1. Find the following derivatives,

    (a) [10%] Given $y = x\cos(x)$, find $\dfrac{dy}{dx}$

    (b) [10%] Given $\sin(x + y) = x$, find $\dfrac{dy}{dx}$

    (c) [10%] Given $x^2 + y^2 - 2xy = 0$, find $\dfrac{d^2y}{dx^2}$

2. [10%] Find the maximum and minimum values of the function
$$f(x) = x^3 + 3x^2 - 24x + 10, \quad -5 \le x \le 3$$

3. Evaluate the following integrations:

    (a) [10%] $\displaystyle\int \frac{1}{1+x}dx$

    (b) [10%] $\displaystyle\int_0^\pi e^x \sin(2x)dx$

4. Given two vectors, $\mathbf{U} = 2\mathbf{i} + 1\mathbf{j} + 2\mathbf{k}$, and $\mathbf{V} = 3\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$, find

    (a) [5%] dot product of $\mathbf{U} \cdot \mathbf{V}$

    (b) [5%] cross product of $\mathbf{U} \times \mathbf{V}$

    (c) [10%] the angle between $\mathbf{U}$ and $\mathbf{V}$

    (d) [10%] the area of triangle formed by $\mathbf{U}$ and $\mathbf{V}$

5. [10%] Find the Maclaurin series of e^x to four terms. (Maclaurin series is a Taylor series expansion of a function about 0)