No.
Date :

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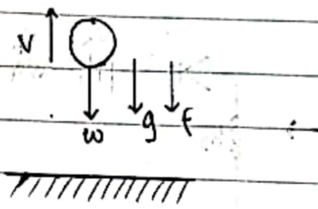

Berdasarkan Hukum II Newton.

$$\Sigma \bar{F} = m\bar{a}$$

$$\bar{w} + \bar{F} = -m\bar{a}$$

$$(mg + bv)\hat{y} = -m\bar{a}\hat{y}$$

$$(mg + bv) = -ma \quad \left(\times \frac{1}{m}\right)$$

$$g + \frac{b}{m}v = -a \quad (\text{subtitusikan nilai } a)$$

$$g + \frac{b}{m}v = -\frac{d^2y(t)}{dt^2}$$

$$g + \frac{b}{m}v = -\frac{dv}{dt}$$

$$\frac{-dv}{g + \frac{b}{m}v} = dt$$

$$-\int_{v_0}^{v(t)} \frac{dv}{g + \frac{b}{m}v} = \int_0^t dt$$

Misalkan $\Rightarrow g + \frac{b}{m}v = u$

$\Rightarrow \frac{b}{m}dv = du$

$dv = \frac{m}{b}du$, maka,

$$-\int_{v_0}^{v(t)} \frac{1}{u}\,du = \int_0^t dt$$

$$-\int_{v_0}^{v(t)} \frac{1}{u}\left(\frac{m}{b}du\right) = \int_0^t dt$$

$$-\frac{m}{b}\int_{v_0}^{v(t)} \frac{1}{u}\,du = t$$

$$-\frac{m}{b}\ln|u| = t$$

$$-\frac{m}{b}\ln\left|g + \frac{b}{m}v\right|_{v_0}^{v(t)} = t$$

$$-\frac{m}{b}\left(\ln\left|g + \frac{b}{m}(v(t))\right| - \ln\left|g + \frac{b}{m}(v_0)\right|\right) = t$$

Karena $\ln a - \ln b = \ln \frac{a}{b}$, maka,

$$\ln\left|\frac{g + \frac{b}{m}v(t)}{g + \frac{b}{m}v_0}\right| = -\frac{bt}{m}$$

$$\exp\left(\ln\left|\frac{g + \frac{b}{m}v(t)}{g + \frac{b}{m}v_0}\right|\right) = e^{-\frac{bt}{m}}$$

$$\frac{g + \frac{b}{m}v(t)}{g + \frac{b}{m}v_0} = e^{-\frac{bt}{m}}$$

$$g + \frac{b}{m}v(t) = \left(g + \frac{b}{m}v_0\right)e^{-\frac{bt}{m}}$$

$$\frac{b}{m}v(t) = \left(g + \frac{b}{m}v_0\right)e^{-\frac{bt}{m}} - g \quad \left(\times \frac{m}{b}\right)$$

$$v(t) = \frac{m}{b}\left(g + \frac{b}{m}v_0\right)e^{-\frac{bt}{m}} - \frac{mg}{b}$$

$$v(t) = \left(\frac{mg}{b} + v_0\right)e^{-\frac{bt}{m}} - \frac{mg}{b}$$

Karena, $f = w$

$bv = mg$

$v_T = \frac{mg}{b}$, maka,

$$\boxed{v(t) = (v_T + v_0)e^{-\frac{bt}{m}} - v_T}$$

$\Rightarrow$ Untuk $a(t)$

$$a(t) = \frac{dv(t)}{dt}$$

$$a(t) = \frac{d}{dt}\left((v_T + v_0)e^{-bt/m} - v_T\right)$$

$$a(t) = (v_T + v_0)\left(-\frac{b}{m}\right)e^{-bt/m}$$

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$$= -\frac{b}{m}(V_T+V_0)e^{-bt/m}$$

$$= \left(-\frac{b}{\cancel{m}}\cdot\frac{\cancel{m}g}{\cancel{b}} - \frac{b}{m}V_0\right)e^{-bt/m}$$

