Nama = Fadiyah Farah Khoirunnisaa
Npm = 2013022016
Prodi = Pendidikan Fisika
Kelas = B

2.1 a) $F_x = m\ddot{x} = F_0 + Ct$

$$\frac{m\,dv}{dt} = F_0 + Ct$$

$$m.dv = (F_0 + ct)\,dt$$

$$m\int_{v_0}^{v} dv = \int_0^t (F_0 + ct)\,dt$$

$$m(v - v_0) = F_0(t - t_0) + \frac{c}{2}(t^2 - t_0^2)$$

Karena $V_0 = 0$ dan $t_0 = 0$, maka:

$$mv = F_0 t + \frac{ct^2}{2}$$

$$V(t) = \frac{1}{m}\left(F_0 t + \frac{Ct^2}{2}\right) = \frac{dx}{dt}$$

$$\int_{x_0}^{x} dx = \int_{t_0}^{t} \frac{1}{m}\left(F_0 t + \frac{Ct^2}{2}\right) dt$$

$$x - x_0 = \frac{1}{m}\left(\frac{F_0}{2}(t^2 - t_0^2) + \frac{c}{6}(t^3 - t_0^3)\right)$$

$$x = \frac{1}{m}\left[\frac{F_0 t^2}{2} + \frac{ct^3}{6}\right]$$

b) $F_x = m\frac{dv}{dt} = F_0 \sin ct$

$$\int_0^v dv = \frac{F_0}{m}\int_0^t \sin ct\,dt$$

$$v(t) = -\frac{F_0}{mc}\cos ct$$

$$x(t) = \int_0^x dt$$

$$x(t) = -\frac{F_0}{mc}\int_0^t \cos ct\,dt$$

$$x(t) = -\frac{F_0}{mc^2}\sin ct$$

c) $F_x = F_0 e^{ct}$

$$v(t) = \frac{F_0}{m}\int_0^t e^{ct}\,dt$$

$$V(t) = \frac{F_0}{cm} e^{ct}$$

$$x(t) = \frac{F_0}{c^2 m} e^{ct}$$

No.
Date :

2.2 a) $F_x = F_0 + Cx$

$f(x) = mv\frac{dv}{dx} = F_0 + Cx$

$\int_{v_0}^{v} mv\,dv = \int_0^x (F_0 + Cx)\,dx$

$\frac{mv^2}{2} = F_0 x + \frac{C}{2}x^2$

$v = \sqrt{\frac{2}{m}\left(F_0 x + \frac{C}{2}x^2\right)}$

b) $F(x) = mv\frac{dv}{dx}$

$\frac{1}{2}mv^2 = F_0 e^{-cx}$

$v = \frac{2}{m}\left[-\frac{F_0}{c}e^{-cx}\right]^{1/2}$

c) $F(x) = mv\frac{dv}{dx} = F_0 \cos Cx$

$\frac{1}{2}mv^2 = \int_0^x F_0 \cos Cx$

$\frac{1}{2}mv^2 = \frac{F_0}{C}\sin Cx$

$v = \frac{2}{m}\left[\frac{F_0}{C}\sin Cx\right]^{1/2}$

2.3 a) $F_x = -\frac{dv}{dx} = F_0 + Cx$

$u(x) = -\left[F_0 x + \frac{C}{2}x^2\right] + C$

b) $F_x = -\frac{dv}{dx} = F_0 + e^{-cx}$

$\int_{u(x_0)}^{u(x)} dv = -F_0 \int_{x_0}^{x} e^{-cx}\,dx$

$u(x) - u(x_0) = \frac{F_0}{C}\left[e^{-cx} - e^{-cx_0}\right]$

c) $F_x = -\frac{dv}{dx} = F_0 \cos cx$

$\int_{u(x_0)}^{u(x)} dv = -F_0 \int_{x_0}^{x} \cos cx\,dx$

$u(x) - u(x_0) = -\frac{F_0}{C}\left[\sin cx - \sin Cx_0\right]$

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

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

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

Jadi, energi potensial $V(x) = \frac{kx^2}{2}$

b) dan c)

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

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

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

$T(x) = \frac{1}{2}kA^2 - \frac{1}{2}kx^2$

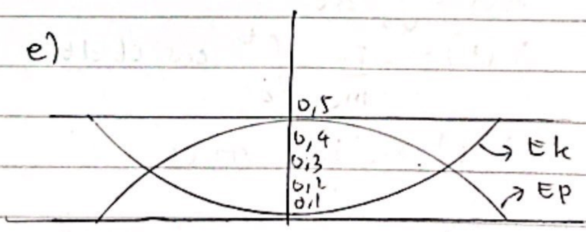
$T(x) = \frac{k}{2}(A^2 - x^2)$

d) $E = V(x)$

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

$x = \pm A$

e)




