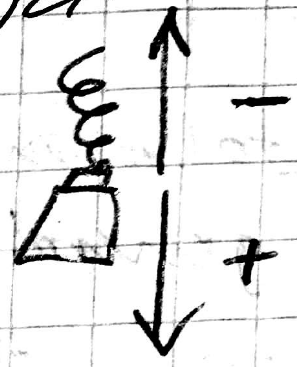
$K = 80$ N/m y que la resistencia del aire $4v$

a) La ley de movimiento de la caja.



$w = 196$ N $\quad x(0) = $ [redacted] 0.25

$K = 80$ N/m $\quad x'(0) = 0 \quad m = \frac{w}{g}$

$\beta = $ [redacted] $4v \quad m = \frac{196\,N}{9.8\,m/s^2}$

$$m\frac{d^2x}{dt^2} + Kx = 0$$

$m = 20$ Kg

$$m\frac{d^2x}{dt^2} = -Kx - \beta\frac{dx}{dt}$$

$$m\frac{d^2x}{dt^2} + \beta\frac{dx}{dt} + Kx = 0$$

$$\frac{20\cdot\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 80x = 0}{20}$$

$$\frac{d^2x}{dt^2} + 0.2\frac{dx}{dt} + 4x = 0$$

$$\frac{d^2x}{dt^2} + 0.2\frac{dx}{dt} + 4x = 0 \; ; \; x(0) = -0.25 \; , \; x'(0) = 0$$

$$\mathcal{L}\left\{\frac{d^2x}{dt^2}\right\} + 0.2\mathcal{L}\left\{\frac{dx}{dt}\right\} + 4\mathcal{L}\{x\} = 0$$

$$(s^2F(s) - sf(0) - f'(0)) + 0.2(sX(s) - x(0))$$
$$+ 4X(s) = 0$$

$$s^2X(s) + 0.25s + 0.2\,sX(s) + 0.05 + 4X(s) = 0$$

$$X(s)(s^2 + 0.2s + 4) = -0.25s - 0.05$$

$$X(s) = \frac{-0.25s - 0.05}{s^2 + 0.2s + 4}$$

$$X(s) = \frac{-0.25s - 0.05}{(s+0.1)^2 + (4 - 0.01)} \rightarrow$$ se hace para mantener equivalencia de la ecuación

$$X(s) = \frac{-0.25(s+0.1) + 0.025}{(s+0.1)^2 + (2)^2}$$

$$x(t) = \mathcal{L}^{-1}\left\{\frac{-0.25(s+0.1)}{(s+0.1)^2+4}\right\} + \mathcal{L}^{-1}\left\{\frac{0.025}{(s+0.1)^2+4}\right\}$$

$$x(t) = -0.25\mathcal{L}^{-1}\left\{\frac{s+0.1}{(s+0.1)^2+2^2}\right\} + 0.025\,\mathcal{L}^{-1}\left\{\frac{1}{(s+0.1)^2+2^2}\right\}$$

$$- \frac{0.25}{2} \mathcal{L}^{-1} \left\{ \frac{s+0.1}{(s+0.1)^2+2^2} \right\} + \frac{0.025}{2} \left\{ \frac{2}{(s+0.1)^2+2^2} \right\}$$

a)

$$X(t) = e^{-0.1t}(-0.125\cos(2t) + 0.0125\sin(2t))$$

b) El tiempo necesario para que la caja se mueva desde la posición inicial hasta 0.0625m por debajo de la posición de equilibrio.

$$-0.0625 = e^{-0.1t}(-0.125\cos(2t) + 0.0125\sin(2t))$$

$$0.0625 = e^{-0.1t}(0.125\cos(2t) - 0.0125\sin(2t))$$

$$0.0625e^{0.1t} = 0.125\cos(2t) - 0.0125\sin(2t)$$

$$= -0.2503\cos(1.9975t + 0.05)$$

$$0.248e^{0.1t} = \cos(1.9975t + 0.05)$$

$$t \approx 0.627\,s$$