MATHEMATICS FOR MACHINE LEARNING

LAB 4– 5%

Use Python to answer the following questions.

Hand in pdf and python file to Dropbox

1) Find the derivative of the functions:

$$S(w) = \frac{w^2(2-w)+w^5}{3w} \qquad h(y) = 3y^{-6} - 8y^{-3} + 9y^{-1} \qquad G(z) = z^2(z-1)^2$$

2) From first principles find the slope of the tangent to the curve at x= 1, $f(t) = (3-2t^3)^2$

3) Determine where the function is increasing and decreasing. $V(t) = t^3 - 24t^2 + 192t - 50$

4)

Compute the derivative $f'(x)$ for

$$f(x) = \log(x^4)\sin(x^3)\,.$$

Compute the derivative $f'(x)$ of the logistic sigmoid

$$f(x) = \frac{1}{1+\exp(-x)}\,.$$

Compute the derivative $f'(x)$ of the function

$$f(x) = \exp(-\tfrac{1}{2\sigma^2}(x-\mu)^2)\,,$$

where $\mu,\ \sigma \in \mathbb{R}$ are constants.

5) Compute the second and third derivatives for: $f(w) = \frac{(1-4w)(2+w)}{3+9w}$

6) Find all the first order partial derivatives of:

$$w = \cos(x^2+2y) - \mathbf{e}^{4x-z^4y} + y^3 \qquad z = \frac{p^2(r+1)}{t^3} + pr\,\mathbf{e}^{2p+3r+4t}$$

7) Compute the Jacobian for the following function, what is the dimension?

$$f_1(\boldsymbol{x}) = \sin(x_1)\cos(x_2)\,, \quad \boldsymbol{x} \in \mathbb{R}^2$$