

Lecture 5 Quiz

1. $r(t) = \langle \sin t, \cos t, t \rangle$

$$r'(t) = \langle \cos t, -\sin t, 1 \rangle \quad r''(t) = \langle -\sin t, -\cos t, 0 \rangle$$

$$r'(t) \times r''(t) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \cos t & -\sin t & 1 \\ -\sin t & -\cos t & 0 \end{vmatrix}$$

$$\hat{i}[0 + \cos t] - \hat{j}[0 + \sin t] + \hat{k}[-\cos^2 t - \sin^2 t]$$

$$\langle \cos t, -\sin t, -\cos^2 t - \sin^2 t \rangle \quad \begin{matrix} (-\cos^2 t - \sin^2 t) & (-\cos^2 t - \sin^2 t) \\ \cos^4 t + \sin^4 t & \cos^2 t + \sin^2 t \end{matrix}$$

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

Final answer:

$$\sqrt{\cos^2 t + \sin^2 t + 1}$$

2. Velocity: $r'(t) = \langle 1, 2t, 0 \rangle$

Acceleration: $r''(t) = \langle 0, 2, 0 \rangle$

Speed: $|v(t)| = \sqrt{1^2 + 4t^2}$