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CHEMICAL ENGINEERING

Assignment

① $v = \frac{ds}{dt}$ $s = 0.5t^2$, $v = \frac{d}{dt} = 0.5t^3$

$$\therefore v = 1.5t^2$$

$$t = 6s \quad , \quad v = 1.5(6)^2$$

$$= 1.5 \times 36 = 54 \text{ m/s}$$

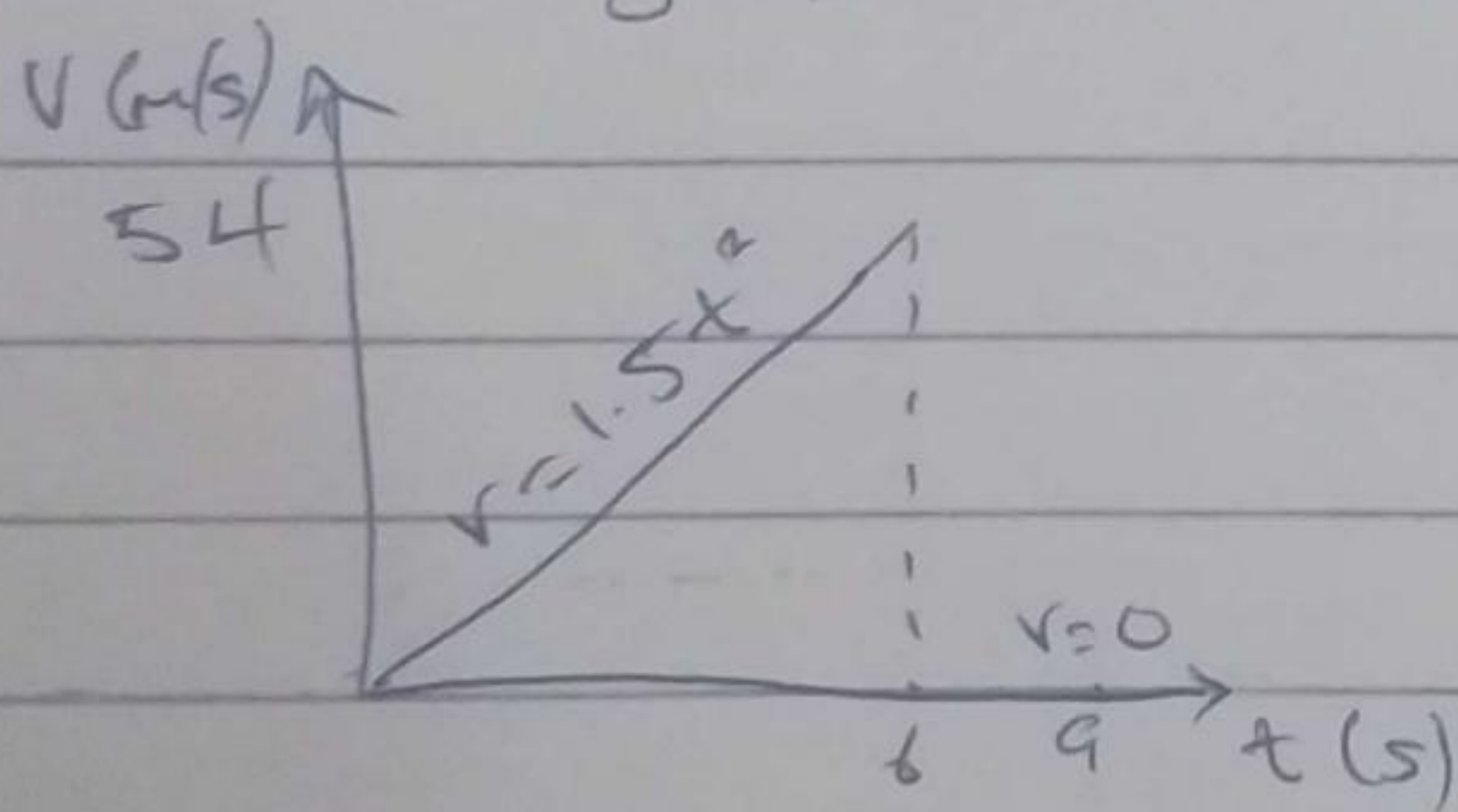
$$6s < t \leq 10s$$

$$s = 108$$

$$v = \frac{ds}{dt} \quad v = \frac{d}{dt} (108)$$

$$v = 0$$

