PEP 2017
Assignment 1

1) Obtain the derivative of the following functions using the first principle method

$$\frac{d}{dx}f(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \tag{1}$$

(a) $f(x) = x^3$

(b) $f(x) = \frac{1}{\sqrt{x}}$, $x > 0$

(c) $f(x) = \sec x = \frac{1}{\cos x}$

2) Evaluate the first order derivatives of the following functions:

(a) $f(x) = x^2 + x + 3$

(b) $f(x) = \sin x \cos x$

(c) $f(x) = \sqrt{1 - x^3}$

(d) $f(x) = \sin \sqrt{1 - x^2}$

(e) $f(x) = \frac{x+2}{x-2}$

3(a) A cylindrical tank, flat at the top and the bottom, is to be made from thin sheet metal. The volume is 4 m^3. We wish to know the diameter D and the height H of the cylinder for which the total area A of sheet metal is a minimum.

(b) Suppose this cylindrical tank is produced automatically with an error of 2% in the dimensions of D and H, what is the resulting error in the volume of the tank?

4(a) A particle is moving with the trajectory $\vec{r}(t) = x(t)\hat{i} + y(t)\hat{j} + z(t)\hat{k}$ where $x(t) = \cos t$, $y(t) = \sin t$ and $z(t) = 2t$ respectively. Sketch the trajectory of the particle.

(b) Calculate the velocityof the particle at time t.

(c) Calculate the acceleration of the particle at time t.

5 A particle is projected up an inclined plane with initial speed v at an angle α with the plane. The inclined plane is at angle θ with the horizontal Determine the angle α such that the particle will hit on the inclined plane at the highest position.