Hasil : a) $V(x) = \frac{kx^2}{2}$

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

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

2.8 $V = \frac{b}{x^3}$

$F = m\frac{dV}{dt} = m\frac{dv}{dt}\frac{dx}{dt}$

$= mv\frac{dv}{dx}$

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

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

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

2.11 $F(v) = -cv^{3/2}$

$= m\frac{dv}{dt} = m\frac{dv}{dx}\frac{dx}{dt}$

$= m\frac{dv}{dx}$

$-cv^{3/2} = m\frac{dv}{dx}$

$\int_0^x dx = \int_{v_0}^{v} \frac{-mv}{cv^{3/2}} dv$

$x = -\frac{m}{c}\int_{v_0}^{v}\frac{dv}{\sqrt{v}}$

$= -\frac{m}{c}\int_{v_0}^{v} v^{-1/2} dv = -\frac{m}{c}\frac{v^{1/2}}{1/2}\Big|_{v_0}^{v}$

$= \frac{2m}{c}\left(\sqrt{v_0} - \sqrt{v}\right)$

Partikel berhenti, maka $v = 0$, jadi $x_{max} = \frac{2m\sqrt{v_0}}{c}$

2.12 $m \cdot a_x = \Sigma F_x$

$m.a_x = -mg - c_2V^2$

$a_x = \frac{dV}{dt} = \frac{dv}{dx}\frac{dx}{dt} = \frac{dv}{dx}.V$

$m\frac{dv}{dx} = -mg - c_2v^2$

$V\cdot\frac{dV}{dx} = -g - \frac{c_2}{m}V^2$

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

$\int_{v_0}^{v}\frac{v\,dv}{-g-kv^2} = \int_0^x dx$

$y = -g - kv^2$

$dy = -2kv\,dv$

$$v\,dv = -\frac{1}{2k}dy$$

$$\int_{v_0}^{v} \frac{-1\,dy}{2ky} = \int_0^x dx$$

$$-\frac{1}{2k}\ln(y)\Big|_{v_0}^{v} = v\Big|_0^x$$

$$-\frac{1}{2k}\ln(-g-kv^2)\Big|_{v_0}^{v} = x$$

$$-\frac{1}{2k}\ln\left(\frac{-g-kv^2}{-g-kv_0^2}\right) = x$$

$$\left(\frac{-g-kv^2}{-g-kv_0^2}\right) = e^{-2kx}$$

$$-g-kv^2 = (-g-kv_0^2)e^{-2kx}$$

$$kv^2 = (g+kv_0^2)e^{-2kx} - \frac{g}{k}$$

$$A = \frac{g}{k} + V_0^2 \longrightarrow \boxed{V^2 = Ae^{-2kx} - \frac{g}{k}}$$

$$Ma_x = \Sigma F_x$$

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

$$a_x = \frac{dv}{dt} = \frac{dv}{dx}\cdot\frac{dx}{dt} = \frac{dv}{dx}\cdot v$$

$$mv\frac{dv}{dx} = -mg + C_2V^2$$

$$C.\frac{dv}{dx} = -g + \frac{C_2}{m}V^2 \qquad k = \frac{C_2}{m}$$

$$V.\frac{dv}{dx} = -g + kv^2$$

$$\int_0^v \frac{v\,dv}{-g+kv^2} = \int_0^x dx$$

$$y = -g + kv^2$$

$$dy = 2kv\,dv$$

$$v\,dv = \frac{1}{2k}dy$$

$$\int_0^v \frac{1}{2k}\frac{dy}{y} = \int_{x_0}^{x} dx$$

$$\frac{1}{2k}\ln(y)\Big|_0^v = x\Big|_{x_0}^{x}$$

$$\frac{1}{2k}\ln(-g+kv^2)\Big|_0^v = x - x_0$$

$$\frac{1}{2k}\ln\left(\frac{-g+kv^2}{-g}\right) = x - x_0$$

$$\frac{-g+kv^2}{g} = e^{2k(x-x_0)}$$

$$-g+kv^2 = -ge^{2k(x-x_0)}$$

$$kv^2 = -ge^{2k(x-x_0)} +$$

$$V^2 = -ge^{2k(x-x_0)} + g$$

$$B = \frac{g}{k}e^{2kx_0}$$

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

No.
Date :

keatas | ke bawah

**2.13** $V^2 = \left(\frac{g}{k} + V_0^2\right) e^{-2kx} - \frac{g}{k}$ | $V^2 = -\frac{g}{k} e^{-2kx_0} e^{2kx} + \frac{g}{k}$

