Momentum-Impulse Theorem :: Extension

In the true, calculus, version of the momentum-impulse theorem; forces are time variant.

Newton's second law was originally formulated as:

Time-variant net Force:

$$\underbrace{\Sigma F(t)} = \frac{dp}{dt}$$; mass is constant

$$\Sigma F(t) = \frac{d\,mv}{dt}$$

$$(\Sigma F(t)) = m\frac{dv}{dt}$$ $\left(\frac{dv}{dt} = \text{acceleration}\right)$

impulse-theorem

$$(\Sigma F(t))\,dt = m\,dv$$

$$J = \int_{t_1}^{t_2} (\Sigma F(t))\,dt = \int_{v_1}^{v_2} m\,dv$$

$$J = \int_{t_1}^{t_2} (\Sigma F(t))\,dt = m\int_{v_1}^{v_2} dv$$

$$= m(v_2 - v_1)$$

$$= m\Delta v$$

$$\boxed{J = \int_{t_1}^{t_2} (\Sigma F(t))\,dt = \Delta p}$$

in general:

$$\underbrace{\int_a^b}_{\text{AREA bounded by the function and the x-axis}} \Rightarrow \text{antiderivative}$$ (UNDO THE DERIVATIVE AND EVALUATE AT a and b)