4/3/2025

سكشن ديناميكيا

Motion with constant acceleration

$\Rightarrow F = \frac{dv}{dt} = a$ $\quad \int dv = \int a\,dt$ $\quad dv = a\,dt$ $\quad t=0$

$v = at + c_1$ $\quad v = v_0$

$\therefore c_1 = v_0$

$\Rightarrow v = v_0 + at$ $\quad \frac{dx}{dt} = v_0 + at$

*) $\int dx = \int (v_0 + at)\,dt$ $\quad x = v_0 t + \frac{1}{2}at^2 + c_2$

$x_0 = 0 \quad t = 0$ $\quad \therefore c_2 = 0$

$\Rightarrow x = x_0 + v_0 t + \frac{1}{2}at^2$

*) $F = \frac{v\,dv}{dx} = a$ $\quad \int v\,dv = \int a\,dx$ $\quad \frac{1}{2}v^2 = ax + c_3$

$v^2 = 2ax + c_3$ $\quad \therefore c_3 = v_0^2$

$\Rightarrow v^2 = v_0^2 + 2ax$

EX]1 $v_0 = 12\ m/s$ $\quad x_0 = 3m$ $\quad x = -5$ $\quad t = 2$

مثال في الكتاب Find acceleration (a).

Solu2

$x = x_0 + v_0 t + \frac{1}{2}at^2$

$-5 = 3 + (12 \times 2) + \frac{1}{2}a(2)^2$

$-5 = 3 + 24 + 2a$ $\quad a = -16$

EX]2 $m = 200\ gm$ $\quad h = 80\ m$ $\quad x = 30\ m$ $\quad g = 10\ m/s^2$

$v_0 = 0$ $\quad x_0 = 0$ Find the time.

Solu2

$x = x_0 + v_0 t + \frac{1}{2}at^2$

$30 = 0 + 0 + \frac{1}{2}10t^2$ $\quad t^2 = \frac{30}{5}$ $\quad t = \sqrt{6}\ s$

Ex]3 Prove that the aecelevation

$$X = a(2t + \sin 2t) \qquad Y = a(1 - \cos 2t)$$

« Solu ↵ →

$$\dot{X} = a(2 + 2\cos 2t) \Rightarrow \therefore \ddot{X} = -4a \sin 2t$$

$$\dot{Y} = 2a \sin 2t \Rightarrow \therefore \ddot{Y} = 4a \cos 2t$$

$$F = \sqrt{\ddot{X}^2 + \ddot{Y}^2} = \sqrt{(-4a\sin 2t)^2 + (4a\cos 2t)^2}$$