Technische Mechanik - Uebungen 1

1) i.

$$\boldsymbol{r_P}(t) = \begin{pmatrix} \frac{6L}{5} + \frac{L}{4}\cos \pi t \\ \frac{6L}{5} + \frac{L}{4}\sin \pi t \end{pmatrix}$$

$$\boldsymbol{v_P}(t) = \frac{d\left(r_{P(t)}\right)}{dt} \qquad = \begin{pmatrix} \frac{-\pi L \sin(\pi t)}{4} \\ \frac{\pi L \cos(\pi t)}{4} \end{pmatrix}$$

ii.

$$\begin{aligned} v_p &= \sqrt{\left(\frac{-\pi L \sin(\pi t)}{4}\right)^2 + \left(\frac{\pi L \cos(\pi t)}{4}\right)^2} \\ &= \sqrt{\frac{\pi^2 L^2 \sin^2(\pi t)}{16} + \frac{\pi^2 L^2 \cos^2(\pi t)}{16}} \\ &= \frac{\pi^2 L^2}{16} \end{aligned}$$

iii. Circle with radius $\frac{L}{4}$ and center $\left(6\frac{L}{5}, 6\frac{L}{5}\right)$.

2)

$$\begin{aligned} x(t) &= at \\ t &= \frac{x}{a} \\ y(t) &= b - \frac{a^2}{b}t^2 \\ y(x) &= b - \frac{a^2}{b}\frac{x^2}{a^2} = b - \frac{x^2}{b} \\ y(t=0) &= b \therefore \neg D \\ y(x=a) &= b - \frac{a^2}{b} \\ y(x=b) &= b - \frac{b^2}{b} = 0 \therefore \text{The answer is B} \end{aligned}$$

3) Polar:

$$\begin{aligned} \rho(t) &= L_0 + at \\ \varphi(t) &= \Omega t \boldsymbol{v_A} \end{aligned}$$