

Solution

9) Since $v = \frac{ds}{dt}$ the v-t

graph can be determined by differentiating the equation

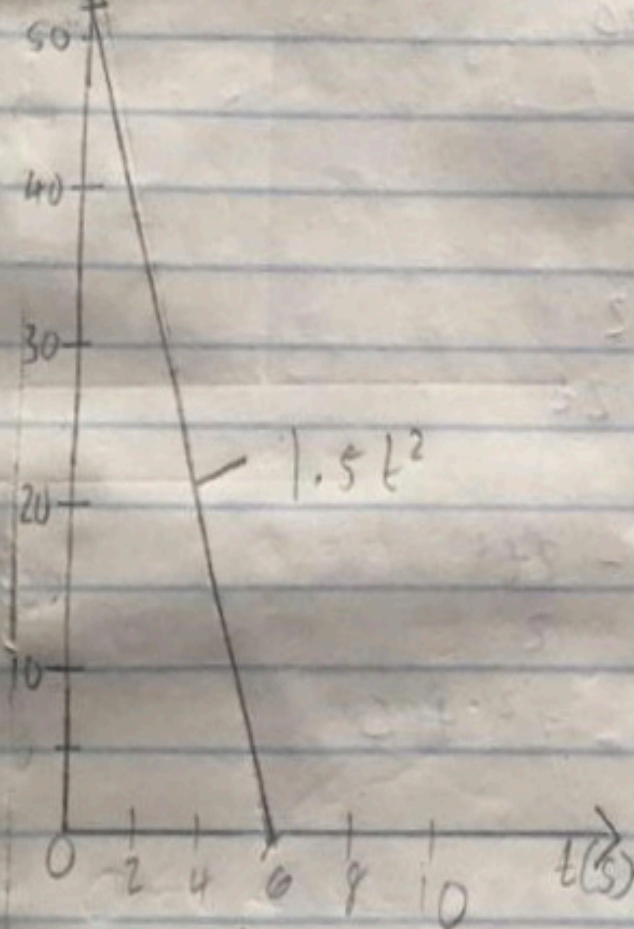
$$0 \leq t < 6s, s = 0.5t^2$$

$$v = \frac{ds}{dt} = 1.5t^2 \text{ m/s}$$
$$= 54 \text{ m/s}$$

$$6 \leq t < 10s, s = 108$$

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

v(m/s) Graph



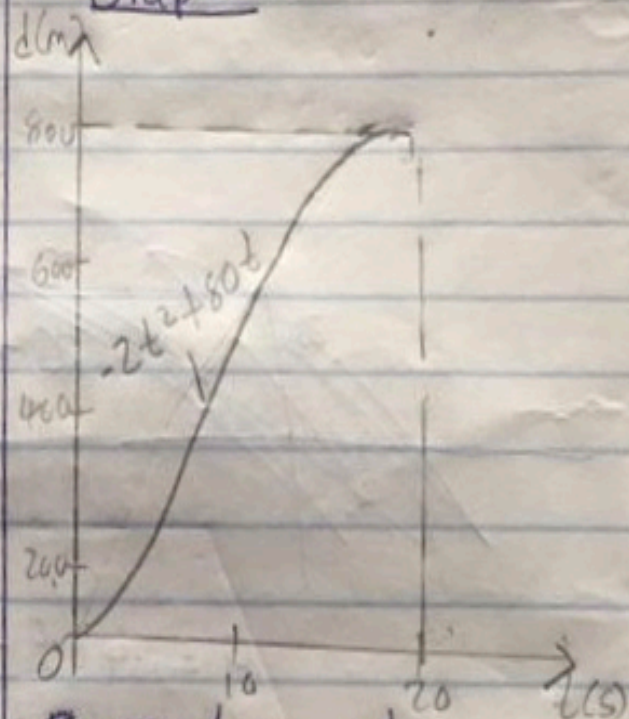
$$0 \leq t < 20s, v = -4t + 80$$

$$\int_0^s ds = \int_0^t -4t + 80$$

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

$$\text{when } t = 20$$
$$= -2(20)^2 + 80 \times 20$$
$$= -800 + 1600$$
$$= 800 \text{ m}$$

