**Mathematical Foundations**

**Instructions**

Please share your answers filled in-line in the word document. Submit code wherever applicable. Mathematical calculations which are manually performed should be uploaded with a picture along with the explanation in a word document.

Please ensure you update all the details:

**Name: Vaibhav Chaudhari**

**Batch ID: DSWDEOS 280422**

**Topic: Mathematical Foundations**

**Note: Submit pictures of mathematical calculations**

**Problem Statements**

**Q1) Find the maximum and minimum values of the function: x^3 - 3x^2 - 9x + 12**

**Soln :** f (x) = x3 - 3x2 - 9x + 12

f ’(x) = 3x2 – 6x – 9

Solving for f ’(x) = 0 , x2 – 2x – 3 = 0

x2 -3x + x -3 = 0

x(x-3) +1 (x-3) = 0

x = -1 and x = 3

f ’’ (x) = 6x – 6

Solving for f ‘’(x) , if x = 3 and x = -1

For x = 3;

f ’’ (x) = 12 > 0 ………. Hence, **minima at x = 3**

For x = -1;

f ’’ (x) = -12 < 0 ………. Hence, **maxima at x = -1**

**Q2) Calculate the slope and the equation of a line which passes through the points (-1, -1) (3, 8)**

**Soln:**

Slope = (y2 – y1) / (x2-x1)

= (8 + 1)/ (3+1) = (9/4) = **2.25**

Equation of line, y = mx + c

-1 = 2.25 (-1) + c (x,y) = (-1, -1)

c = 1.25

Hence, equation becomes

**y = 2.25 x + c**

**Q3) Solve for w’(z) when**



**Soln :**

w’(z) = = =

**Q3) Consider Y(x)= 2x^3+6x^2+3x. Identify the critical values and verify if it is the maxima or minima.**

**Soln :** f (x) = 2x3 + 6x2 +3x

f ’(x) = 6x2 + 12x +3

Solving for f ’(x) = 0 , 2x2 + 4x +1 = 0

x1, x2 = (- b + sqrt (b2 – 4ac) / 2a)

x1 = -0.295 , x2 = -1.7

f ’’ (x) = 4x + 4

Solving for f ‘’(x) , if x = -0.295 and x = -1.7

For x = -0.295;

f ’’ (x) = 2.82 > 0 ………. Hence, **minima at x = -0.295**

For x =-1.7;

f ’’ (x) = -2.8 < 0 ………. Hence, **maxima at x = -1.7**

**Q4) Determine the critical points and obtain relative minima or maxima of a function defined by**



**Soln :** f (x) = 2x12 + 2x1x2 +2x22+ 6x1

f ’(x1) = 4x1 + 2x2 + 6

f ’(x2) = 2x1 + 4x2

Solving for f ’(x1) = 0 , 4x1 + 2x2 + 6 = 0 -----(1) and f ’(x2) = 0 , 2x1 + 4x2 =0 -----(2)

From (2), x1 = -2 x2

From (1), -8x2 + 2x2 +6 = 0 --- > -6x2 + 6 = 0

x2 = 1

x1 = -2

The above system of equations has one solution at the point (-2,1).

Finding the second order partial derivatives,

f ’’ (x1) = 4

f ’’ (x2) = 4

f’’(x1 x2) = 2

Finding D,

D = f ’’ (x1)(-2,1) \* f ’’ (x2)(-2,1) – (f’’(x1 x2) (-2,1))2

= (4) (4) - 22  = 12

**Since D is positive and f ’’(x1) (-2,1) is also positive, according to the theorem function f has a local minimum at (-2,1).**