method is used to find the origin of the equation $F(x) = 0$. It starts from two different estimates, x_1 and x_2 for the root. It is a repetition process with linear interpolation to a source.

The iteration stops if the difference between the two intermediate values is less than the convergence factor.

Steps:

1. x_1, x_2, E, n // E = convergence indicator
2. Calculate $f(x_1), f(x_2)$
3. if $(f(x_1) * f(x_2) = E)$; // Repeat the loop until convergence
4. Print the value of ' x_0 ' // value of the root
5. Print the ' n ' // iterations
- else
6. Print "Source not found"

In this Python program, x_0 & x_1 are the two initial estimation values, e is the tolerable error and $f(x)$ is the actual non-linear function whose root is obtained using the second method. Variable x_2 has approximately root in each step.

Example 1: Program to find the solution of equation x^2-9 using secant method

Python Code:

```
from pylab import *
def secant(f,x0,x1,eps):
    f_x0=f(x0)
    f_x1=f(x1)
    iteration_counter=0
    while abs(f_x1)>eps and iteration_counter<100:
        try:
            x2 = float(f_x1-f_x0)/(x1-x0)
            x = x1-float(f_x1)/x2
        except:
            print("error")
        x0 = x1
        x1 = x
        f_x0=f_x1
        f_x1=f(x1)
        iteration_counter+=1
    if abs(f_x1)>eps:
        iteration_counter-=1
    return x, iteration_counter
def f(x):
    return x**2-9
x0 = 10
x1 = x0 - 1
solution, no_iterations=secant(f,x0,x1,eps=0.00001)
if no_iterations>0:
    print("number of function call: %d" %(2+no_iterations))
    print("solution is:", solution)
else:
    print("solution is not found")
```

Output:

```
number of function call: 9
solution is: 3.000000000915234
```

Example 2: Program to find the solution of equation x^3-4 using secant method

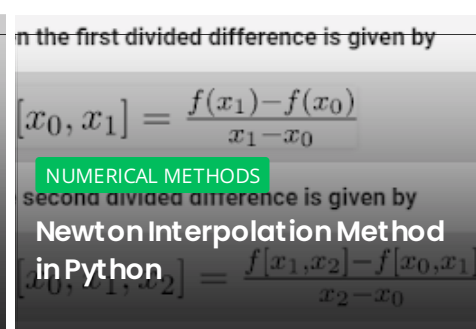
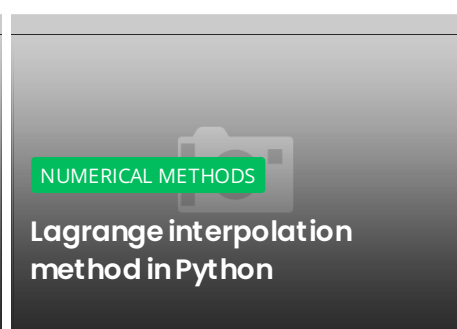
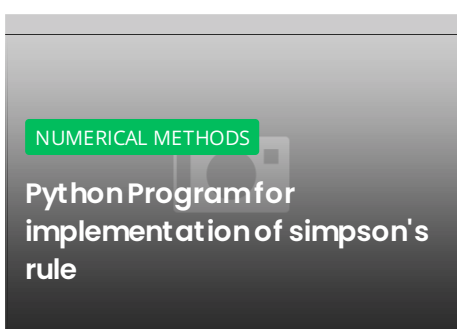
Python Code:

```
from pylab import *
def secant(f,x0,x1,eps):
    f_x0=f(x0)
    f_x1=f(x1)
    iteration_counter=0
    while abs(f_x1)>eps and iteration_counter<100:
        try:
            x2 = float(f_x1-f_x0)/(x1-x0)
            x = x1-float(f_x1)/x2
        except:
            print("error")
        x0 = x1
        x1 = x
        f_x0=f_x1
        f_x1=f(x1)
        iteration_counter+=1
    if abs(f_x1)>eps:
        iteration_counter-=1
    return x, iteration_counter
def f(x):
    return x**3-4
x0 = 10
x1 = x0 - 1
solution, no_iterations=secant(f,x0,x1,eps=0.00001)
if no_iterations>0:
    print("number of function call: %d" %(2+no_iterations))
    print("solution is:", solution)
else:
    print("solution is not found")
```

Output:

```
number of function call: 13
solution is: 1.5874010554986935
```

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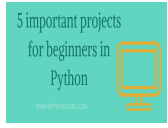
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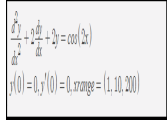


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