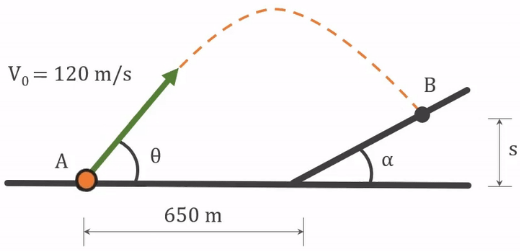
Car Brakes for Corner



A ball is launched from point A with the initial conditions shown. Find an expression for the horizontal displacement x(t).

Using known expressions:

$$a = \frac{\mathrm{d}v}{\mathrm{d}t} \quad \Rightarrow \quad \mathrm{d}v = a\mathrm{d}t \tag{1}$$

$$\int_{v_0}^{v} \mathrm{d}v = a \int_{0}^{t} \mathrm{d}t \tag{2}$$

$$v(t) = a \cdot t + v_0 \tag{3}$$

$$v = \frac{\mathrm{d}s}{\mathrm{d}t} \quad \Rightarrow \quad \mathrm{d}s = v\mathrm{d}t = (a \cdot t + v_0)\mathrm{d}t \tag{4}$$

$$\int_{s_0}^{s} \mathrm{d}s = \int_{0}^{t} (a \cdot t + v_0)\,\mathrm{d}t \tag{5}$$

$$s(t) = \frac{1}{2} a \cdot t^2 + v_0 \cdot t + s_0 \tag{6}$$

For the horizontal displacement in x-direction, this results in:

$$x(t) = \frac{1}{2} a_x \cdot t^2 + v_{x,0} \cdot t + s_{x,0} \tag{7}$$

Given:
Initial velocity: $v_0 = 120m/s$
Angle: θ

Since a_x and $s_{x,0}$ are both zero, the resulting equation becomes:

$$x(t) = v_{x,0} \cdot t \tag{8}$$

Where $v_{x,0} = v_0 \cdot \cos\theta$. Combining gives the final answer:

$$x(t) = v_0 \cdot \cos\theta \cdot t$$