Igor Eiki Ferreira Kubota

Ra: 19.02466-5

1ª Questão:

$a(v) = 1 + \frac{1}{2}v^2$

$s = 0$

$v = 0$

$a \cdot ds = v\,dv$

$\left(1 + \frac{1}{2}v^2\right) ds = v\,dv$

$$\int_0^s ds = \int_0^v \frac{v \cdot dv}{1 + \frac{1}{2}v^2}$$

$$s = \int_0^v \frac{v \cdot dv}{\frac{2 + v^2}{2}}$$

$u = 2 + v^2$

$du = 2v\,dv$

$dv = \frac{du}{2v}$

$$s = 2\int_0^v \frac{v\,dv}{2 + v^2}$$

$$s = 2\int_0^v \frac{v\,du}{u \cdot 2v}$$

$$s = \int_0^v \frac{du}{u} \Rightarrow s = \ln|u|\Big|_0^v$$

$$s = \ln|2 + v^2|\Big|_0^v$$

$$s = \ln|2 + v^2| - \ln|2|$$

$$s = \ln\left|\frac{2 + v^2}{2}\right|$$

$$e^s = \frac{2 + v^2}{2}$$

$$v^2 = e^s \cdot 2 - 2$$

$$v = \sqrt{2e^s - 2} \Rightarrow \boxed{v = \sqrt{2(e^s - 1)}\ \frac{m}{s}}$$

Igor Eiki Ferreira Kubota
Ra: 19.02466-5

2ª Questão:

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

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

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

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

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

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

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

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

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

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

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

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

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

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