$V = 0$ pada gerak keatas

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

$e^{-2kh} = \frac{\frac{g}{k}}{\frac{g}{k} + V_0^2}$  h = posisi awal untuk gerakan kebawah dan (x) a = 0,

$V^2 = -\frac{g}{k} e^{-2kh} e^{2k0} + \frac{g}{k}$ → substitusikan $x = 0$

$V^2 = -\frac{g}{k} \cdot \frac{\frac{g}{k}}{\frac{g}{k} + V_0^2} \cdot 1 + \frac{g}{k}$

$Vt^2 = \frac{g}{k}$

$V^2 = -Vt^2 \cdot \frac{Vt^2}{Vt^2 + V_0^2} + Vt^2$

$V^2 = Vt^2 \left(1 - \frac{Vt^2}{Vt^2 + V_0^2}\right)$

$V^2 = Vt^2 \left(\frac{Vt^2 + V_0^2 - Vt^2}{Vt^2 + V_0^2}\right)$ → $V^2 = \frac{Vt^2 V_0^2}{Vt^2 + V_0}$

$V = \frac{Vt\, V_0}{\sqrt{Vt^2 + V_0^2}}$

**2.14** $Ma_x = \Sigma F_x$

$Ma_x = -kx^{-2}$

$a_x = \frac{dv}{dt} = \frac{dv}{dx}\frac{dx}{dt} = \frac{dv}{dx} \cdot v$

$mv\frac{dv}{dx} = -kx^{-2}$

$v\frac{dv}{dx} = -\frac{k}{m} x^{-2}$

$\int_0^v v\,dv = -\frac{k}{m}\int_b^x x^{-2}\,dx$

$\left.\frac{v}{2}\right|_0^v = \frac{-k}{m} (-1) \left. x^{-1}\right|_0^x$

$\frac{v^2}{2} = \frac{k}{m}\left(x^{-1} - b^{-1}\right)$

$v^2 = \frac{2k}{m}\left(\frac{b - x}{bx}\right)$

$v = \frac{dx}{dt}$

$\sqrt{\frac{2k}{m}\left(\frac{b-x}{m}\right)} = \frac{dx}{dt}$

$\int_b^0 \frac{dx}{\sqrt{\frac{2k}{m} \cdot \frac{b-x}{bx}}} = \int_0^k dt$

$\int_b^0 \frac{dx}{\sqrt{\frac{2k}{m}\left(\frac{b-x}{bx}\right)}} = \sqrt{\frac{mb}{2k}} \int_b^0 \sqrt{\frac{x}{b-x}}$

$u = \frac{\sqrt{b-x}}{\sqrt{x}}$

No ..........

Date : ..........

$$dv = \frac{\frac{1}{2\sqrt{b-x}}(-1).\sqrt{x}\,dx - \frac{1}{2\sqrt{x}}}{x}$$

$$dx = \frac{dv}{\frac{1}{-2\sqrt{x}.v\sqrt{x}} - \frac{v\sqrt{x}}{2x^{3/2}}} = \frac{dv}{\frac{1}{-2\sqrt{x}} - \frac{v}{dx}} = -\frac{dv}{\frac{1+v^2}{2xv}} = \frac{2xv\,dv}{v^2+1}$$

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

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

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

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

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

$$-\sqrt{\frac{mb}{2k}}\int_b^0\frac{2b\,dv}{(v^2+1)^2} = -2b\sqrt{\frac{mb}{2k}}\left(\frac{v}{2(v^2+1)}\Big|_b^0 + \frac{1}{2}\,arc\tan v\Big|_b^0\right.$$
$$= -2b\sqrt{\frac{mb}{2k}}\left(\frac{v}{2(v^2+1)}\Big|_0^{-\infty} + \frac{1}{2}\,arc\tan v\Big|_b^0\right.$$
$$= -2b\sqrt{\frac{mb}{2k}}\left(0-0+\frac{1}{2}\cdot\left(\frac{\pi}{0}-0\right)\right)$$
$$= \pi\sqrt{\frac{mb^3}{8k}}$$

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

No.
Date :

2.15

$$ma = \Sigma F$$

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

$$ma = 0$$

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

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

$$V_{1,2} = \frac{-C_1 \pm \sqrt{C_1^2 + 4 C_2 mg}}{2C_2}$$

pilih (+)

$$V_1 = \frac{-C_1 + \sqrt{C_1^2 + C_2 mg}}{2C_2}$$

$$V_1 = Vt = -\frac{C_1}{2C_2} + \sqrt{\left(\frac{C_1}{2C_2}\right)^2 + \frac{mg}{C_2}}$$

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