1 2 Verdadeira
$(-1, \pi/3)$

$\frac{\pi}{3} = 60°$

$-\frac{2\pi}{3} = -120° = 60°$

Sim, pois é só inverso o sentido

E falsa, pois $\pi/2$ não está contido no segundo quadrante

2) a) $(\sqrt{2}, -\sqrt{2}, 2\sqrt{3})$

$$\boxed{(r, \theta, z) = \left(2, \frac{7\pi}{4}, 2\sqrt{3}\right)}$$

$$r = \sqrt{(\sqrt{2})^2 + (-\sqrt{2})^2}$$
$$\sqrt{2+2} = \sqrt{4} = 2$$

$$-\sqrt{2} = 2 \cdot \cos\theta$$
$$-\frac{\sqrt{2}}{2} = \cos\theta = -\cos 45°$$

$\ldots^2 + z^2$ $\left(\ldots \theta, \phi\right) = \left(4, \frac{7\pi}{\ldots}, \frac{\pi}{\ldots}\right)$

$r = \sqrt{(\sqrt{2})^2 + (\sqrt{2})^2}$

$-\sqrt{2} = 2 \cdot \cos\theta \qquad \sqrt{2+2} = \sqrt{4} = 2$

$-\frac{\sqrt{2}}{2} = \cos\theta = -\cos 45^\circ$

b) $\rho^2 = x^2 + y^2 + z^2$ $\qquad \boxed{(\rho, \theta, \phi) = (4, \frac{7\pi}{4}, \frac{\pi}{6})}$

$\rho^2 = 2 + 2 + 4 \cdot 3$

$\rho^2 = 16 \Rightarrow \rho = 4$

$\tan\phi = \frac{\sqrt{4}}{2\sqrt{3}} = \frac{2}{2\sqrt{3}} = \frac{\sqrt{3}}{3}$

$\cos\theta = -\frac{\sqrt{2}}{2} = \cos\theta = 45$

3) a) $r = (3+2t)i + 5tj$

$r = 5t \qquad 3 + 2t = 0 \qquad \boxed{(0, -\frac{15}{2})}$

$x = 0 \qquad t = -\frac{3}{2}$

$r = 5 \cdot -\frac{3}{2}$

$r = -\frac{15}{2}$

b) $r = ti + (1+2t)j - 3tk$

(b) $r = ti + (1+2t)j - 3tk$

$3x - y - z = 2$

$x = t$

$y = 1+2t$

$z = -3t$

$3(t) - (1+2t) + (3t) = 2$

$3t - 1 - 2t + 3t = 2$

$4t = 3$

$t = \frac{3}{4}$

$x = \frac{3}{4}$

$y = 1 + 2\frac{3}{4} = \frac{2}{5}$

$z = -3 \cdot \frac{3}{4} = \frac{-9}{4}$

$$\boxed{\left(\frac{3}{4}, \frac{5}{2}, \frac{-9}{4}\right)}$$

(5) $\lim_{t \to 0} \left(e^{-t} i + \frac{1-\cos t}{t} j + t^2 k\right) = \boxed{1}$

$= \lim_{t \to 0} (e^{-t}) + \lim_{x \to 0} \left(\frac{1-\cos(t)}{t}\right) + \lim_{t \to 0} (t^2) = 1 + 0 + 0$

$= \lim_{t \to 0} (e^{-t}) = 1$ //

$\lim_{t \to 0} \left(\frac{1 - \cos t}{t}\right) = 0$ //

$\lim_{t \to 0} \left(\frac{\operatorname{sen} t}{1}\right) = \lim_{t \to 0} \operatorname{sen} 0 = 0$

$\lim_{t \to 0} t^2 = 0^2 = 0$ //

⑥ $r(t) = (t + \cos 2t)i - (t^2 + t)j + \text{sen } t k$

$x = t + \cos^2 t$ $\quad$ $r(0) = 0 + \cos 2 0 - 0^2 - 0 + \text{sen } 0$

$y = t^2 + t$ $\quad$ $r(0) = 1$

$z = \text{sen } t$

⑧

$\int (\cos t \, [illegible] \, \text{sen} t) \, dt$

$\int (\cos t \, i) \, dt + \int (\text{sen} t) \, dt$

$= \text{sen} t + (-\cos t) + C$

$\boxed{\text{sen} t - \cos t + C}$

9) $\int_0^{\pi/3} (\cos 3t, -\operatorname{sen} 3t)\,dt = \int_{t=0}^{t=\pi/3} = \dfrac{(\cos u, -\operatorname{sen} u)\,du}{3} = \dfrac{(\operatorname{sen} u, \cos u)}{3}\Big]_{t=0}^{t=\pi/3}$

$\dfrac{du}{dt} = 3 \quad u = 3t$

$du = 3dt$

$\left(\dfrac{\operatorname{sen} 3t}{3}, \dfrac{\cos 3t}{3}\right)\Big|_0^{\pi/3} = \left(\dfrac{\operatorname{sen}\pi}{3}, \dfrac{\cos\pi}{3}\right) - \left(\dfrac{\operatorname{sen} 0}{3}, \dfrac{\cos 0}{3}\right)$