The v-t graph is shown below



② $v = \frac{ds}{dt}$ $ds = v dt$

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

$$0 \leq t \leq 20$$

$$v = -4t + 80$$

$$s = \int_0^t (-4t + 80) dt$$

$$s = \left[\frac{-4t^2}{2} + 80t \right]_0^t$$

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

When $t = 20$

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

$$= -800 + 1600$$

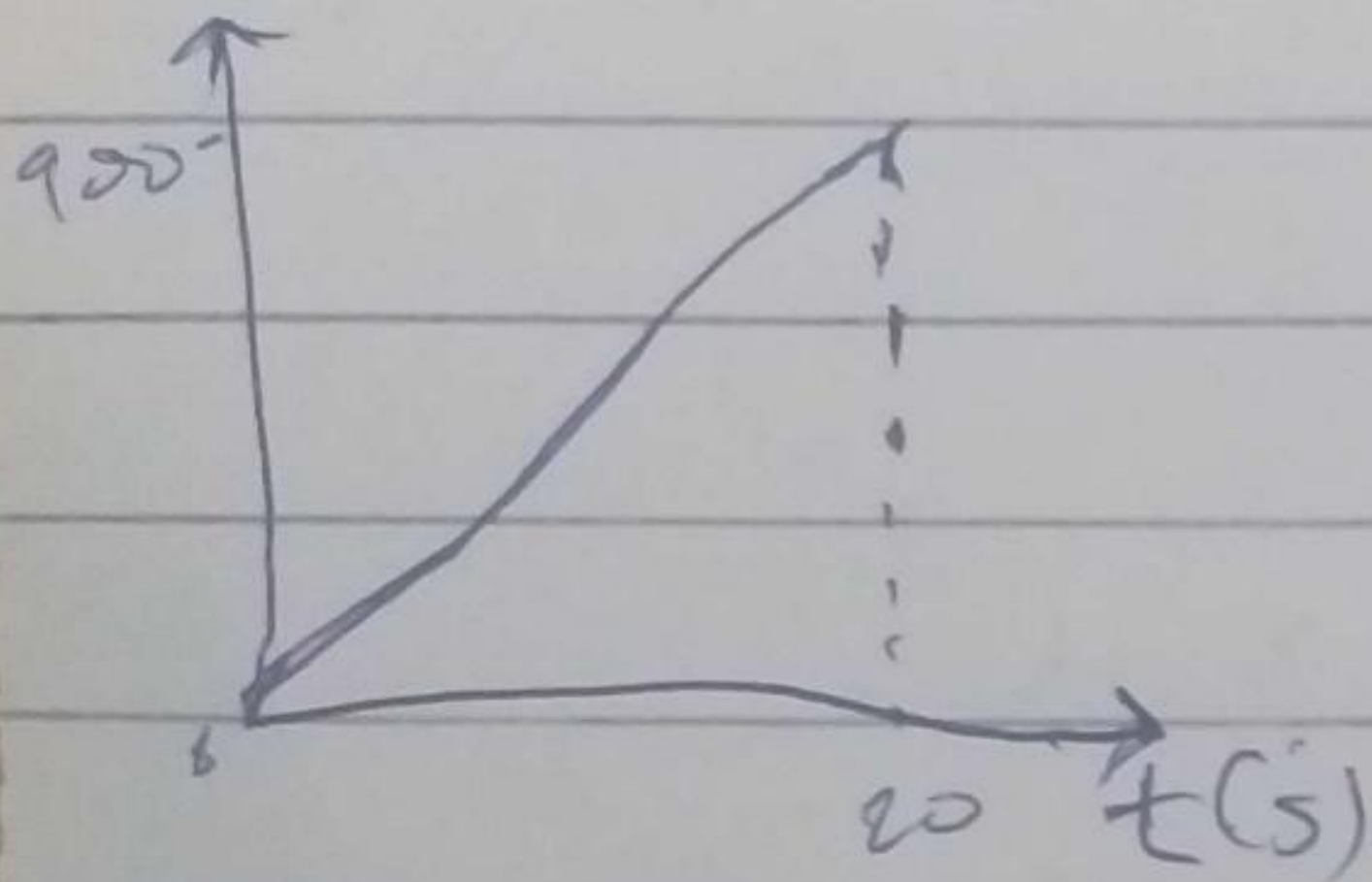