$$\boxed{a(t) = \left(-g - \frac{b}{m}V_0\right)e^{-bt/m}}$$

=> Untuk $y(t)$

$$V(t) = \frac{dy(t)}{dt}$$

$$dy(t) = V(t)\cdot dt$$

$$\int_0^{y(t)} dy(t) = \int_0^t V(t)\,dt$$

$$y(t) = \int_0^t \left((V_T+V_0)e^{-\frac{bt}{m}} - V_T\right)$$

$$y(t) = \left[(V_T+V_0)\left(-\frac{m}{b}\right)e^{-bt/m} - V_T.t\right]_0^t$$

$$y(t) = \left[(V_T+V_0)\left(-\frac{m}{b}\right)e^{-bt/m} - V_T t\right] - \left[(V_T+V_0)\left(-\frac{m}{b}\right)\right]$$

$$y(t) = -\frac{m}{b}(V_T+V_0)\left(e^{-bt/m}-1\right) - V_T.t$$

$$\boxed{y(t) = \frac{m}{b}(V_T+V_0)\left(1-e^{-\frac{bt}{m}}\right) - V_T.t}$$

=> Aproksimasi

- $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$

  $e^{-\frac{bt}{m}} = 1 - \frac{bt}{m} + \frac{1}{2}\left(\frac{bt}{m}\right)^2 + \dots$

- $y(t) = -V_T t + \frac{m}{b}(V_T+V_0)\left(1-e^{-\frac{bt}{m}}\right)$

$$= -V_T t + \frac{m}{b}(V_T+V_0)\left(1-1+\frac{bt}{m}-\frac{1}{2}\left(\frac{bt}{m}\right)^2\right)$$

$$= -V_T t + (V_T+V_0)\left(t - \frac{1}{2}\frac{b}{m}t^2\right)$$

$$= -\cancel{V_T t} + \cancel{V_T t} - \frac{1}{2}\frac{b}{m}V_T t^2 + V_0 t - \frac{1}{2}\frac{b}{m}V_0 t^2$$

$$= V_0 t - \frac{1}{2}\frac{\cancel{b}}{\cancel{m}}\left(\frac{\cancel{m}g}{\cancel{b}}\right)t^2 - \frac{1}{2}\frac{b}{m}V_0 t^2$$

$$= V_0 t - \frac{1}{2}gt^2 - \frac{1}{2}\frac{b}{m}V_0 t^2$$

$$\boxed{y(t) = V_0 t - \frac{1}{2}gt^2 - \frac{1}{2}\frac{b}{m}V_0 t^2}$$

Untuk $b=0$ maka,

$$\boxed{y(t) = V_0 t - \frac{1}{2}gt^2}$$

=> $V(t)$

$$V(t) = (V_T+V_0)e^{-bt/m} - V_T$$

$$= -V_T + (V_T+V_0)\left(1-\frac{bt}{m}\right)$$

$$= -\cancel{V_T} + \cancel{V_T} - \frac{b}{m}V_T t + V_0 - \frac{b}{m}V_0 t$$

$$= V_0 - \frac{\cancel{b}}{\cancel{m}}\left(\frac{\cancel{m}g}{\cancel{b}}\right)t - \frac{b}{m}V_0 t$$

$V(t) = V_0 - gt - \frac{b}{m}V_0 t$ (untuk $b=0$) maka,

$$\boxed{V(t) = V_0 - gt}$$

=> $a(t)$

$$a(t) = \left(-g - \frac{b}{m}V_0\right)e^{-\frac{bt}{m}}$$

$$= \left(-g - \frac{b}{m}V_0\right)\left(1 - \frac{bt}{m}\right)$$

$$= -g + \frac{gbt}{m} - \frac{b}{m}V_0 + \frac{b^2}{m^2}V_0 t$$

$$a(t) = -g - \frac{b}{m}V_0 + \left(\frac{b^2}{m^2}V_0 + \frac{gb}{m}\right)t \quad (b=0)$$

maka,

$$\boxed{a(t) = -g}$$