Optimization Assignment - 1

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I. Question

-Investigate for the maxima and minima of the function $f(x) = \int_1^x 2(t-1)(t-3)^3 + 3(t-1)^2(t-2)^2$

II. Solution

STEP-1 The given function **f(x)** can be written as

$$f(x) = (x-2)^3(x-1)^2 \tag{1}$$

STEP-2 we can find the maxima of eq(1) by using gradient ascent method

$$\implies x_{n+1} = x_n + \alpha \nabla f(x_n)$$

$$\implies x_{n+1} = x_n + \alpha \left((x_n - 1)(x_n - 2)^2(5x_n - 7)\right) \tag{2}$$

Taking $x_0 = 0.5, \alpha = 0.001$ and precision = 0.00000001, values obtained using python are:

$$\boxed{\text{Maxima} = -2.4985e^{-}11} \tag{3}$$

$$\boxed{\text{Maxima Point} = 1} \tag{4}$$

STEP-3 we can find the minima of eq(1) by using gradient descent method

$$\implies x_{n+1} = x_n - \alpha \nabla f(x_n)$$

$$\implies x_{n+1} = x_n - \alpha \left((x_n - 1)(x_n - 2)^2(5x_n - 7)\right) \tag{5}$$

Taking $x_0 = 1.5, \alpha = 0.001$ and precision = 0.00000001, values obtained using python are:

$$\boxed{\text{Minima} = -0.03455} \tag{6}$$

$$\boxed{\text{Minima Point} = 1.4} \tag{7}$$

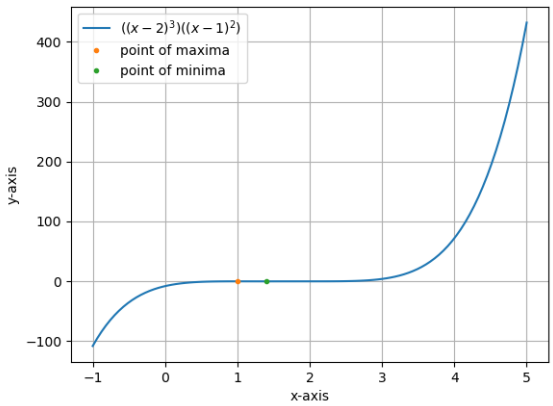

Fig. 1. plot of f(x) with maxima and minima points

Get the python code of the figures from

https://github.com/kkousar/KOUSAR_FWC/blob/main/optimization_1/code/optimization1.py