$$S = 800$$

When $t = 0$

$$S = -2(0)^2 + 80(0)$$

$$S = 0$$

The $S-t$ graph is shown below



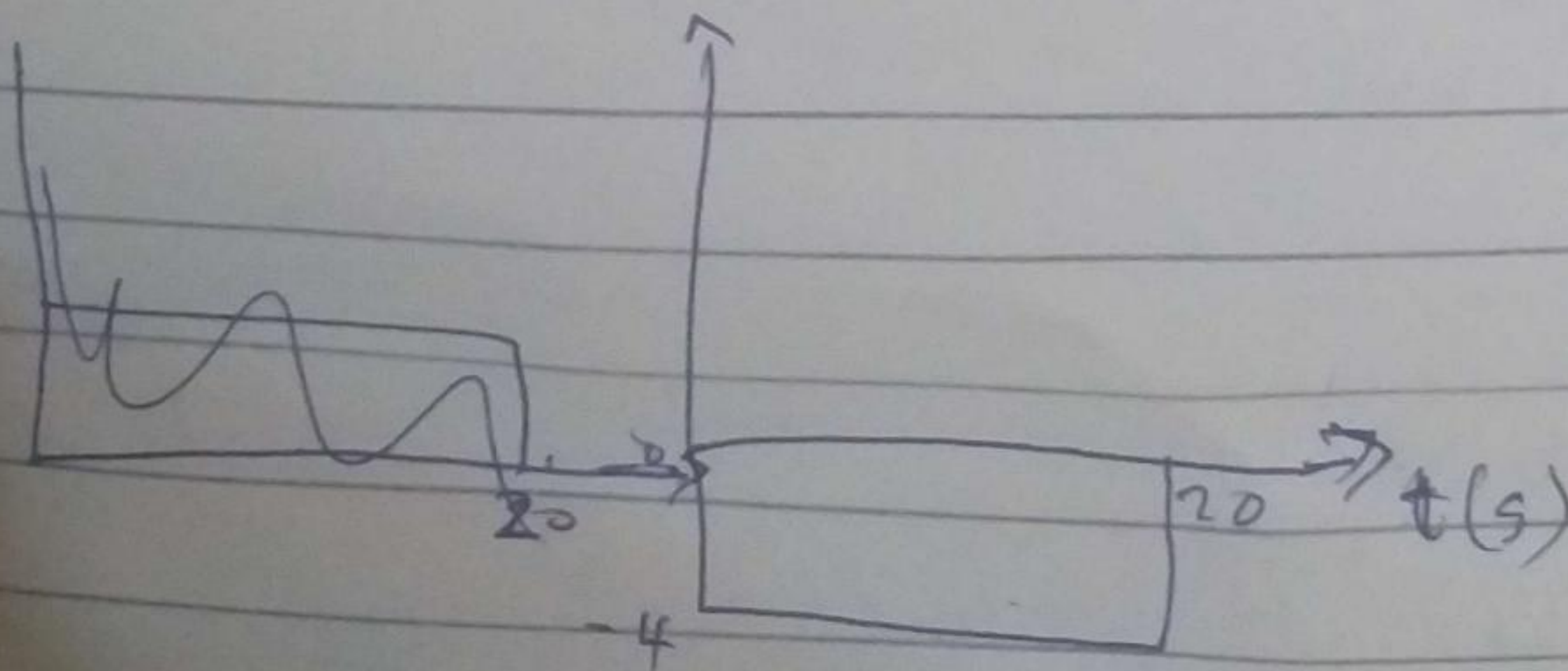
For $v-t$ graph

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

$$v = -4t + 80$$

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

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



$$3) a = \frac{v \frac{dv}{dt}}{ds}$$

