Nama : Lafia Merinda
NPM : 2013022026
Prodi : Pendidikan fisika (B)

Tugas Mekanika.

No.
Date

2.1) $x = 0$
$t = 0$

Tentukan :

a. $f x = f_0 + ct$
b. $f x = f_0 \sin ct$
c. $f x = f_0 e^{ct}$

Dimana f_0 dan c adalah konstan

Jawab :

a.) $\ddot{x} = \frac{1}{m}(f_0 + ct)$
$\dot{x} = \int_0^x \frac{1}{m}(f + ct)\,dt = \frac{f_0}{m}t + \frac{c}{2m}t^2$
$x = \int_0^x \left(\frac{f_0}{m}t + \frac{c}{2m}t^2\right)dt = \frac{f}{m}t^2 + \frac{c}{6m}t^3$

b.) $\ddot{x} = \frac{f}{m}\sin ct$
$\dot{x} = \int_0^x \frac{f_0}{m}\sin ct\,dt = \frac{f_0}{cm}\cos ct\,\Big|_0^t$
$= \frac{f_0}{cm}(1 - \cos ct)$

$x = \int_0^t \frac{f_0}{cm}(1 - \cos ct)\,dt = \frac{f_0}{cm}\left(1 - \frac{1}{c}\sin ct\right)$

c) $\ddot{x} = \frac{f_0}{m}e^{ct}$
$\dot{x} = \frac{f_0}{cm}e^{ct}\Big|_0^t = \frac{f_0}{cm}(e^{ct} - 1)$
$x = \frac{f_0}{cm}\left(\frac{1}{c}e^{ct} - \frac{1}{c} - 1\right)$
$= \frac{f_0}{c^2 m}(e^{ct} - 1 - ct)$

2.2) a.) $\ddot{x} = \frac{d\dot{x}}{dt} = \frac{d\dot{x}}{dx} \cdot \frac{dx}{dt} = \dot{x}\frac{d\dot{x}}{dx}$

$\dot{x}\frac{d\dot{x}}{dx} = \frac{1}{m}(f_0 + cx)$

$\dot{x}\frac{d\dot{x}}{dx} = \frac{1}{m}(f + cx)\,dx$

$\frac{1}{2}\dot{x}^2 = \frac{1}{m}\left(f_0 x + \frac{cx^2}{2}\right)$

$\dot{x} = \left(\frac{x}{m}(2f_0 + cx)\right)^{1/2}$

b.) $\ddot{x} = \dot{x}\frac{d\dot{x}}{dx} = \frac{1}{m}f_0 e^{-cx}$

$\dot{x}\,d\dot{x} = \frac{f_0}{cm}(e^{-cx} - 1) = \frac{f_0}{cm}(1 - e^{-cx})$

$\frac{1}{2}\dot{x}^2 = \frac{f_0}{cm}(e^{-cx} - 1) = \frac{f_0}{cm}(1 - e^{-cx})$

$\dot{x} = \left[\frac{2f_0}{cm}(1 - e^{-cx})\right]^{1/2}$

c.) $\ddot{x} = \dot{x}\dfrac{d\dot{x}}{dx} = \dfrac{1}{m}\left(f\cos cx\right)$

$\dot{x}\,d\dot{x} = \dfrac{f_0}{m}\cos cx\,dx$

$\dfrac{1}{2}\dot{x}^2 = \dfrac{f_0}{cm}\sin cx$

$\dot{x} = \left(\dfrac{2f_0}{cm}\sin cx\right)^{\frac{1}{2}}$

2.3). a). $V(x) = \int_0^x (f_0 + cx)\,dx$

$= f_0x - \dfrac{cx^2}{2} + c$

b.). $V(x) = -\int_c^x f_0 e^{-ct}\,dx$

$= \dfrac{f_0}{c}\sin cx + c$

c.) $V(x) = -\int_x^x f_0\cos cx\,dx$

$= \dfrac{f_0}{c}\sin cx + c$

2.4) a.) $V(x) = -\int f(x)\,dx$

$V(x) = -\int(-kx)\,dx$

$V(x) = \dfrac{kx^2}{2}$

b.) $E = T_0 = \frac{1}{2}kA^2$

$= T(x) + V(x)$

$T(x) = E - V(x)$

$= \frac{1}{2}kA^2 - \frac{1}{2}kx^2$

$= \frac{k}{2}(A^2 - x^2)$

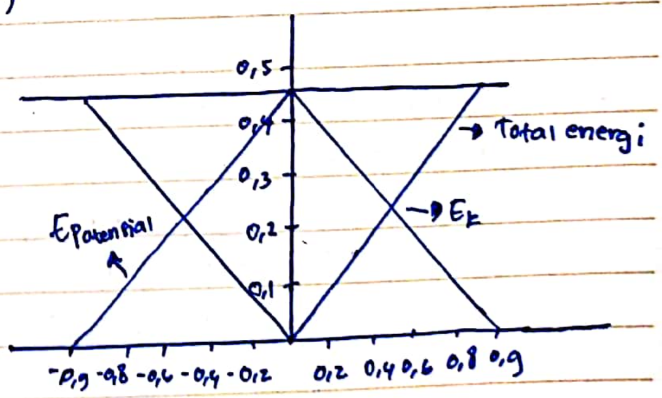
c.) $E = T_0 = \frac{1}{2}kA^2$

d.) $E = V(x)$

$\frac{1}{2}kA^2 = \frac{1}{2}kx^2$

$x = \pm A$

c)



