

## MTH 234 - Quiz 2

Due 29 May at the beginning of class

Name:

You may work together on solving these problems, but what you hand in must be your work written in your own words.

1. (5 points) If  $\vec{r}$  is a twice-differentiable vector-valued function, show that

$$\frac{d}{dt}[\vec{r}(t) \times \vec{r}'(t)] = \vec{r}'(t) \times \vec{r}''(t)$$

2. (5 points) If  $\vec{r}(t) \neq 0$ , show that

$$\frac{d}{dt}|\vec{r}(t)| = \frac{1}{|\vec{r}(t)|} \vec{r}(t) \cdot \vec{r}'(t)$$

*Hint:* One way is to write  $|\vec{r}(t)|^2 = \vec{r}(t) \cdot \vec{r}(t)$  and differentiate both sides with the chain rule.

3. (5 points) Consider the function  $\vec{r}(t) = \langle t, \ln t, t \rangle$ ,  $t > 0$ .

- (a) Compute the curvature  $\kappa$  of  $\vec{r}$ .
- (b) What is  $\lim_{t \rightarrow \infty} \kappa(t)$ ? Describe this geometrically.

4. (5 points) A particle moves along the helix  $x(t) = 3 \cos t$ ,  $y(t) = 3 \sin t$ ,  $z(t) = t$ , starting at time 0 (at the point  $(3, 0, 0)$ ). How long does it take for the particle to travel 1 unit?