

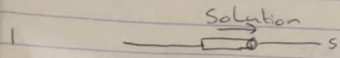
18/ENG05/005
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MECHATRONICS
ENG234

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Mechanics

ENG 232



Position

$$v = f(t)$$

$$v = \frac{ds}{dt}$$

$$v = \frac{ds}{dt} = 24t - 3t^2$$

$$\int_0^s ds = \int_0^t (24t - 3t^2) dt$$

$$s \Big|_0^s = \left[12t^2 - t^3 \right]_0^t$$

$$s = 12t^2 - t^3$$

$$t = 4s$$

$$s = 12(4)^2 - (4)^3$$

$$s = 32 - 64$$

$$s = -32m$$

$$s = 32 \leftarrow$$

11)

$$v = (0.5t^3 - 8t)$$

Find the acceleration

$$v = f(t)$$

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

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

$$= 1.5t^2 - 8$$

$$t = 2$$

$$a = 1.5(2)^2 - 8$$

$$a = 6 - 8$$

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

$$a = 2 \leftarrow$$

4) $u = (20 - 0.05s^2) \text{ m/s}$
Determine the acceleration

$$a = u \left(\frac{du}{ds} \right)$$

$$u = (20 - 0.05s^2) \text{ m/s}$$

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

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

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

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

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

$$= 8.75(-1.5)$$

$$a = -13.125 \text{ m/s}^2$$

3 $a = (4t^2 - 2) \text{ m/s}^2$ 4)
 when $t=0, s=2\text{m}$; $t=2\text{secs}$ $s=20\text{m}$ $t=4\text{secs}$
 $a = 4t^2 - 2$
 $v = \int a dt \therefore v = \int_0^t (4t^2 - 2) dt$

$$v = \frac{4}{3} t^3 - 2t \text{ m/s}$$

$$s = \int v dt \therefore s = \int_0^t \left(\frac{4}{3} t^3 - 2t + c \right) dt$$

$$s = \frac{1}{4} \cdot \frac{4t^4}{3} - \frac{2t^2}{2} + ct + A$$

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

when $t=0, s=2$
 $-2 = \frac{1}{3} (0)^4 - (0)^2 + (0) + A$

$$\therefore A = -2$$

when $t=2, s=20$

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

$$-20 = 5.33 - 4 + 2c - 2$$

$$-20 = -0.67 + 2c$$

$$2c = +0.67 - 20$$

$$c = -9.665$$

The general equation $s = \frac{1}{3} t^4 - t^2 - 9.665t - 2$

when $t=4\text{secs}$ $s = 85.333 - 16 - 38.66 - 2$

$$\therefore s = 28.673\text{m}$$

4) $v = (20 - 0.055s^2) \text{ m/s}$

Determine acceleration at $s=15\text{m}$

