$V = at + V_0$ مشتقها

Cat

Ex 10:

$$a = 3v = \frac{dv}{dt}$$

$$3\int_0^t dt = \int_{v_0}^{v} \frac{dv}{v}$$

$$3t = \ln v \Big|_{v_0}^{v} = \ln \frac{v}{v_0}$$

$$e^{3t} = \frac{v}{v_0} \; ; \; V = V_0 e^{3t} \Rightarrow V = 2e^{3} \quad (t = 1s)$$

$$* \quad V = \frac{dx}{dt} = V_0 e^{3t}$$

$$\int_0^x dx = \int_0^t V_0 e^{3t} \, dt$$

$$x = V_0 \cdot \frac{1}{3} e^{3t} \Big|_0^t$$

$$x = \frac{2}{3}\left(e^{3t} - 1\right)$$

بالعادة بيعطونا ال $a \to a(t)$

إذا كان معطى $V = v(x)$ or $a = a(x)$

↓ use $a\,dx = v\,dv$

Ex 12:

a) $v = \dfrac{5}{4+x}$ Print.

if $x \nearrow$

$v \searrow$, $v > 0$

$$a = \frac{dv}{dt} < 0$$

إذا كانو عكس بعض

↓ ⊕ ↓ ⊖ (a and v)

the motion decelerated motion

b) change of rate of v: $\dfrac{dv}{dt} = a = ??$

Since $v = v(x)$, $a\,dx = v\,dv$

$$a = v\frac{dv}{dx} = v \cdot \frac{d}{dx}\left(\frac{5}{4+x}\right)$$

Rate of change

نسبة تغير السرعة

$$= -5 \frac{1}{(4+x)^2} \cdot \frac{5}{4+x}$$

$$a = -\frac{25}{(4+x)^3}$$

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We need an eq relating x and t.

$$v = \frac{dx}{dt} = \frac{5}{(4+x)}$$

$$\int_0^x (4+x)\,dx = 5\int_0^t dt$$

$$4x + \frac{x^2}{2} = 5t = 20$$ $\to x_1 = -11,5$; $x_2 = 3,5$

At $t = 4s$,

$x = 3,5m \to a = -0,059\ m/s^2$

<u>Ex 13:</u>

(V (ع) thrown (مقذوفة))
Dropped ($v_0 = 0$)

$V_{01} = 25\ m/s$

The balls meet at the same height:

$$y_1 = y_2$$

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$$\cancel{\frac{1}{2}at^2} + V_{01}t + \cancel{y_{01}}^{0} = \cancel{\frac{1}{2}at^2} + \cancel{V_{02}t}^{0} + y_{02}$$

$$25t = 15$$ (Can apply $a = st$?!)

$$t = \frac{15}{25} = \frac{3}{5} = 0,6s$$

Ex 15:

$r = 2e^{\omega t}$ $\qquad \dot{r} = 2\omega e^{\omega t}$

$\theta = \omega t$ $\qquad \dot{\theta} = \omega$

a) $\vec{V} = \dot{r}\,\hat{e}_r + r\dot{\theta}\hat{e}_\theta$

$= 2\omega e^{\omega t}\hat{e}_r + 2e^{\omega t}\omega\hat{e}_\theta$

$= 2\omega e^{\omega t}(\hat{e}_r + \hat{e}_\theta)$ $\qquad V = 2\omega e^{\omega t}\sqrt{2}$

b) $v = \dfrac{ds}{dt} \Rightarrow S = \int ds = \int v\,dt = 2\sqrt{2}\,\omega \int e^{\omega t}$

$= 2\sqrt{2}\,\omega \cdot \dfrac{1}{\omega} e^{\omega t}\Big|_0^t$

$= 2\sqrt{2}\,[e^{\omega t} - 1] \Rightarrow (t = 2s) = 151,5\ m$

Ex 17:

$r = r_0 e^{\theta}$

$(\vec{Or} ; \vec{Ox})$ $\theta = \omega t$

a) $A : y = 0$ $\quad ; \theta_A = 0$

$r_A = x_A = r_0 e^0 = r_0$

$A(r_0 ; 0)$

$B : x_B = 0$; $\theta = \dfrac{\pi}{2}$

$y_B = r_B = r_0 e^{\frac{\pi}{2}}$; $B(0, r_0 e^{\pi/2})$

b) $r = r_0 e^{\omega t} \rightarrow \dot{r} = r_0\omega e^{\omega t}$; $\ddot{r} = r_0\omega^2 e^{\omega t}$

$\theta = \omega t \rightarrow \dot{\theta} = \omega$; $\ddot{\theta} = 0$

$\vec{V} = \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta$

$= \underbrace{r_0\omega e^{\omega t}}_{V_r}\hat{e}_r + \underbrace{r_0 e^{\omega t}\omega}_{V_\theta}\cdot\hat{e}_\theta = r_0\omega e^{\omega t}[\hat{e}_r + \hat{e}_\theta]$

$V = r_0 \omega e^{\omega t} \sqrt{2}$

c) $\vec{v} \cdot \hat{e}_r = v \cdot (1) \cdot \cos\theta$

$= (v_r \hat{e}_r + v_\theta \hat{e}_\theta)\hat{e}_r = \cancel{v_r (1) +}$

$(\text{proj } \vec{v} \cdot \hat{e}_r) = v_r$

$v \cos\theta = v_r \Rightarrow \cos\theta = \frac{v_r}{v} = \frac{\cancel{r_0 \omega e^{\omega t}}}{\cancel{r_0 \omega e^{\omega t}} \sqrt{2}}$

$= \frac{1}{\sqrt{2}}$; $\theta = \frac{\pi}{4}$

$\vec{v} \cdot \hat{e}_r = (v \hat{e}_r + v_\theta \theta)\hat{e}_r$

$= v_r + 0$

d) pdf Jls