Problem 1. Find the moments of inertia about the coordinate axes of a thin wire lying along the curve parametrized by
\[ r(t) = t \hat{i} + \frac{2\sqrt{2}}{3} t^{3/2} \hat{j} + \frac{t^2}{2} \hat{k}, \quad 0 \leq t \leq 2, \]
if the density of mass is given by \( \delta = \frac{1}{1+t} \).

Problem 2. The field \( \mathbf{F} = xy \hat{i} + y \hat{j} - yz \hat{k} \) is the velocity field of a flow in space. Find the flow from \((0,0,0)\) and \((1,1,1)\) along the curve of interesection of the cylinder \( y = x^2 \) and the plane \( z = x \). \textit{Hint}: Use \( t = x \) as the parameter.
Problem 3. A vector field $\mathbf{F}$ is defined by

$$\mathbf{F} = (y^2 \cos x + z^3) \mathbf{i} + (-4 + 2y \sin x) \mathbf{j} + (3xz^2 + 2) \mathbf{k}.$$ 

Determine whether $\mathbf{F}$ is a conservative field. If that is the case, find a corresponding potential function $f$. 