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18/ENG408/023

Biomedical Engineering
ENG 234 - mechanics

1) $(0 \leq t \leq 6)$ seconds

$$S = 0.5t^3$$

$$V = \frac{ds}{dt} = 1.5t^2$$

$$\therefore V = 1.5(6)^2$$

$$= 54 \text{ m/s}$$

$(6 \leq t \leq 10)$ seconds

$$S = 108$$

$$V = \frac{ds}{dt} = 0 \text{ m/s}$$

$V(\text{m/s})$

54

20

10

$$V = 1.5t^2$$

$t(\text{s})$

6 8 10

2) $V = -4t + 80$

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

$$\int_0^S ds = \int_0^{20} (-4t + 80) dt$$

$$S \Big|_0^S = -2t^2 + 80t \Big|_0^{20}$$

$$S = -2(20)^2 + 80(20)$$

$$S = 800 \text{ ft}$$

$S(\text{ft})$

800

600

400

200

$$S = -2t^2 + 80t$$

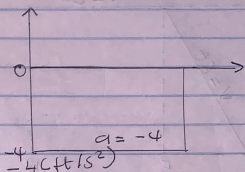
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For Acceleration

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

$$= \frac{d(-4t + 80)}{dt}$$

$$a = -4 \text{ ft/s}^2$$



3) $V = (0.25 \text{ s}^{-1}) \text{ m/s}$

$$a = V \left(\frac{dv}{ds} \right) = 0.25 \text{ s}^{-1} (0.25)$$

$$a = (0.0625 \text{ s}^{-2}) \text{ m/s}^2$$

$$\text{At } S = 40 \text{ m}$$

$$a = 0.0625 \times 40 = 2.5 \text{ m/s}^2$$

$a(\text{m/s}^2)$

2.5

$$a = 0.0625 \text{ s}^{-2}$$

$S(\text{m})$

40

4) $(0 \leq t \leq 5)$ seconds

$$s = 3t^2$$

$$v = ds/dt = 6t$$

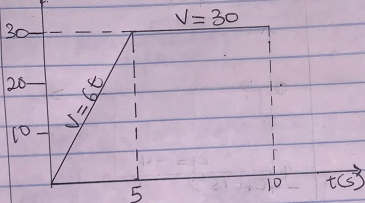
$$\text{max } v = 6(5) = 30 \text{ m/s}$$

$(5 \leq t \leq 10)$ second

$$s = 20t -$$

$$v = ds/dt = 20 \text{ m/s}$$

$v \text{ (m/s)}$



FOR ACCELERATION

$(0 \leq t \leq 5)$ seconds

$$v = 6t$$

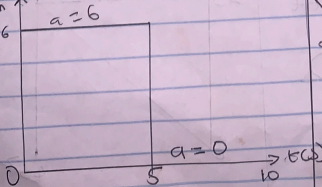
$$a = dv/dt = 6 \text{ m/s}^2$$

$(5 \leq t \leq 10)$ seconds

$$v = 20$$

$$a = dv/dt = 0 \text{ m/s}^2$$

$a \text{ (m/s}^2)$



5) $0 \leq t \leq t$

$$a = 20 \text{ m/s}^2$$

$$\int dv = \int a \cdot dt$$

$$g = -10 \text{ m/s}^2$$

$$\int_0^v dv = \int_0^t 20 \cdot dt$$

$$v = 20t$$

At $t = 5$ seconds

$$v - 100 = -10(t - 5)$$

$$v - 100 = -10t + 50$$

$$v = 150 - 10t + 50$$

$$v = (150 - 10t) \text{ m/s}$$

At $v = 0$

$$0 = 150 - 10t$$

$$t = \frac{150}{10} = 15 \text{ seconds}$$

6) $(0 \leq t \leq 5)$

$$v = 30t$$

$$v = ds/dt$$

$$ds = v \cdot dt$$

$$\int_0^s ds = \int_0^5 (30t) dt$$

$$s = 15t^2 \Big|_0^5$$

$$s = 15(5)^2 = 375 \text{ m}$$

$(5 \leq t \leq 15)$

$$v = -15t + 225$$

$$\int_0^s ds = \int_5^{15} (30t) dt$$

$$s = 15t^2 \Big|_5^{15}$$

$$s = 15(5)^2 = 375 \text{ m}$$

$(5 \leq t \leq 15)$ second

$$v = -15t + 225$$

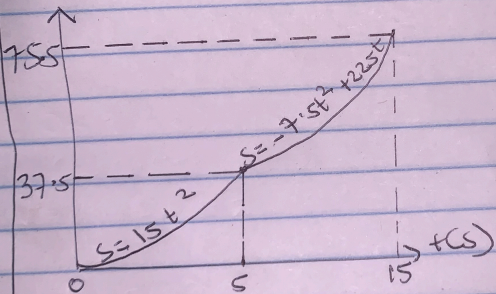
$$\int_0^s ds = \int_5^{15} (-15t + 225) dt$$

$$s = -7.5t^2 + 225t \Big|_5^{15}$$

$$s = [-7.5(15)^2 + 225(15)] -$$

$$[-7.5(5)^2 + 225(5)]$$

$$S = 1687.5 - 937.5 = 750\text{m}$$



$$\begin{aligned} \text{Total distance} &= 750\text{m} + 37.5\text{m} \\ &= 1125\text{m} \end{aligned}$$