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Course/Title: Engineering Mechanics II

Assignment

$V = (4t - 3t^2)\ m/s$ $\quad t = 0,\ s = 0,\ t = 4$

$V = \frac{ds}{dt} = (4t - 3t^2)$

$\therefore \frac{ds}{dt} = (4t - 3t^2)$

$\int ds = \int_0^4 (4t - 3t^2)\, dt$

$S = \left[\frac{4t^2}{2} - \frac{3t^3}{3}\right]_0^4$

$S = [2t^2 - t^3]_0^4$

$\therefore S = [2t^2 - t^3]^4 - [2t^2 t^3]^0$

$S = 2(4)^2 - (4)^3 - [0]$

$S = 32 - 64$

$S = -32\ m$ $\quad \therefore S = 32\ m$ Left of Origin

∴ This means that the position of the Particle is to left of the Origin

2.

$V = (0.5t^3 - 8t)\ m/s$, $t = 2s$, $a = ?$

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

$a = \frac{d}{dt}(0.5t^3 - 8t)$

$a = (1.5t^2 - 8)\ m/s^2$

at $t = 2s$

$= 1.5(2)^2 - 8$

$= (1.5 \times 4) - 8$

$= -2\ m/s^2$

∴ This implies that the particle is decelerating

3; $a = (4t^2 - 2)$

$a = \frac{dv}{dt} = (4t^2 - 2)$

$\frac{dv}{dt} = (4t^2 - 2)$

$\int dv = \int (4t^2 - 2)\,dt$

$v = (4t^3 - 2t + C_1)\ m/s$

$\therefore v = \frac{ds}{dt} = (\frac{4t^3}{3} - 2t + C_1)\ m/s$

$\frac{ds}{dt} = (\frac{4t^3}{3} - 2t + C_1)$

$\int ds = \int (\frac{4}{3}t^3 - 2t + C_1)\,dt$

$s = (\frac{4t^4}{3 \times 4} - \frac{2t^2}{2} + C_1 t + C_2)\ m$

$s = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$

At $t = 0s$, $s = -2m$

$s = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$

$-2 = \frac{1}{3}(0)^4 - (0)^2 + C_1(0) + C_2$

$\therefore C_2 = -2$

At $t = 2$, $s = -20m$

$s = \frac{1}{3}t^4 - t^2 + C_1 t - 2$

$-20 = \frac{1}{3}(2)^4 - (2)^2 + C_1(2) - 2$

$-20 = \frac{16}{3} - 4 + 2C_1 - 2$

$-20 = -\frac{2}{3} + 2C_1$

$2C_1 = -20 + \frac{2}{3}$

$2C_1 = -19.33$

$C_1 = \frac{-19.33}{2} = -9.67$

$\therefore C_1 = -9.67$

$C_2 = -2$

$\therefore S = \frac{1}{3}t^4 - t^2 + C_1 t + C_2$

$S = \frac{1}{3}t^4 - t^2 - 9.67t -$

At $t = 4s$ $\quad S = ?$

$S = \frac{1}{3}(4)^4 - (4)^2 - 9.67(4) - 2$

$S = \frac{256}{3} - 16 - 38.668 - 2$

$S = \frac{256}{3} - 56.668$

$S = 29.667\ m$

$\therefore$ The position of the particle is $29.67\ m$

4)

$V = (20 - 0.055^2)$

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

$= \frac{dv}{ds} \times v$

$\therefore a = v\frac{dv}{ds}$

$\frac{dv}{ds} = -0.15$

$\therefore a = (20 - 0.055^2)(-0.15)$

At $S = 15\ m$

$a = (20 - 0.05(15)^2)(-0.1(15))$

$a = (20 - 11.25)(-1.5)$

$a = (8.75)(-1.5)$

$a = -13.125\ m/s^2$

$a = -13.13\ m/s^2$