Dipindai dengan CamScanner

2.8) $V = \frac{b}{x^2}$

$$f = m\frac{du}{dt} = m\frac{dv}{dt}\cdot\frac{dx}{dt}$$

$$= mu\frac{du}{dx}$$

$$\frac{du}{dx} = \frac{-3b}{x^4}$$

$$f = m\left(\frac{b}{m^3}\right)\left(\frac{-3b}{x^4}\right)$$

$$= \frac{-3mb^2}{x^7}$$

2.11) $a = \frac{dv}{dt} \cdot \frac{dv}{dx}\cdot\frac{dx}{dt} = v\frac{dv}{dx} = -\frac{c}{m}v^{3/2}$

$$= V^{-\frac{1}{2}}dv = -\frac{c}{m}dx$$

$$= \int_{v}^{v} V^{-\frac{1}{2}}dx = \int_0^x -\frac{c}{m}dx$$

$$= -2V_0^{\frac{1}{2}} \cdot \frac{-c}{m}\, x\, max$$

$$x_{max} = \frac{2mV_0^{\frac{1}{2}}}{c}$$

2.12) $M.a_x = \varepsilon f_x = \Sigma f_x$

$$m.a_x = mg - C_2V^2$$

$$a_x = \frac{du}{dx} = \frac{du\,dx}{dx\,dt} = \frac{du}{dt} : V$$

$$m = \frac{du}{dx} = -mg = -C_2V^2$$

$$V = \frac{du}{dx} = -g - \frac{C_2}{m}V^2$$

$$k = \frac{C^2}{m}$$

$$\int_{v_0}^{v}\frac{v\,dv}{-g-kv^2} = \int_B^A dx$$

$$y = -g - kV^2$$

$$dy = -2kv\,dv$$

$$vdv = \frac{1}{2}k\,dy$$

$$\int_{V_0}^{V} \cdot \frac{dy}{2ky} = \int_0^x dy$$

$$-\frac{1}{2}k\ln(-g-kv^2)\Big|_{V_0}^{v} = x$$

$$-\frac{1}{2k}\ln\left(\frac{-g-kV^2}{-g-kV_0^2}\right) = x$$

$$\frac{-g-kV^2}{-g-kV_0^2} = e^{-2kx}$$

$$-g-kv^2 = (-g-kV_0^2)e^{-2kx}$$

$$kV^2 = (g+kV_0^2)e^{-2kx} - \frac{g}{k}$$

$$A = \frac{g}{k} + V_0^2$$

$$V^2 = Ae^{-kx} - \frac{g}{k}$$

$$Ma_x = \Sigma f_x$$
$$m \cdot a_x = -mg + C_2 V^2$$
$$a_x = \frac{dv}{dt} = \frac{dv}{dx} \cdot \frac{dx}{dt} = \frac{dv}{dx} \cdot V$$
$$mV = \frac{dv}{dx} - mg + C_2 V^2$$
$$\frac{dv}{dx} = -g + \frac{C_2}{m} \cdot V^2$$
$$k = \frac{C_2}{m}$$
$$V\frac{dv}{dx} = -g + kV^2$$
$$\int_0^v \frac{V\,dv}{-g+kV^2} = \int_0^x dx$$

$$y = -g + kV^2$$
$$V\,dv = 2kV\,dv$$
$$V\,dv = \frac{1}{2} k\,dy$$
$$\int_0^v \frac{1}{2k} \frac{dy}{y} = \int_{x_0}^x dx$$
$$\frac{1}{2k} \ln(y) \Big|_0^v = x \Big|_{x_0}^x$$
$$\frac{1}{2k} \ln(-g + kV^2) \Big|_0^v = x - x_0$$
$$\frac{1}{2k} \ln\left(\frac{-g+kV^2}{g}\right) = x - x_0$$
$$\frac{-g+kV^2}{g} = e^{2k(x+x_0)}$$
$$-g + kV^2 = -ge^{2k(x-x_0)}$$
$$kV^2 = -ge^{2k(x-x_0)}$$
$$V^2 = \frac{-g}{k} e^{2kx_0} e^{2kx} + \frac{g}{k}$$
$$B = \frac{g}{k} e^{2kx_0}$$
$$V^2 = \frac{g}{k} - Be^{2kx}$$

