

**Instructions:** Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each question.

1. Find the curvature of the vector-valued function  $\vec{r}(t) = t^2\hat{i} + t \sin \pi t \hat{j} + 2t\hat{k}$ , at the point  $(1,0,2)$ . Use the formula  $\kappa = \frac{\|\vec{r}' \times \vec{r}''\|}{\|\vec{r}'\|^3}$ .

2. Find the surface area for the function  $f(x, y) = 4 - x^2 - y^2$  above the plane.