$$0 \leq s \leq 40 \text{ m}, v = 0.25$$

$$a = 0.25 \frac{d}{ds} (0.25s)$$

$$a = 0.25 \times 0.25$$

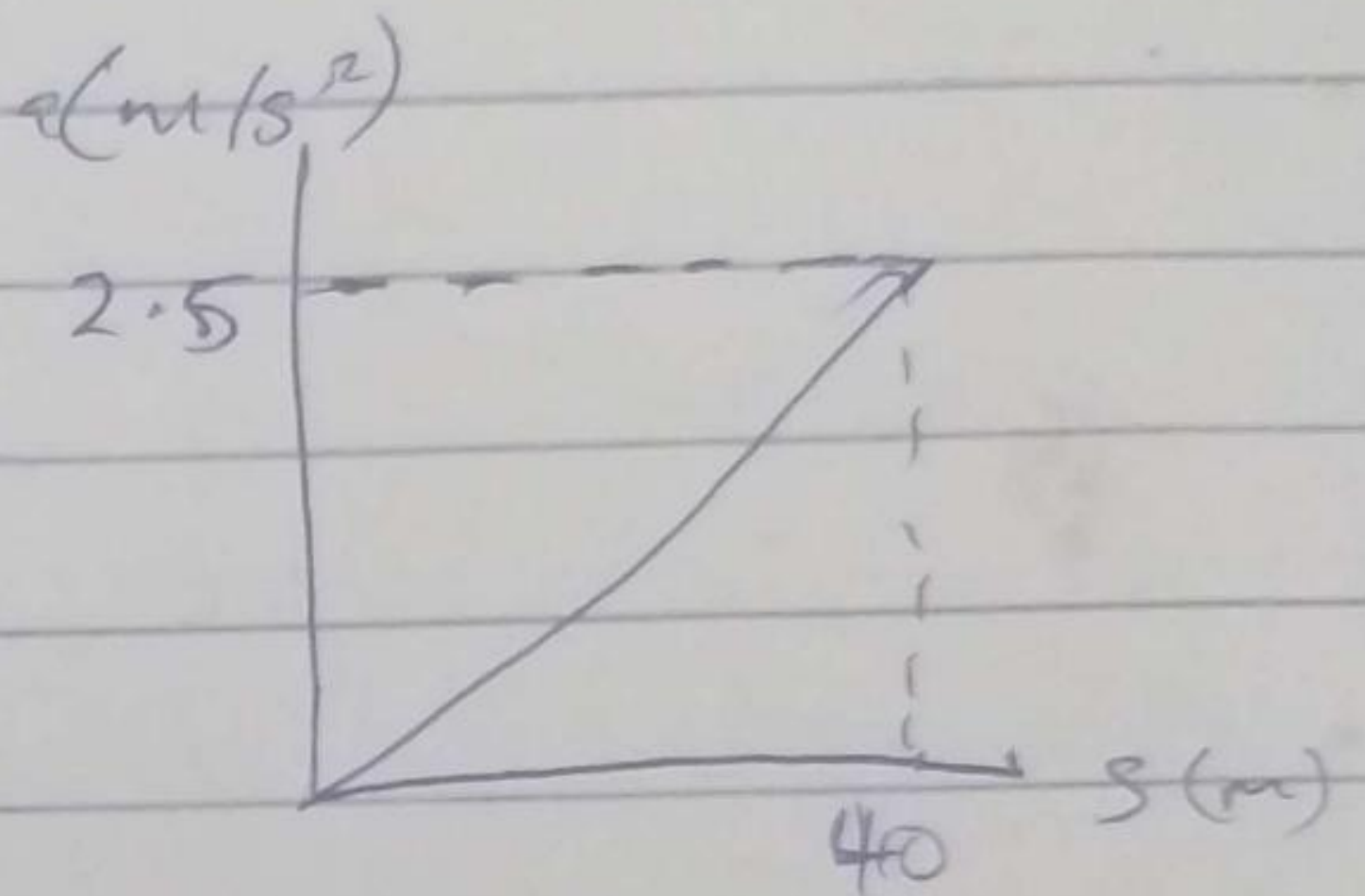
$$a = 0.0025 \text{ (m/s}^2\text{)}$$

$$\text{When } s = 40 \text{ m}$$

$$a = 0.0025 \times 40$$

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

$$\text{When } s = 0, a = 0 \text{ m/s}^2$$



$$4) v = \frac{ds}{dt} \quad 0 \leq t < 5 \text{ s} \quad s = 3t^2$$