Graph



a-t graph

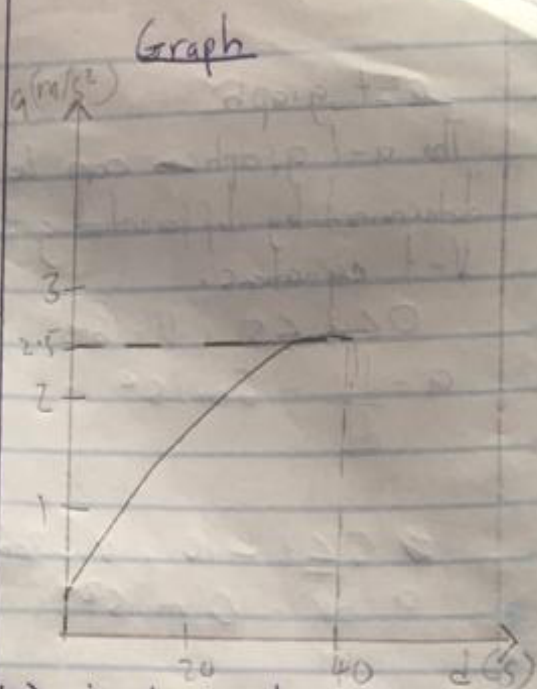
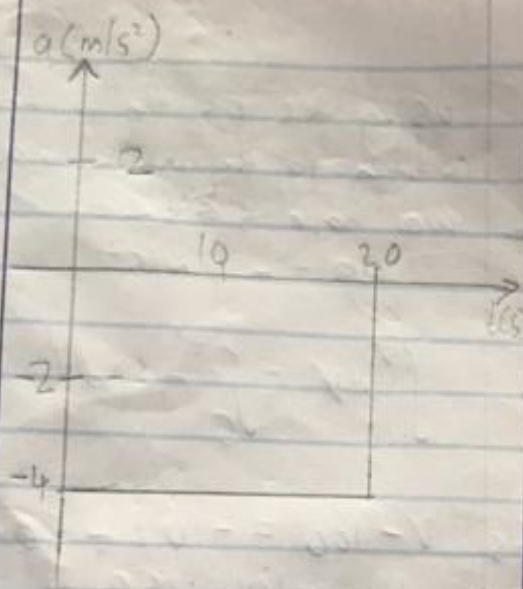
the a-t graph is determined by differentiating the equation

$$0 \leq t < 20s, v = -4t + 80$$

$$a = \frac{dv}{dt} = -4$$

10) s-t graph

Since the s-t graph is determined by integrating



(1) with the values of V and $\frac{dV}{ds}$ known, the value of "a" can be calculated

$$0 \leq s < 40$$

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

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

$$V = 10 \text{ m/s}$$

$$a = \frac{dV}{ds} \times V = 0.25 \times 10$$

$$a = V \times \frac{dV}{ds}$$

$$a = 10 \times 0.25$$

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

(2) $V-t$ graph

the $V-t$ graph can be constructed by differentiating the equations

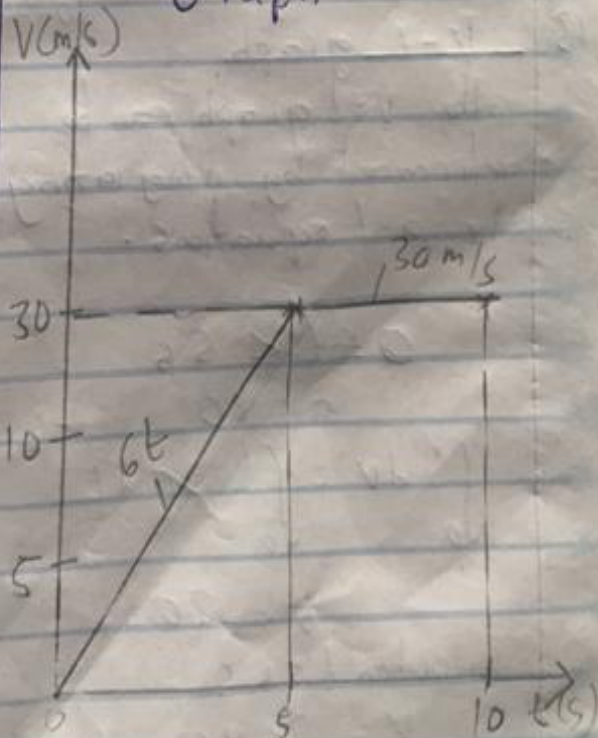
$$0 \leq t < 5, s = 3t^2$$

$$V = \frac{ds}{dt} = 6t = 6(5) = 30 \text{ m/s}$$

$$5 \leq t < 10, s = 30t - 75$$

$$V = \frac{ds}{dt} = 30 \text{ m/s}$$

Graph



a-t graph

The a-t graph can be determined by differentiating the v-t equations.

