NAME: (print!) _Fady   Besada_   Section: 22

1, Find the curvature for

$$r(t) = \sin t\,\mathbf{i} + \cos t\,\mathbf{j} + t\,\mathbf{k} \quad.$$

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

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

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

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

$\longrightarrow r'(t) \times r''(t) = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \cos t & -\sin t & 1 \\ -\sin t & -\cos t & 0 \end{vmatrix} = (-\cos t)\mathbf{i} - (\sin t)\mathbf{j} + (-\cos^2 t - \sin^2 t)\mathbf{k}$

$\longrightarrow |-\cos t \cdot \mathbf{i} - \sin t \cdot \mathbf{j} - \mathbf{k}| = |\langle -\cos t, -\sin t, -1 \rangle| = \sqrt{\cos^2 t + \sin^2 t + 1} = \sqrt{2}$

$\longrightarrow |\langle \cos(t), -\sin(t), 1 \rangle|^3 = (\sqrt{\cos^2 t + \sin^2 t + 1})^3 = (\sqrt{2})^3 = 2\sqrt{2} \longrightarrow \frac{\sqrt{2}}{2\sqrt{2}} \longrightarrow$ **Ans: $\frac{1}{2}$**

2.: Find the velocity, acceleration, and speed of a particle with the given position function.

$$r(t) = t\,\mathbf{i} + t^2\,\mathbf{j} + 5\,\mathbf{k} \quad.$$

$\longrightarrow v(t) = r'(t) = \langle 1, 2t, 0 \rangle$

$\longrightarrow \boxed{v(t) = \mathbf{i} + 2t\mathbf{j}} \longleftarrow$ velocity

$\longrightarrow a(t) = r''(t) = \langle 0, 2, 0 \rangle$

$\longrightarrow \boxed{a(t) = 2\mathbf{j}} \longleftarrow$ acceleration

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

$\longrightarrow \boxed{s(t) = \sqrt{1+4t^2}} \longleftarrow$ speed