

Gabarito Lista 6 - Oscilações

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1. (a) Mostre!

(b) Mostre!

(c) Mostre!

$$(d) \quad \cos x = \frac{e^{ix} + e^{-ix}}{2} \quad \text{e} \quad \sin x = \frac{e^{ix} - e^{-ix}}{2i}.$$

(e) Demonstre!

(f) Mostre!

2. (a) Mostre!

(b) Mostre!

$$(c) \quad C_1 = C_2^* = \frac{a + ib}{2}.$$

$$(d) \quad a = A \cos \phi \quad \text{e} \quad b = -A \sin \phi.$$

3. (a) $y_{\text{eq}} = mg/k$.

$$(b) \quad \frac{d^2 y}{dt^2} + \frac{k}{m} y = g.$$

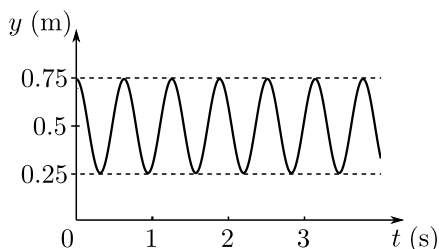
$$(c) \quad \frac{d^2 z}{dt^2} + \frac{k}{m} z = 0.$$

$$(d) \quad \omega = \sqrt{k/m}. \quad \text{Independe de } g.$$

$$(e) \quad z(t) = a \cos \omega t + b \sin \omega t.$$

$$(f) \quad y(t) = y_{\text{eq}}(1 + \frac{1}{2} \cos \omega t).$$

(g)



$$4. (a) \quad \frac{d^2 \theta}{dt^2} + \frac{g}{R} \theta = 0.$$

$$(b) \quad \omega = \sqrt{g/R}.$$

$$(c) \quad \theta(t) = \theta_0 \cos \omega t.$$

$$5. (a) \quad \frac{d^2 \theta}{dt^2} + \frac{g}{l} \left(\frac{1 + \alpha + \frac{\alpha^2}{2}}{1 + \frac{11}{15} \alpha^2} \right) \sin \theta = 0.$$

$$(b) \quad \theta(t) = A \cos(\omega t + \phi) \quad \text{e}$$

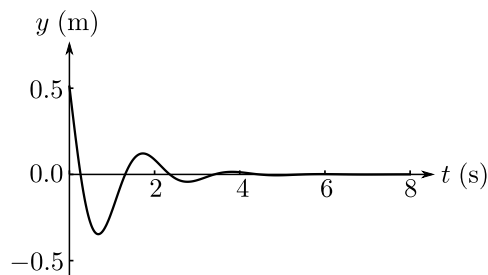
$$\omega = \sqrt{\frac{g}{l} \left(\frac{1 + \alpha + \frac{\alpha^2}{2}}{1 + \frac{11}{15} \alpha^2} \right)}.$$

$$(c) \quad \omega = \sqrt{\frac{g}{l}} \quad \text{que é a frequência do pêndulo simples.}$$

$$6. (a) \quad \omega = 3 \text{ s}^{-1}.$$

$$(b) \quad x(t) = 0.71 e^{-t} \cos\left(3t + \frac{\pi}{4}\right) \text{ m.}$$

(c)

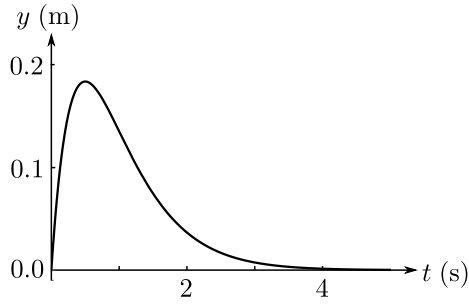


$$7. (a) \quad \gamma = 2\omega_0. \quad \text{Crítico.}$$

$$(b) \quad x(t) = (x_0 + \omega_0 x_0 t + v_0 t) e^{-\omega_0 t}.$$

(c) Não há oscilação!