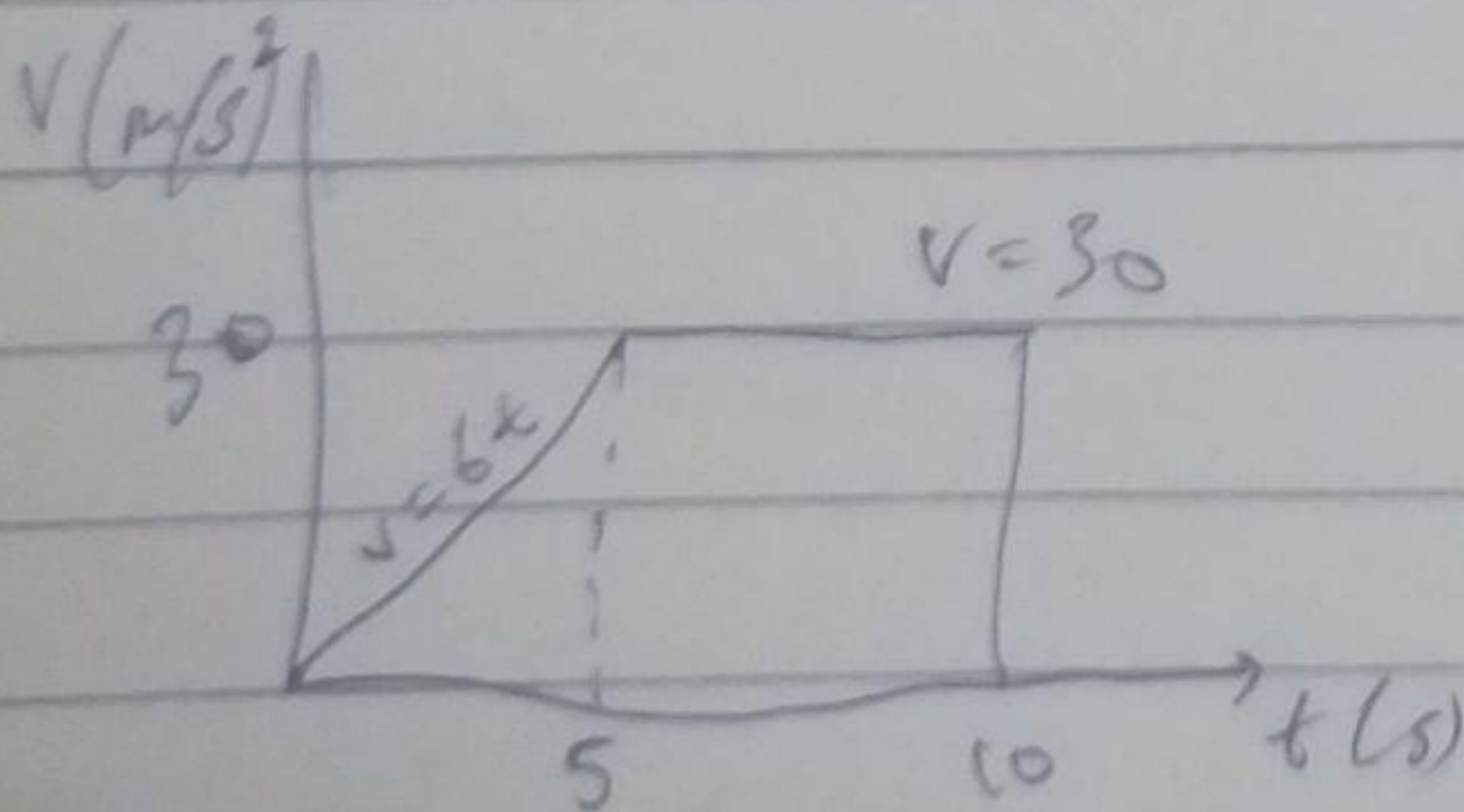
$$\frac{d}{dt} (3t^2) = 6t$$

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

$$\text{for } 5 \text{ s} < t \leq 10 \text{ s}$$

$$v = \frac{ds}{dt} = \frac{d}{dt} (30t - 75)$$

$$v = 30 \text{ m/s}$$



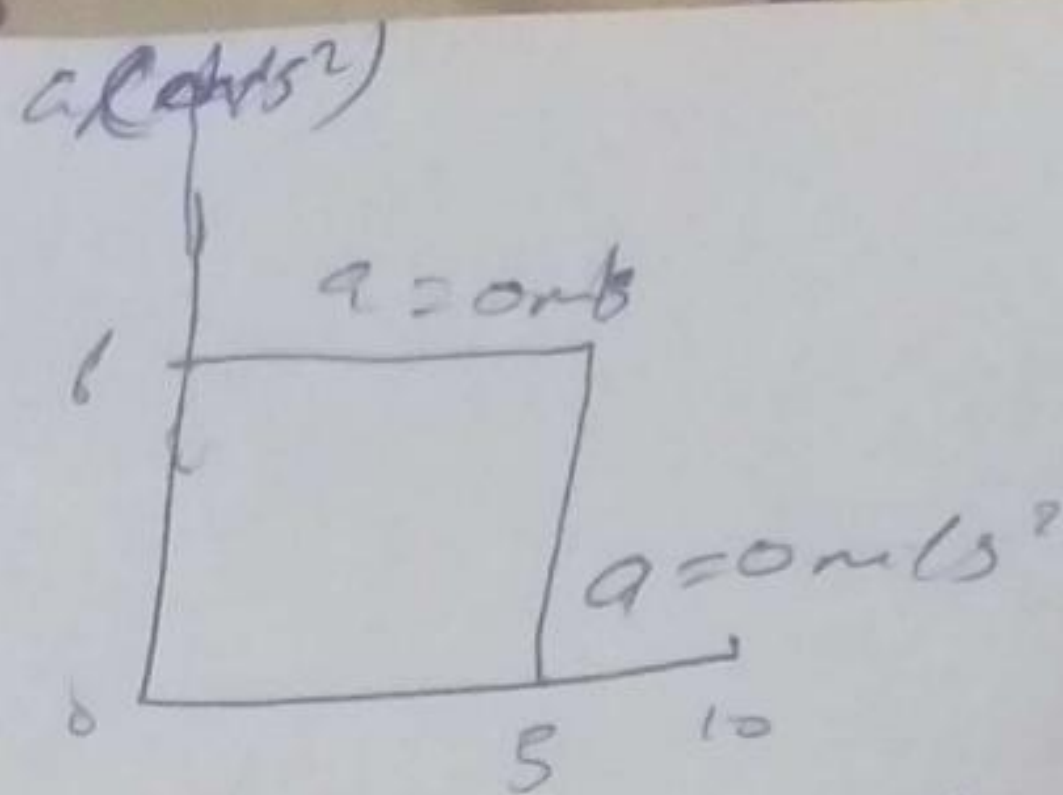
v-t graph

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

$$a = \frac{dv}{dt} = \frac{d}{dt} (6t) = 6$$

