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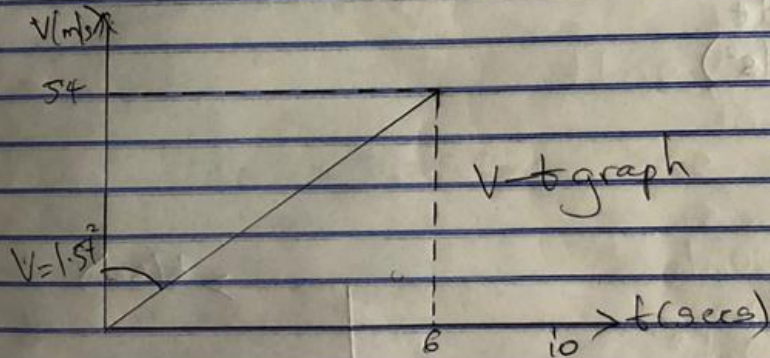
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18/Eng 06/046
Mechanical engineering
Eng 234 (mechanics)

$$1) S = 0.5t^3$$
$$at = 0 < t < 6 \text{ secs}$$
$$V = \frac{ds}{dt} = 1.5t^2 \text{ m/s}$$
$$\frac{d}{dt} v = 15(6)^2 = 54 \text{ m/s}$$

$$6 < t < 10 \text{ secs}$$

$$S = 108$$

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



$$2) V = -4t + 80$$
$$S = \int_0^5 ds = \int_0^5 dt$$
$$S = \int_0^4 (-4t + 80)$$
$$S = \left[-2t^2 + 80t \right]_0^{20}$$

$$0 < t < 20 \text{ secs}$$

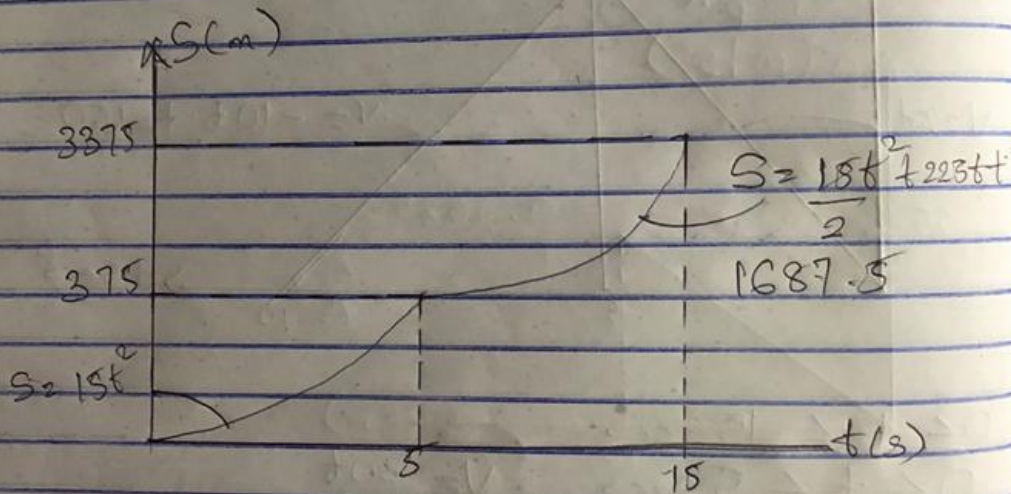
$$S = [-2(20)^2 + 80(20)]$$

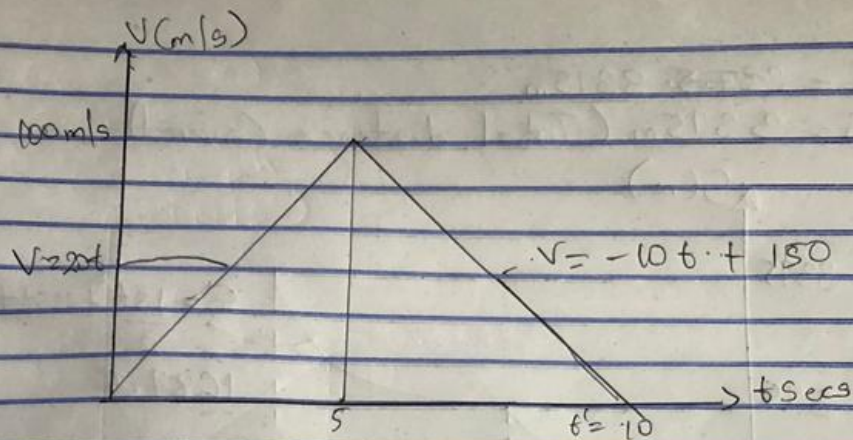
$$S = -800 + 1600$$

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

$S = 3375, 3375m$

$S = 3375m$ (Total distance covered)