$= \left(0, \dfrac{-1}{3}\right) - \left(0, \dfrac{1}{3}\right) = \left(0, \dfrac{-2}{3}\right)$

10)

$T(t) = \vec{r}\,'(t)$

$r(t) = \left(2\cos t, 2\cos t + \dfrac{3}{\sqrt5}\operatorname{sen} t, \cos t - \dfrac{6}{\sqrt5}\operatorname{sen} t\right)$

$r'(t) = \left(-2\operatorname{sen} t, -2\operatorname{sen} t + \dfrac{3}{\sqrt5}\cos t, -\operatorname{sen} t - \dfrac{6}{\sqrt5}\cos t\right)$

$\|r'(t)\| = \sqrt{4\operatorname{sen}^2 t + 4\operatorname{sen}^2 t + \dfrac{9}{5}\cos^2 t + \operatorname{sen}^2 t + \dfrac{36}{5}\cos^2 t}$

$\|r'(t)\| = \sqrt{9\operatorname{sen}^2 t + 9\cos^2 t}$

$\|r'(t)\| = \sqrt{9(\operatorname{sen}^2 t + \cos^2 t)} = \sqrt9 = 3$

$T(0) = \dfrac{\left(-2\operatorname{sen}(0), -2\operatorname{sen}(0) + \dfrac{3}{\sqrt5}\cos(0), -\operatorname{sen}(0) - \dfrac{6}{\sqrt5}\cos 0\right)}{3}$

$T(0) = \left(0, \dfrac{\sqrt5}{5}, -\dfrac{2\sqrt5}{5}\right)$

$T'(t) = \left(-\dfrac{2}{3}\cos(t), -\dfrac{2}{3}\cos t - \dfrac{1}{\sqrt5}\operatorname{sen} t, -\dfrac{\cos t}{3} + \dfrac{2}{\sqrt5}\operatorname{sen} t\right)$

$\|T'(t)\| = \sqrt{\dfrac{4}{9}\cos^2 t + \dfrac{4}{9}\cos^2 t + \dfrac{1}{5}\operatorname{sen}^2 t + \dfrac{\cos^2 t}{9} + \dfrac{4}{5}\operatorname{sen}^2 t} = 1$

$N(0) = \left(-\dfrac{2}{3}, -\dfrac{2}{3}, -\dfrac{1}{3}\right)$

$r''(t) = \left(-2\cos t, -2\cos t + \dfrac{3}{\sqrt5}\operatorname{sen} t, -\cos t + \dfrac{6}{\sqrt5}\operatorname{sen} t\right)$

$r'(0) = \left(0, \dfrac{3}{\sqrt5}, -\dfrac{6}{\sqrt5}\right)$

$r''(0) = (-2, -2, -1)$

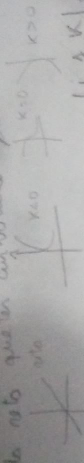
$r'(0) \times r''(0) = \begin{bmatrix} 1 & j & k \\ 0 & \frac{3}{\sqrt5} & -\frac{6}{\sqrt5} \\ -2 & -2 & -1 \end{bmatrix} = -\dfrac{3}{\sqrt5}i + \dfrac{12}{\sqrt5}j - \dfrac{12}{\sqrt5}i + \dfrac{6}{\sqrt5}k$

$-\dfrac{15i}{\sqrt5} + \dfrac{12}{\sqrt5}j + \dfrac{6}{\sqrt5}k$

$$\| r'(0) \times r''(0) \| = \sqrt{\frac{225}{5} + \frac{144}{5} + \frac{36}{5}} = \sqrt{81} = 9$$

$$B(0) = \left(-\frac{15\sqrt{5}}{45}, \frac{12\sqrt{5}}{45}, \frac{6\sqrt{5}}{45} \right)$$

(11) Curvatura indica o quanto uma linha se curva ao contrário da reta que tem curvatura $\emptyset$



(12) $r'(0) = i$

$r''(0) = i + 2j$

Encontra curvatura $t=0$

$$r'(0) \times r''(0) = \begin{vmatrix} i & j & k \\ 1 & 0 & 0 \\ 1 & 2 & 0 \end{vmatrix} = 2k$$

$$\| r'(0) \times r''(0) \| = \sqrt{0^2+0^2+2^2} = 2$$

$$\| r'(0) \| = \sqrt{1^2+0+0} = 1$$

$$\boxed{K(t) = \frac{\| r'(0) \times r''(0) \|}{\| r'(0) \|^3} = \frac{2}{1} = 2}$$

(13) $r(t) = 2\cos t\, i, 3\,\text{sen}\, t\, j, t k$; $t = \pi/2$

$r'(t) = -2\,\text{sen}\, t, 3\cos t, -1)$

$r''(t) = -2\cos t, -3\,\text{sen}\, t, 0)$

$$K(0) = \frac{\| (-2, 0, -1) \times (0, 3, 0) \|}{\| (-2, 0, -1) \|^3} = \frac{\sqrt{9+36}}{\sqrt{5}^3} = \frac{\sqrt{45}}{\sqrt{125}} = \boxed{\frac{3}{5}}$$

$$\begin{bmatrix} i & j & k \\ -2 & 0 & -1 \\ 0 & 3 & 0 \end{bmatrix} = -6k + 3i = (3, 0, 6)$$