**R-K METHOD (CODES)**

**#RK Method (1st order or EULER'S method)**

**import matplotlib.pyplot as plt**

**[xo,xn,yo,h]=[0,4,1,0.5]**

**n=(xn-xo)/h**

**#f(x.y)=dy/dx (i.e derivative/slope of original; function)**

**print("EULER\'S METHOD EXAMPLE 25.1")**

**def f1(x):**

**return -2\*(x)\*\*3 + 12\*(x)\*\*2 - 20\*(x) + 8.5**

**#f(x,y)=y(i.e integral of f1 which is original function)**

**def f2(x):**

**return -0.5\*(x)\*\*4 + 4\*(x)\*\*3 - 10\*(x)\*\*2 + 8.5\*(x) + 1**

**print("xi \t yi \t f(xi,yi) \t xi+1 \t yi+1 \t\t y(true)")**

**print("==================================================================")**

**a=[]**

**b=[]**

**c=[]**

**for i in range(0,int(n)+1):**

**yi=yo+f1(xo)\*h**

**print(xo, '\t',yo, '\t',f1(xo), '\t\t',xo+h, '\t',yi, '\t \t',f2(xo))**

**a.append(xo)**

**b.append(yo)**

**c.append(f2(xo))**

**xo=xo+h**

**yo=yi**

**print("\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_")**

**print("x=",a,"\ny(euler)=",b,"\ny(true)=",c)**

**plt.plot(a,b,label = "y(euler)=dy/dx")**

**plt.plot(a,c,label = "y(true)=y")**

**plt.title('EULER\'S METHOD')**

**plt.xlabel('x')**

**plt.ylabel('f(x,y)')**

**plt.legend()**

**OUTPUT**

**EULER'S METHOD EXAMPLE 25.1**

**xi yi f(xi,yi) xi+1 yi+1 y(true)**

**==================================================================**

**0 1 8.5 0.5 5.25 1.0**

**0.5 5.25 1.25 1.0 5.875 3.21875**

**1.0 5.875 -1.5 1.5 5.125 3.0**

**1.5 5.125 -1.25 2.0 4.5 2.21875**

**2.0 4.5 0.5 2.5 4.75 2.0**

**2.5 4.75 2.25 3.0 5.875 2.71875**

**3.0 5.875 2.5 3.5 7.125 4.0**

**3.5 7.125 -0.25 4.0 7.0 4.71875**

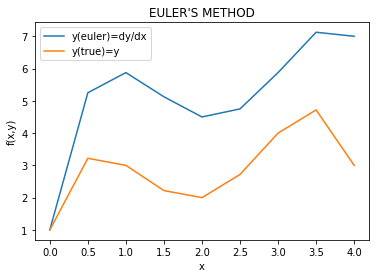
**4.0 7.0 -7.5 4.5 3.25 3.0**

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**x= [0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0]**

**y(euler)= [1, 5.25, 5.875, 5.125, 4.5, 4.75, 5.875, 7.125, 7.0]**

**y(true)= [1.0, 3.21875, 3.0, 2.21875, 2.0, 2.71875, 4.0, 4.71875, 3.0]**

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