

ATOGLWE VICTORIA ALOIYE.

18/ENG08/003.

BIOMEDICAL ENG.

ENG 234.

1. $v = (4t - 3t^2) \text{ m/s}$

To find the position, integrate velocity

$$ds = v dt$$

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

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

$$ds = 2t^2 - t^3 + c$$

$$s = 0 \text{ when } t = 0$$

$$s = 2t^2 - t^3 + c$$

$$c = s - 2t^2 + t^3$$

$$c = 0 - 2(0)^2 + 0^3$$

$$c = 0$$

$$s = ? \text{ when } t = 4$$

$$s = 2t^2 - t^3 + 0$$

$$s = 2(4)^2 - (4)^3$$

$$s = 32 - 64 = -32 \text{ m}$$

\therefore The position is 32m in the opposite direction.

2. $v = (0.5t^3 - 8t) \text{ m/s}$

To find acceleration, differentiate velocity

$$a = \frac{dv}{dt} = 1.5t^2 - 8$$

$$\text{when } t = 2$$

$$a = 1.5 \times (2)^2 - 8 = 6 - 8$$

$$a = -2 \text{ m/s}^2$$

∴ the acceleration of the particle is 2 m/s^2 in the opposite direction.

3. $a = (4t^2 - 2) \text{ m/s}^2$

to get velocity, integrate acceleration.

$$v = \int a \, dt$$

$$v = \int 4t^2 - 2$$

$$v = \frac{4t^3}{3} - 2t + C$$

∴ s is integration of v

$$v = \frac{4t^3}{3} - 2t + C_v$$

$$s = \int \left[\frac{4t^3}{3} - 2t + C_v \right] dt$$

$$s = \frac{4t^4}{4 \times 3} - \frac{2t^2}{2} + tC_v + C_s$$

$$s = \frac{t^4}{3} - t^2 + tC_v + C_s$$

when $t = 0$, $s = -2 \text{ m}$

$$-2 = \frac{0^4}{3} - (0)^2 + 0(C_v) + C_s$$

$$-2 = C_s$$

at $t = 2$, $s = -20 \text{ m}$

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

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

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

$$2C_v = -19.33$$

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

$$\text{At } t = 4$$

$$s = \frac{t^4}{3} - t^2 - t(9.67) - 2$$

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

$$s = \underline{\underline{28.65 \text{ m}}}$$

$$4. \quad v = (20 - 0.05s^2) \text{ m/s}$$

$$v = \frac{ds}{dt} \quad a = \frac{dv}{dt}$$

$$dt = \frac{ds}{v} \quad dt = \frac{dv}{a}$$

$$dt = dt$$

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

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

$$v = (20 - 0.05s^2)$$

$$\frac{dv}{ds} = -0.1s$$

$$a = (20 - 0.05s) \cdot -0.1s$$

$$= -2s + (5 \times 10^{-3} s^3)$$

$$\text{when } s = 15$$

$$= -2(15) + 5 \times 10^{-3} (15)^3$$

$$a = 16.875 - 30$$

$$a = -13.125$$

$\therefore a = 13.125 \text{ m/s}^2$ in opposite direction.