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ITU Faculty of Aeronautics and Astronautics
Department of Aeronautical Engineering
2015-2016 Fall Term
11230 DNK201E Dynamics QUIZ – 1

Problem: The velocity of a particle is defined by the relationship $v = 3x$, where v is in meters per second, x is in meters. Determine the position, velocity, and acceleration at $t = 0.5\ s$ if initially $x_0 = 0.1\ m$.

Solution:

$$v = \frac{dx}{dt} = 3x \longrightarrow \int_{x_0=0.1m}^{x} \frac{dx}{x} = 3\int_0^t dt$$

$$\ln \frac{x}{0.1} = 3t \longrightarrow x = x(t) = 0.1\, e^{3t}$$

$$v = \dot{x}(t) = 0.3\, e^{3t}$$

$$a = \ddot{x}(t) = 0.9\, e^{3t}$$

$$x(0.5\,s) = 0.1\, e^{3 \cdot 0.5} = 0.448\ m$$

$$v(0.5\,s) = 0.3\, e^{3 \cdot 0.5} = 1.344\ m/s$$

$$a(0.5\,s) = 0.9\, e^{3 \cdot 0.5} = 4.033\ m/s^2$$