

# Calc 251 Quiz for Lecture 5 (PDF)

1.  $r(t) = \sin(t)i + \cos(t)j + tk$

$\langle \sin t, \cos t, t \rangle$

$r'(t) = \langle \cos t, -\sin t, 1 \rangle$

$r''(t) = \langle -\sin t, -\cos t, 0 \rangle$

$$k(t) = \frac{|r'(t) \times r''(t)|}{|r'(t)|^3}$$

$|r'(t) \times r''(t)|$

$i$	$j$	$k$	$=$	$\begin{vmatrix} -\sin t & 1 \\ -\cos t & 0 \end{vmatrix} i$	$-$	$\begin{vmatrix} \cos t & 1 \\ -\sin t & 0 \end{vmatrix} j$	$+$	$\begin{vmatrix} \cos t & -\sin t \\ -\sin t & -\cos t \end{vmatrix} k$
$\cos t$	$-\sin t$	$1$		$(0 + \cos t)i$		$-(0 + \sin t)j$		$+ (-\cos^2 t - \sin^2 t)k$
$-\sin t$	$-\cos t$	$0$		$\cos t i$		$-\sin t j$		$- k$

$\langle \cos t, -\sin t, -1 \rangle$

$|r'(t) \times r''(t)| = \sqrt{\cos^2 t + \sin^2 t + 1} = \sqrt{2}$

$|r'(t)|^3 = \sqrt{\cos^2 t + \sin^2 t + 1} = (\sqrt{2})^3 = 2\sqrt{2}$

$k(t) = \frac{\sqrt{2}}{2\sqrt{2}} = \frac{1}{2}$

$k(t) = \frac{1}{2}$

$$2. \quad r(t) = ti + t^2j + 5tk$$

$$r'(t) = i + 2tj + k$$

$$r''(t) = 2j$$

$$|r'(t)| = \sqrt{1^2 + (2t)^2 + 1^2} = \sqrt{2+4t^2}$$

$$\text{Velocity: } v(t) = i + 2tj + k$$

$$\text{Acceleration: } a(t) = 2j$$

$$\text{Speed: } |v(t)| = \sqrt{2+4t^2}$$