

MATH 2401, PRACTICE TEST 1

- 1 Let  $\mathbf{u}(t) = \cos t \mathbf{i} + \sin t \mathbf{j} + t \mathbf{k}$ ,  $\mathbf{v}(t) = \cos t \mathbf{i} - \sin t \mathbf{j} + t \mathbf{k}$  and  $f(t) = e^{2t}$ . Find

$$\frac{d}{dt}(\mathbf{u} \cdot \mathbf{v}) \quad \frac{d}{dt}f(t)\mathbf{u}(t)$$

- 2 Find the length of the curve given by:

$$\mathbf{r}(t) = 6t \mathbf{i} + 3\sqrt{2}t^2 \mathbf{j} + 2t^3 \mathbf{k}$$

for  $t$  from 0 to 1.

- 3 The position of a particle is given by  $\mathbf{r}(t) = 5t \mathbf{i} + 3t \mathbf{j} + (-2t^2 + 3t) \mathbf{k}$ . When is the speed a minimum?

- 4 Find the curvature of the curve given by  $\mathbf{r}(t) = 3 \cos 2t \mathbf{i} + 3 \sin 2t \mathbf{j} + t \mathbf{k}$ .

- 5 Find the domain and range of the function  $f(x, y, z) = \sqrt{x^2 + y^2 - 1} - \ln z$  and write the equation of the level surface that contains the point  $(1, 2, e^2)$ .

- 6 Find the following limit or show that it does not exist:

$$\lim_{(x,y) \rightarrow (0,0)} \frac{xy}{\sqrt{x^2 + y^2}}$$

$$\lim_{(x,y) \rightarrow (0,0)} \frac{xy^2}{\sqrt{x^7 + y^7}}$$

- 7 Compute

$$\frac{\partial^2}{\partial_x \partial_y} (y \cos y + xy \sin xy)$$