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18/SNG04/026
Sleet/Sleet
Mechanics Assignment

(1) $v = (4t - 3t^2)$ m/s $t = 4$, $s = 0$, $t = 4$

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

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

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

$s = [4t^2/2 - 3t/3^3]_0^4$

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

$s = [2t^2 - t^3]^4 - [2t^2 + t^3]^0$

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

$s = 32 - 64$

$s = -32m$ $\therefore$ $s = 32m$ left of rest

$\therefore$ This means that the position of the particle is to the 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 $t = 2s$

$= 1.5[2]^2 - 8$

$= [1.5 \times 4] - 8$

$= -2\ m/s^2$

$\therefore$ This implies that the particle is decelerating

(3)

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

$a = \frac{dv}{dt} = [4t^2 - 2]$

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

$\int dv = \int [4t^2 - 2]\,dt$

$v = \left[\frac{4t^3}{3} - 2t + C\right] m/s$

$v = ds/dt = \left[\frac{4t^3}{3} - 2t + C_1\right] m/s$

$ds/dt = [4/3 t^3 - 2t + C_1]$

$\int ds = \int [4/3 t^3 - 2t + C_1]\,dt$

$S = [4t^4/3 \times 4 - 2t^2/2 + C_1 t + C_2)\,m$

$S = 1/3 t^4 - t^2 + C_1 t + C_2$

At $t = 0$ $S = -2m$

$S = 1/3 t - t^2 + Ct + C_2$

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

$\therefore C_2 = -2,$

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

$S = 1/3 t^4 - t^2 + C_1 t - 2$

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

$-20 = 16/3 - 4 + 2C_1 - 2$

$-20 = -2/3 + 2C_1$

$2C_1 = -20 + 2/3$

$2C_1 = -19.33$

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

$= -9.67$

$S = 1/3t^4 - t^2 - 9.67t - 2$

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

$S = 1/3(4)^4 - (4)^2 - 9.67(4) - 2$

$S = 256/3 - 16 - 38.6668 - 2$

$S = 256/3 - 56.6668$

$S = 28.667m$

The position at the particle is 28.67m

(4) $V = [20 - 0.055^2]$

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

$= dv/ds \times V$

$a = V\, dv/ds$

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

$a = [20 - 0.055s^2)(-0.15)$

At $s = 15m$

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

$a = (20 - 11.75)(-1.5)$

$a = (8.75)(-1.5)$

$a = -13.125 m/s^2$

$a = -13.13 m/s^2$

The acceleration of the particle at $S = 15m$ is $-13.125 m/s^2$ which implies that the particle is decelerating