(d)



8. (a) Mostre!

$$(b) \quad a = -\frac{(\omega^2 - \omega_0^2)(F_0/m)}{(\omega^2 - \omega_0^2)^2 + \gamma^2\omega^2} \quad e \quad b = \frac{\gamma\omega(F_0/m)}{(\omega^2 - \omega_0^2)^2 + \gamma^2\omega^2}.$$

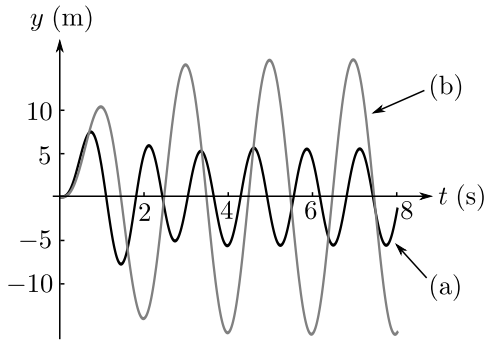
$$(c) \quad R = \frac{(F_0/m)}{[(\omega^2 - \omega_0^2)^2 + \gamma^2\omega^2]^{1/2}} \quad e \quad \tan \phi = -\frac{\gamma\omega}{\omega^2 - \omega_0^2}.$$

(d) Mostre!

$$9. \quad (a) \quad x(t) = \frac{40}{13}e^{-t} \cos 3t + \frac{340}{39}e^{-t} \sin 3t + \frac{60}{13} \sin 5t - \frac{40}{13} \cos 5t.$$

$$(b) \quad x(t) = 5\sqrt{10} e^{-t} \cos 3t + \frac{5}{3}\sqrt{10} e^{-t} \sin 3t - 5\sqrt{10} \cos \sqrt{10}t.$$

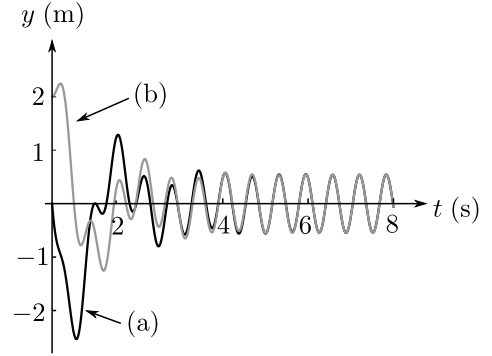
(c)



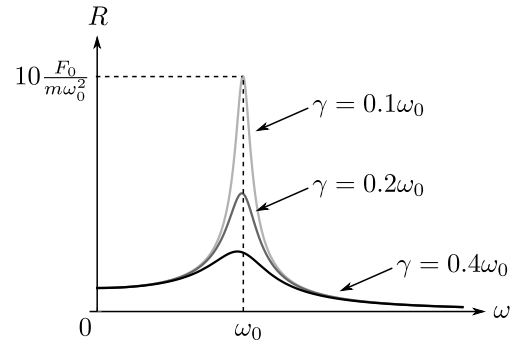
$$10. \quad (a) \quad x(t) = \frac{18}{17}e^{-t} \cos 3t - \frac{64}{17}e^{-t} \sin 3t - \frac{18}{17} \cos 10t + \frac{4}{17} \sin 10t.$$

$$(b) \quad x(t) = \frac{52}{17}e^{-t} \cos 3t + \frac{4}{17}e^{-t} \sin 3t - \frac{18}{17} \cos 10t + \frac{4}{17} \sin 10t.$$

(c)



11. (a)



$$(b) \quad \omega_{\max}^2 = \omega_0^2 - \frac{\gamma^2}{2}.$$

$$(c) \quad R_{\max} = \frac{(F_0/m)}{\gamma^2(\omega_0^2 - \gamma^2/4)^{1/2}}.$$

12. (a) Mostre!

(b) Mostre!

(c) Mostre!

(d)

