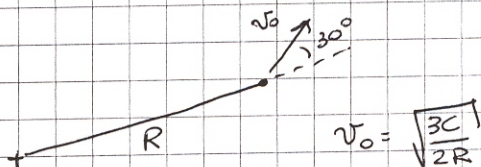


Exercício 4



$$a) \quad E = \frac{1}{2} v^2 - \frac{C}{R} = \frac{1}{2} \frac{3C}{2R} - \frac{C}{R} = -\frac{1}{4} \frac{C}{R} < 0 \rightarrow \text{elipse}$$

$$b) \quad h = \vec{r} \times \vec{v} = R v_0 \sin 30 = R \sqrt{\frac{3C}{2R}} \frac{1}{2} = \sqrt{\frac{3}{8}} \sqrt{CR}$$

$$c) \quad e = \sqrt{1 + \frac{2Eh^2}{C^2}} = \sqrt{1 + \frac{2}{C^2} \left(-\frac{1}{4} \frac{C}{R} \right) \frac{3}{8} CR} \\ = \sqrt{1 - \frac{6}{32}} = \sqrt{\frac{26}{32}} = \sqrt{\frac{13}{16}}$$

$$r_0(1+e) = \frac{h^2}{C} = \frac{3}{8} \frac{CR}{C} = \frac{3}{8} R$$

$$\Rightarrow r_0 = \frac{3}{8} \frac{R}{(1+e)}$$

$$r_{\max} = r_0 \frac{(1+e)}{1-e}$$

$$a = \frac{1}{2} \left(r_0 + r_0 \frac{(1+e)}{(1-e)} \right) \\ = \frac{1}{2} r_0 \left(\frac{1-e+1+e}{1-e} \right) = \frac{r_0}{1-e}$$

$$\Rightarrow a = \frac{\frac{3}{8} R}{(1+e)(1-e)} = \frac{\frac{3}{8} R}{1 - \frac{13}{16}} = 2R$$

$$d) \quad T = \frac{2\pi}{\sqrt{C}} (2R)^{3/2}$$

$$e) \quad v_e = ? \quad \frac{1}{2} v_e^2 - \frac{C}{R} = 0 \rightarrow v_e^2 = \frac{2C}{R}$$

$$\Delta v = v_e - v_0 = \sqrt{\frac{2C}{R}} - \sqrt{\frac{3}{2} \frac{C}{R}}$$