Tutor:

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By appointment

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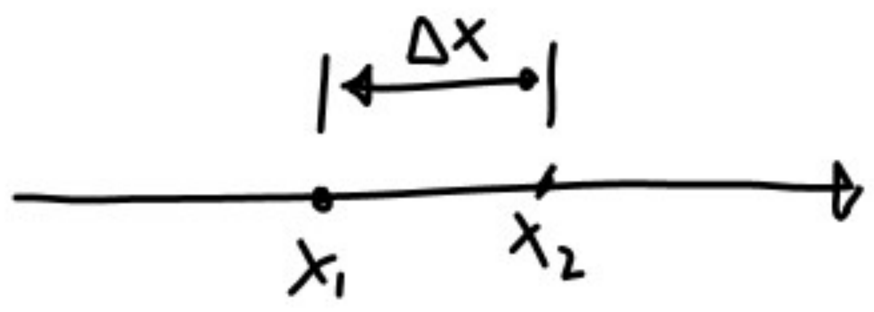
Statics: $\Sigma F = ma$ assume $a=0$ $\Sigma F = 0$

Dynamics: $\Sigma F = ma$ no acceleration assumption



it takes Δt to move from x_1 to x_2

$$\text{average vel} = \frac{\Delta x}{\Delta t}$$

$$v = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

V_1 at x_1 and V_2 at x_2

$$\Delta V = V_2 - V_1$$

average acceleration $= \dfrac{\Delta V}{\Delta t}$

$$a = \lim_{\Delta t \to 0} \frac{\Delta V}{\Delta t} = \frac{dv}{dt}$$

$$a = \frac{d^2 x}{dt^2}$$

$$a = v \frac{dv}{dx}$$

$$F_K = Kx$$

$$F = ma$$

$$V = \frac{dx}{dt} \qquad dx = v\,dt \qquad \int_{x_1}^{x_2} dx = \int_{t_1}^{t_2} v(t)\,dt \qquad x\Big|_{x_1}^{x_2} = x_2 - x_1 = \int_{t_1}^{t_2} v(t)\,dt$$

$$a = \frac{dV}{dt} \qquad dV = a\,dt \qquad \int_{V_1}^{V_2} dV = \int_{t_1}^{t_2} a(t)\,dt \qquad V_2 - V_1 = \int_{t_1}^{t_2} a(t)\,dt$$

$$a = v\,\frac{dv}{dx} \qquad v\,dv = a\,dx \qquad \int_{V_1}^{V_2} v\,dV = \int_{x_1}^{x_2} a(x)\,dx \qquad \frac{1}{2}V^2\Big|_{V_1}^{V_2} = \frac{1}{2}\left(V_2^2 - V_1^2\right) = \int_{x_1}^{x_2} a(x)\,dx$$

assume v constant

$v = \frac{dx}{dt}$ $dx = v\,dt$ $\int_{x_0}^{x} dx = \int_0^t v\,dt$ $x - x_0 = vt$ $x = x_0 + vt$

assume a constant

$a = \frac{dv}{dt}$ $dv = a\,dt$ $\int_{v_0}^{v} dv = \int_0^t a\,dt$ $v - v_0 = at$ $v = v_0 + at$

$dx = v\,dt = v_0 + at\,dt$ $\int_{x_0}^{x} dx = \int_0^t v_0 + at\,dt$ $x - x_0 = v_0 t + \frac{1}{2}at^2$ $x = x_0 + v_0 t + \frac{1}{2}at^2$

$a = v\frac{dv}{dx}$ $v\,dv = a\,dx$ $\int_{v_0}^{v} v\,dv = \int_{x_0}^{x} a\,dx$ $\frac{1}{2}(v^2 - v_0^2) = a(x - x_0)$ $v^2 = v_0^2 + 2a(x - x_0)$

11.34

A cars acceleration and braking is tested. In one tes the car accelerates from 10 to 100 Km/h in 8.2 s. In the braking test the car decelerates from 100 Km/h to a stop in 44 m. Assume constant acceleration.

a) what is the acceleration

b) what is the deceleration

$$V = V_0 + at$$

$$100\ \frac{Km}{h} = 10\ \frac{Km}{h} + a\ 8.2s$$

$$100\ \frac{Km}{h} - 10\ \frac{Km}{h} = 90\ \frac{Km}{h} = a\ 8.2s$$

$$\frac{90\ Km/h}{8.2s}\left(\frac{1\ h}{60\ Min}\right)\left(\frac{1\ Min}{60s}\right) = 0.003\ \frac{Km}{s^2}\left(\frac{1000\ m}{1\ Km}\right)$$

$$= \boxed{3.05\ m/s^2}$$

$$V^2 = V_0^2 + 2a(x - x_0)$$

$$0^2 = \left(100\ \frac{km}{h}\right)^2 + 2a(44\ m - 0)$$

$$-\left(100\ \frac{km}{h}\right)^2 = 2a\ 44m$$

$$-10000\ \frac{km^2}{h^2} = a\ 88m$$

$$\frac{-10\,000\ \frac{km^2}{h^2}}{88\ m}\left(\frac{1000\ m}{1\ km}\right)^2\left(\frac{1\ h}{60\ mr}\right)^2\left(\frac{1\ mr}{60\ s}\right)^2 = -8.77\ \frac{m^2}{s^2 m}$$

$$\boxed{-8.77\ \frac{m}{s^2}}$$