

# Mechanics

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Ex 12.2

$$v = (6.5t^3 - 8t) \text{ m/s}$$

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

$$\frac{dv}{dt} = 3(6.5)t^2 - 8$$

$$= 1.95t^2 - 8$$

$$a = \frac{dv}{dt} \Big|_{t=2} = 1.95(2)^2 - 8$$

$$= 6 - 8 = -2 \text{ m/s}$$

Ex 12.3

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

$$s = \int v dt$$

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

$$= 2t^2 - t^3$$

when  $t = 4$

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

$$= 32 - 64$$

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

Ex 12.8

$$v = (20 - 0.5s) \text{ m/s}$$

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

$$\frac{dv}{dt} = \frac{dv}{ds} \cdot \frac{ds}{dt}$$

$$\frac{dv}{ds} = -0.5, \frac{ds}{dt} = (20 - 0.5s^2)$$

$$a = (-0.5)(20 - 0.5s^2)$$

when  $s = 15$

$$a = (-0.5 \times 15)(20 - 0.5 \times 15^2)$$

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

Ex 12.7

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

$$v = \int a dt$$

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

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

$$s = \int v dt$$

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

$$= \frac{4t^4}{12} - \frac{2t^2}{2} + ct$$

$$p = \frac{1}{3}t^4 - t^2 + ct + k$$

When  $t = 0, p = 2$

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

$$k = -2$$

When  $t = 2, p = -20, k = -2$

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

$$-20 = 0.7 + 2c$$

$$c = -9.7$$

$$p = \frac{1}{3}t^4 - t^2 - 9.7t - 2$$

When  $t = 4$

$$p = \frac{1}{3}(4)^4 - 4^2 - (9.7 \times 4) - 2$$

$$p = 28.7 \text{ m/s}$$