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2ª Questão:

$$\begin{cases} x = 4 + t - \frac{t^3}{3} \\ y = 2 - \frac{t^2}{2} \end{cases} \qquad P = \left(4 + t - \frac{t^3}{3}\ ,\ 2 - \frac{t^2}{2}\ ,\ 0\right)$$

$$\vec{V} = \dot{P} = (1 - t^2\ ,\ -t\ ,\ 0)$$
$$\vec{a} = \ddot{P} = (-2t\ ,\ -1\ ,\ 0)$$
$$\Big\} \ P/t=1$$

$$\dot{P} = (0, -1, 0)$$
$$\ddot{P} = (-2, -1, 0)$$

$$|\dot{P}| = |\vec{V}| = \sqrt{0^2 + (-1)^2 + 0^2} = 1$$
$$|\ddot{P}| = |\vec{a}| = \sqrt{(-2)^2 + (-1)^2 + 0^2} = \sqrt{5}$$

$$\vec{\tau} = \frac{\dot{P}}{|\dot{P}|} = (0, -1, 0)$$

$$a_\tau = \vec{a} \cdot \vec{\tau}$$
$$a_\tau = (-2, -1, 0) \cdot (0, -1, 0)$$
$$\boxed{|\vec{a_\tau}| = 1\ m/s^2}$$

$$\dot{P} \wedge \ddot{P} = \begin{vmatrix} i & j & k \\ 0 & -1 & 0 \\ -2 & -1 & 0 \end{vmatrix}$$

$$\dot{P} \wedge \ddot{P} = (0, 0, -2)$$

$$|\dot{P} \wedge \ddot{P}| = \sqrt{4}$$
$$|\dot{P} \wedge \ddot{P}| = 2$$

$$a_n = \frac{|\dot{P} \wedge \ddot{P}|}{|\dot{P}|}$$

$$a_n = \frac{2}{1}$$

$$\boxed{|\vec{a_n}| = 2\ m/s^2}$$

$$a^2 = a_\tau^2 + a_n^2$$
$$a^2 = 1^2 + 2^2$$
$$a^2 = 5 \rightarrow$$

$$\boxed{|\vec{a}| = \sqrt{5}\ m/s^2}$$