2.13) $V^2 = \left(\frac{g}{k} + V_0^2\right) e^{-2kx} - \frac{g}{k}$ ⇒ Keatas

$V^2 = -\frac{g}{k} \cdot e^{-2kx_0} e^{2x_0 x} + \frac{g}{k}$ ⇒ Kebawah

$V = 0$ ⇒ gerak keatas

$$0 = \left(\frac{g}{k} + V_0^2\right) e^{-2kx} - \frac{g}{k}$$
$$e^{-2kx} = \frac{\frac{g}{k}}{\frac{g}{k} + V_0^2}$$

h posisi awal untuk gerakan kebawah (+) $a > 0$

$V^2 = \frac{-g}{k} \cdot e^{-2kh} e^{2k_0} + \frac{g}{k}$ Subsitusi $x = 0$

$$V^2 = \frac{-g}{k} \cdot \frac{\frac{g}{k}}{\frac{g}{k} + V_0^2} \cdot 1 + \frac{g}{k}$$
$$V^2 = \frac{g}{k}$$
$$= -V_t^2 - \frac{V_t^2}{V_t + V_0^2} + V_t^2$$
$$= V_t^2 \left(1 - \frac{V_t^2}{V_t^2 + V_0^2}\right)$$
$$V^2 = \frac{V_t^2 V_0^2}{V_t + V_0^2}$$
$$V = \frac{V_t V_0}{\sqrt{V_t^2 + V_0}}$$

$$\sqrt{\frac{2k}{m}\left(\frac{b - x}{m}\right)} = \frac{dx}{dt}$$
$$\int_0^0 \frac{dx}{\sqrt{\frac{2k}{m} \cdot \left(\frac{b-x}{bx}\right)}} = \int_0^t dt$$
$$\int_0^0 \frac{dx}{\sqrt{\frac{2k}{m}\left(\frac{b-x}{bx}\right)}} = \sqrt{\frac{mb}{2k}} \int_b^0 \sqrt{\frac{x}{b-x}}\, dx$$
$$u = \sqrt{\frac{b-x}{\sqrt{x}}}$$
$$du = \frac{\frac{1}{2\sqrt{bx}}(-1) \cdot \sqrt{x}\, dx \cdot \frac{1}{\sqrt{x}}}{x}$$
$$dx = \frac{dv}{\frac{1}{-2\sqrt{2} \cdot V\sqrt{x}} - \frac{V\sqrt{x}}{2x}}$$
$$= \frac{dv}{-\frac{1}{2\sqrt{x}} - \frac{V}{2x}}$$
$$= \frac{dv}{\frac{1+V^2}{2xV}}$$
$$= \sqrt{b-x} = V\sqrt{x}$$
$$b - x = V^2 x$$
$$b = x^2(V^2+1)$$
$$r = \frac{b}{4^2} + 1$$

No.

Date

$$dx = \frac{-2bv\,dv}{(v^2+1)^2}$$

$$\sqrt{\frac{mb}{2k}} \int_b^0 \sqrt{\frac{x}{b-x}}\,dx = \sqrt{\frac{mb}{2k}} \int_b^0 f(x) \frac{2bv\,dv}{(v^2+1)^2}$$

$$= \sqrt{\frac{mb}{2k}} \int_b^0 \frac{2bv\,dv}{(v^2+1)^2}$$

$$\int \frac{dv}{(av+b)^n} = \frac{2n-3}{2b(n-1)} \int \frac{dv}{(av^2+b)^{n+1}} + \frac{v}{2b(n-1)(av^2+b)^{n-1}}$$

$$= \frac{v}{2(v^2+1)} + \frac{1}{2} \int \frac{dv}{b^2+1}$$

$$\int_b^0 \frac{dv}{(v^2+1)^2} = \frac{v}{2(v^2+1)} \Big|_b^0 + \frac{1}{2} \arctan v \Big|_b^0$$

$$-\sqrt{\frac{mb}{2k}} \int_b^0 \frac{2b\,dv}{(v^2+1)^2} = -2b\sqrt{\frac{mb}{2k}} \left(\frac{v}{2(v^2+1)} \Big|_b^0 + \frac{1}{2} \arctan v \Big|_b^0 \right)$$

$$= -2b\sqrt{\frac{mb}{2k}} \left(\frac{v}{2(v^2+1)} \Big|_0^{-\infty} + \frac{1}{2} \arctan v \Big|_0^{-\infty} \right)$$

$$= -2b\sqrt{\frac{mb}{2k}} \left(0 - 0 + \frac{1}{2} \cdot \left(-\frac{\pi}{0} - 0\right)\right) = \pi\sqrt{\frac{mb^3}{8k}}$$

$$\pi\sqrt{\frac{mb^3}{8k}} = \int_0^t dt$$

$$t = \pi\sqrt{\frac{mb^3}{8k}}$$

2.15.) $ma = \Sigma F$

$$ma = mg - v - C_2 v^2$$

$$mg - C_1 v - C_2 v^2 = 0$$

$$C_2 v^2 - C_1 v - mg = 0$$

$$v_{1,2} = \frac{-C \pm \sqrt{C_1^2 + 4(2mg)}}{2C_2}$$

Pilih (+)

$$v_1 = \frac{-C_1 + \sqrt{C_1^2 + 4(2mg)}}{2C_2}$$

$$v_1 = v_t = \frac{-C_1}{2C_2} + \sqrt{\left(\frac{C_1}{2v_2}\right)^2 + \frac{mg}{C_2}}$$

$$v_t = \frac{-C_1}{2C_2} + \sqrt{\left(\frac{C_1}{2v_2}\right)^2 + \frac{mg}{C_2}}$$