Q1) (a) Find the vector form of curve of intersection given by 
\[ x^2 + y^2 = 4, \quad z = 4 - x^2, \quad x = 2 \cos t. \]

(b) Consider the curve 
\[ r(t) = \sqrt{3} t^2 \hat{i} + \frac{2}{3} t^3 \hat{j} + 3tk, \] 
find the arc length parameter \( s(t). \)

(c) Find directional derivative of 
\[ f(x, y, z) = \frac{y^2 - z^2}{x^2} \] 
in the direction of vector \( \hat{i} + \hat{j} + \hat{k} \) at the point \( P(1, 4, 2). \)