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Ra: 19.02466-5

1ª Questão:

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

$S=0$
$v=0$

$a.ds = v\,dv$

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

$\int_0^S ds = \int_0^v \frac{v.dv}{1+\frac{1}{2}v^2}$

$S = \int_0^v \frac{v.dv}{\frac{2+1v^2}{2}}$

$u = 2+v^2$
$du = 2v\,dv$
$dv = \frac{du}{2v}$

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

$S = 2\int_0^v \frac{v\,du}{u.\,2v}$

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

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

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

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

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

$v^2 = e^S . 2 - 2$

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

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2ª Questão:

$$\begin{cases} x = 4 + t - \frac{t^3}{3} \\ y = 2 - \frac{t^2}{2} \end{cases}$$

$$P = \left(4 + t - \frac{t^3}{3},\ 2 - \frac{t^2}{2},\ 0\right)$$

$$\left.\begin{aligned} \vec{V} &= \dot{P} = (1 - t^2,\ -t,\ 0) \\ \vec{a} &= \ddot{P} = (-2t,\ -1,\ 0) \end{aligned}\right\} P/t=1 \quad \begin{aligned} \dot{P} &= (0, -1, 0) \\ \ddot{P} &= (-2, -1, 0) \end{aligned}$$

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

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

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

$$a_\tau = \vec{a} \cdot \vec{\tau}$$

$$a_\tau = (-2, -1, 0) \cdot (0, -1, 0)$$

$$\boxed{|\vec{a_\tau}| = 1\ m/s^2}$$

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

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

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

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

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

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

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

$$a^2 = a_\tau^2 + a_n^2$$

$$a^2 = 1^2 + 2^2$$

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