2) $r(t) = (t, t^2, e^t)$

$r'(t) = (1, 2t, e^t)$

$r''(t) = (0, 2, e^t)$

$$r'(t) \times r''(t) = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 2t & e^t \\ 0 & 2 & e^t \end{vmatrix}$$

$$= \vec{i}(2te^t - 2e^t) - \vec{j}(e^t - 0) + \vec{k}(2) = (2e^t(t-1), -e^t, 2)$$

$$\| r'(t) \times r''(t) \| = \sqrt{(2te^t - 2e^t)^2 + (-e^t)^2 + (2)^2}$$

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

$$\| r'(t) \|^3 = (1 + 4t^2 + e^{2t})^{\frac{3}{2}}$$

$$k(t) = \frac{\sqrt{(2e^t(t-1))^2 + (-e^t)^2 + 2^2}}{(1 + 4t^2 + e^{2t})^{3/2}}$$

$$k(0) = \frac{\sqrt{(2(-1))^2 + 1 + 4}}{(1+1)^{3/2}}$$

$$k(0) = \frac{\sqrt{9}}{\sqrt{8}} = \frac{3}{2\sqrt{2}} \times \frac{2\sqrt{2}}{2\sqrt{2}} = \frac{6\sqrt{2}}{8} = \frac{3\sqrt{2}}{4}$$

3 a) $r(t) = (2 \sin t, \sqrt{5}t + 1, 2 \cos t), t \in R$

$r'(t) = (2 \cos t, \sqrt{5}, -2 \sin t)$

$$\| r'(t) \| = \sqrt{(2\cos t)^2 + (\sqrt{5})^2 + (-2 \sin t)^2} = \sqrt{9}$$

$\| r'(t) \| = 3$