6) $0 \leq t \leq 15 \text{ secs}$

$0 \leq t \leq 5 \text{ secs} \quad V = 30t$

$$\int_0^5 ds = \int_0^t v dt$$

$$\int_0^5 ds = \int_0^t 30t dt$$

$$S = 15t^2$$

$$S = 15(5)^2$$

$$S = 375 \text{ m}$$

$5 \leq t \leq 15 \text{ secs} \quad V = -15t + 225$

$$\int_{15}^5 ds = \int_5^t (-15t + 225) dt$$

$$S - 375 = \left[\frac{-15t^2}{2} + 225t \right]_5^t$$

$$S - 375 = \left[\frac{-15t^2}{2} + 225t \right] - \left[\frac{-15(5)^2}{2} + 225(5) \right]$$

$$S - 375 = \frac{-15t^2}{2} + 225t + 1312.5$$

$$S = \frac{-15t^2}{2} + 225t + 1312.5 + 375$$

$$S = \frac{-15t^2}{2} + 225t + 1687.5$$

When $t = 15$

$$S = \frac{-15(15)^2}{2} + 225(15) + 1687.5$$

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

5

t (secs)

5) $0 < t < 5 \text{ secs}$

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

$$dv = a dt$$

$$\int_0^v du = \int_0^t 20 dt$$

$$v = 20t$$

When $t = 5$

$$v = 20 \times 5$$

$$= 100 \text{ m/s}$$

$5 < t < 10 \text{ secs}$

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

$$\int_{100}^v du = \int_5^t -10 dt$$

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

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

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

$$v = -10t + 150$$

When $v = 0$

$$0 = -10t + 150$$

$$10t = 150$$

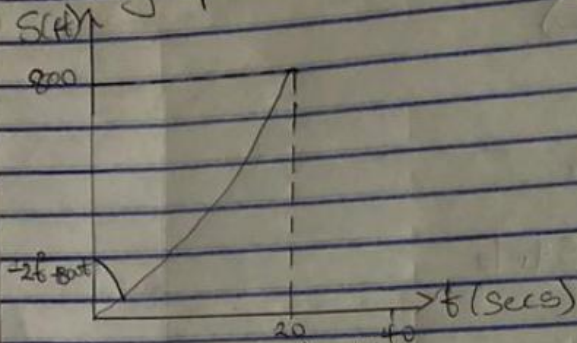
$$t = \frac{150}{10} = 15 \text{ secs}$$

$5 < t < t' \quad t' = 15 \text{ secs}$

$$v = -10 \times 15 + 150$$

$$v = 0$$

S-T graph

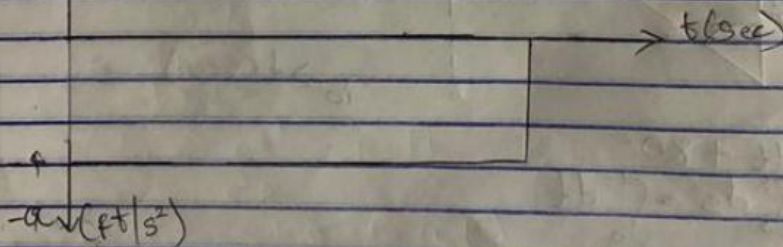


$$V = (-4 + 80) \text{ ft/s}$$

$$0 < t < 20 \text{ s}$$

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

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



$$3) V = (0.25S) \text{ m/s}$$

$$a ds = V dv$$

$$a = V \left(\frac{dv}{ds} \right)$$

$$\frac{dV}{ds} = 0.25$$

$$a = (0.25S)(0.25)$$

$$a = 0.0625 S \text{ m/s}^2$$

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