$$5s < t \leq 10s, v = 30$$

$$a = \frac{dv}{dt} = \frac{d(30)}{dt} = 0$$



a-t graph

5) $a = \frac{dv}{dt}, dt = a dt$

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

For $0 \leq t < 5s, a = 20$

$$dv = a dt$$

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

$$v = 20t$$

When $t = 5$

$$v = 20(5) = 100 \text{ m/s}^2$$

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

$$dv = a dt$$

$$\int_{100}^v dv = \int_5^t a dt$$

$$v - 100 = \int_5^t -10 dt$$

$$v = [-10t]_5^t + 100$$

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

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

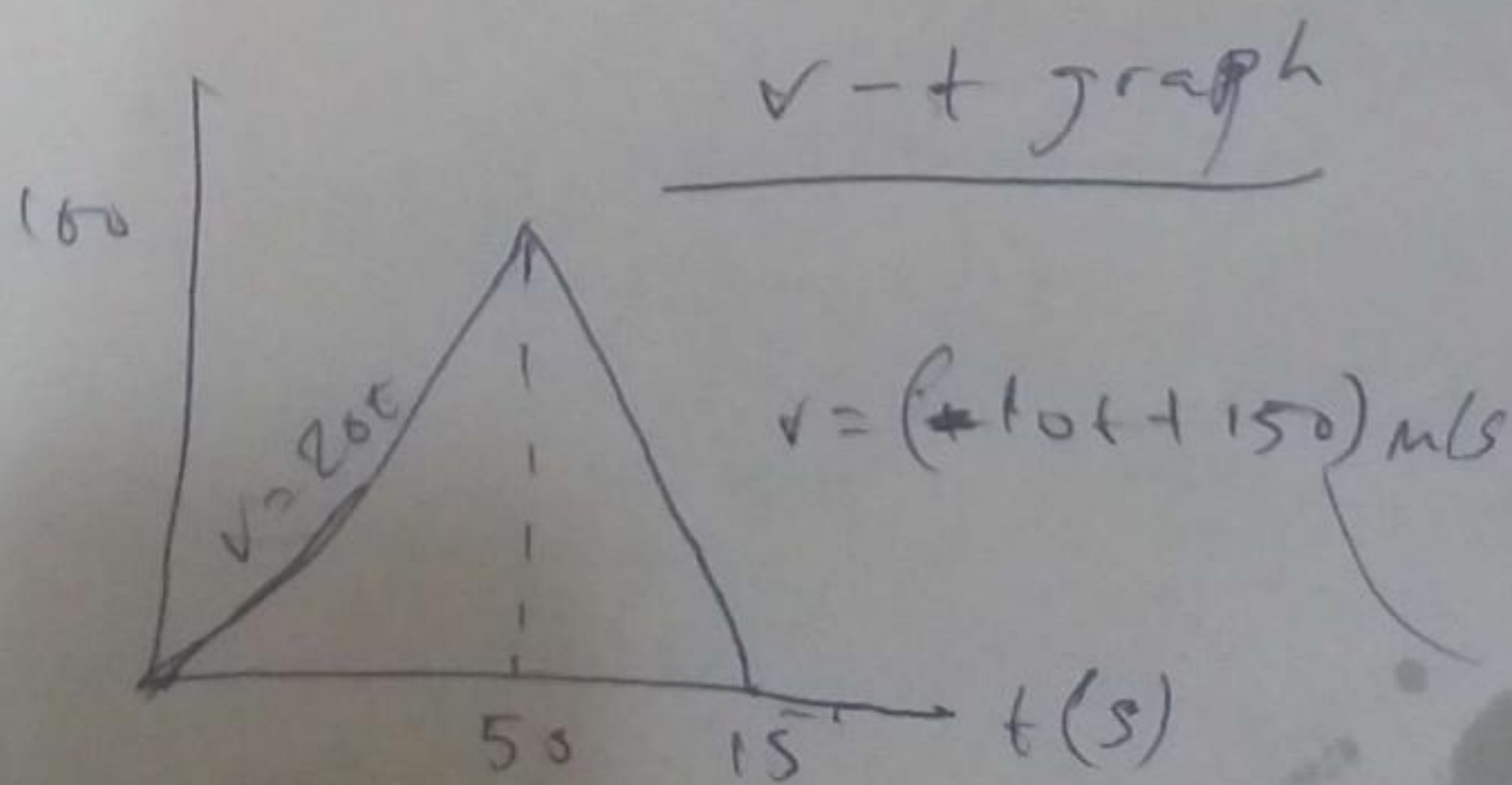
When $t = t', v = 0$

$$0 = -10t' + 150$$

$$10t' = 150$$

$$t' = 15s$$

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



v-t graph