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**DEPARTMENT:** Mechatronics Engineering

**COURSE:** ENG 234 Assignment

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Mechatronics Engineering

ENG 234 Assignment

1)  $V = (4t - 3t^2) \text{ms}^{-1}$

$$ds = v dt$$

$$s = \int v dt$$

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

$$s = (2t^2 - t^3 + c) \text{m}$$

$$c = 0, \text{ bcs } s = 0 \text{ @ } t = 0$$

(i) when  $t = 4$ ,

$$s = [2t^2 - t^3 + 0]_0^4$$

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

$$= 32 - 64$$

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

∴ Position is 32m from the starting point in the opposite direction

(ii) When  $s = 0$ ,

particle does not move from

2)  $V = (0.5t^3 - 8t) \text{ms}^{-1}$

$$a = \frac{dv}{dt} = (1.5t^2 - 8) \text{ms}^{-2}$$

$$|a|_{t=2} = [1.5(2)^2 - 8] \text{ms}^{-2}$$

$$= [1.5(4) - 8] \text{ms}^{-2}$$

$$a = (6 - 8) \text{ms}^{-2}$$

$$a = -2 \text{ms}^{-2}$$

3)  $a = (4t^2 - 2) \text{ms}^{-2}$

$$v = \int a dt$$

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

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

$$s = \int v dt$$

$$= \int \left( \frac{4}{3}t^3 - 2t + c \right) dt$$

$$s = \frac{t^4}{3} - t^2 + ct + k$$

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

$$\therefore -2 = \frac{(0)^4}{3} - (0)^2 + c(0) + k$$

$$k = -2$$

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

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

$$2c = -20 - \frac{16}{3} + 6$$

$$2c = -19.33$$

$$c = -9.67$$

$$\therefore s = \frac{t^4}{3} - t^2 - 19.33t - 2$$

$$\text{when } t = 4,$$

$$S = \frac{(4)^4}{3} - (4)^4 + \frac{29(4)}{3} - 2$$

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

$$= \frac{140}{3} - 18$$

~~$s = 106 \text{ m to the right of origin}$~~

$$= \frac{140}{3} - 18$$

$s \approx 28.67 \text{ m to the right of origin}$

4.)  $V = (20 - 0.05s^2) \text{ ms}^{-1}$

$$a ds = v dv$$

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

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

$$ds$$

$$\therefore a = v \times -0.1s$$

$$a = [-0.1s(20 - 0.05s^2)] \text{ ms}^{-2}$$

$$= (0.005s^3 - 2s) \text{ ms}^{-2}$$

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

$$a = 0.005(15)^3 - 2(15)$$

$$= 16.875 - 30$$

$$a = -13.125 \text{ ms}^{-2}$$