Tutor:

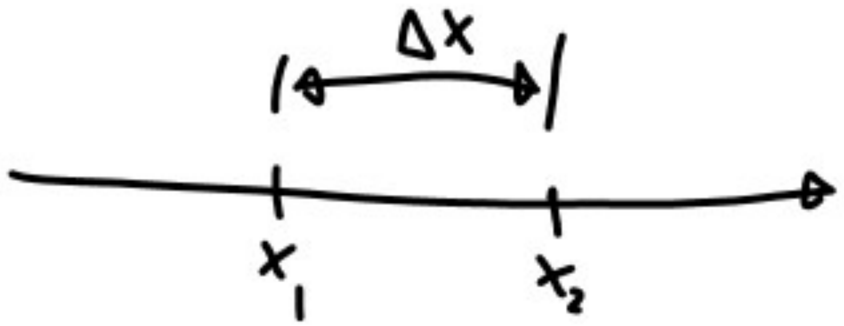
Edward Suppes

By appointment

edward.suppes@stmartin.edu

Statics $\quad \Sigma F = ma \quad a = 0 \quad \Rightarrow \quad \Sigma F = 0$

Dynamics $\quad \Sigma F = ma \quad$ Kinematics



Δt to go from x_1 to x_2

Average Vel $= \dfrac{\Delta x}{\Delta t}$

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

V_1 at X_1, V_2 at X_2

Average accel $= \frac{\Delta V}{\Delta t}$

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

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

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

$$dx = v\,dt$$

$$\int_{x_1}^{x_2} dx = \int_{t_1}^{t_2} v(t)\,dt$$

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

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

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

$$dv = a\,dt$$

$$\int_{v_1}^{v_2} dv = \int_{t_1}^{t_2} a(t)\,dt$$

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

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

$$v\,dv = a\,dx$$

$$\int_{v_1}^{v_2} v\,dv = \int_{x_1}^{x_2} a(x)\,dx$$

$$\frac{v^2}{2}\Big|_{v_1}^{v_2} = \frac{1}{2}\left(v_2^2 - v_1^2\right) = \int_{x_1}^{x_2} a(x)\,dx$$

$$dx = v\,dt$$

assume v constant

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

$$dv = a\,dt$$

assume a constant

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

$$\int_{x_0}^{x} dx = \int_0^t v_0 + at\,dt$$

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

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

$$\int_{v_0}^{v} v\,dv = \int_{x_0}^{x} a\,dx$$

assume a constant

$$\frac{1}{2}v^2\Big|_{v_0}^{v} = ax\Big|_{x_0}^{x}$$

$$\frac{1}{2}(v^2 - v_0^2) = a(x - x_0)$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

11.34 A car is tested for acceleration and breaking. In the street start test the elapsed time is 8.2 s for a velocity increase from 10 to 100 Km/h. In the braking test the distance traveled is 44m starting at 100 km/h.

a) Determine acceleration

b) Determine deceleration

$$V = V_0 + at$$

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

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

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

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

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

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

$$-10000\ \frac{km^2}{h^2} = 2a\ 44m = a\ 88m$$

$$\frac{-10000\ \frac{km^2}{h^2}}{88\ m}\left(\frac{1000\ m}{1\ km}\right)^2\left(\frac{1\ h}{60\ m}\right)^2\left(\frac{1\ m}{60\ s}\right)^2 = \boxed{-8.8\ m/s^2}$$