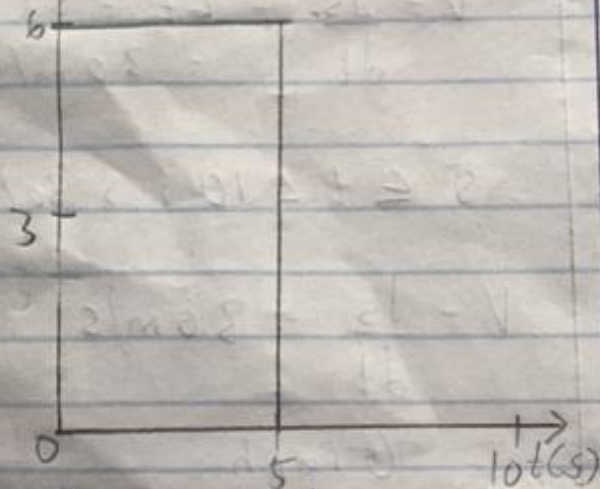
$$0 \leq t < 5, v = 6t$$

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

$$5 \leq t < 10, v = 30 \text{ m/s}$$

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

a graph
(m/s²)



13 v-t graph

The v-t graph can be determined by integrating the a-t equations.

$$0 \leq t < 5 \text{ s}$$

$$a = 20$$

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

$$v = 20t$$

$$\text{when } t = 5 \text{ s}$$

$$v = 20 \times 5 = 100 \text{ m/s}$$

Using this as the initial condition for the next time period we have $5 \leq t < t'$

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

$$\int_{100}^v dv = \int_5^{t'} -10 dt$$

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

$$v = -10t + 150$$

$$\text{when } t = t'$$

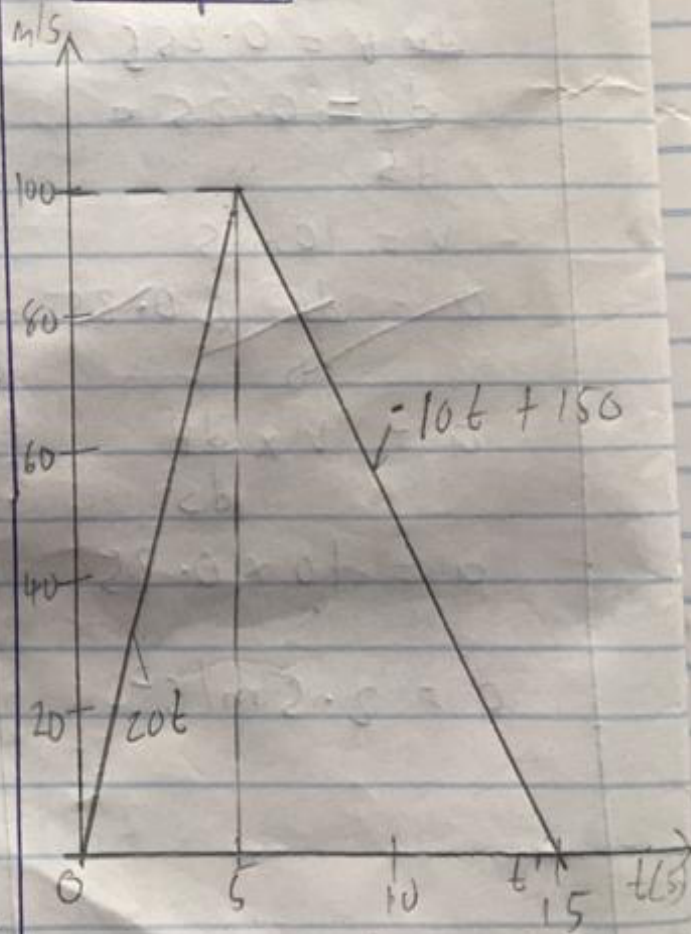
$$v = 0$$

$$0 = -10t + 150$$

$$10t = 150$$

$$t' = 15 \text{ s}$$

Graph



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S-t graph

the S-t graph can be determined by integrating the equations

$$0 \leq t < 5s, v = 30t$$

$$\int_0^S S = \int_0^t 30t dt$$

$$S = 15t^2 m$$

when $t = 5s$

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

$$S = 375 m$$

Using this initial conditions

$$5s \leq t < 15s$$

$$\int_{375}^S S = \int_5^t (-15t + 225)$$

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

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

$$S - 375 = -7.5t^2 + 225t + 187.5 + 1125$$

$$S = -7.5t^2 + 225t + 1687.5$$

When $t' = 15s$

$$S = -7.5(15)^2 + 225(15) + 1687.5$$

$$S = -1687.5 + 1687.5 + 3,375$$

$$S = 3,375 m$$

