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18IENG071001
Petroleum Engineering

ENG 284 (mechanics)

a)

$$S = 0.5t^3$$

$$at = 0 < t < 6sec$$

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

$$6 < t < 105sec$$

$$S = 105$$

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

2) $$v = -4t + 80$$

$$S = \int_0^s ds = \int_0^t dt$$

$$S = \int_0^4 \cdot (-4t + 80)$$

$$S = [-2t^2 + 80t]_7^{20}$$
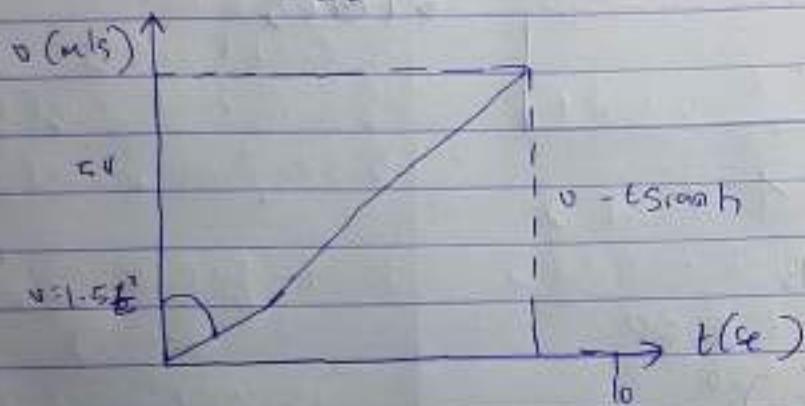
$$0 < t < 20 sec^s$$

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

$$S = -800 + 1600$$

$$S = 800 ft$$

S-T graph:

$$V = (-4t + 20)\,ft/s$$
$$a = \frac{dv}{dt} = -4\,ft/s^2$$
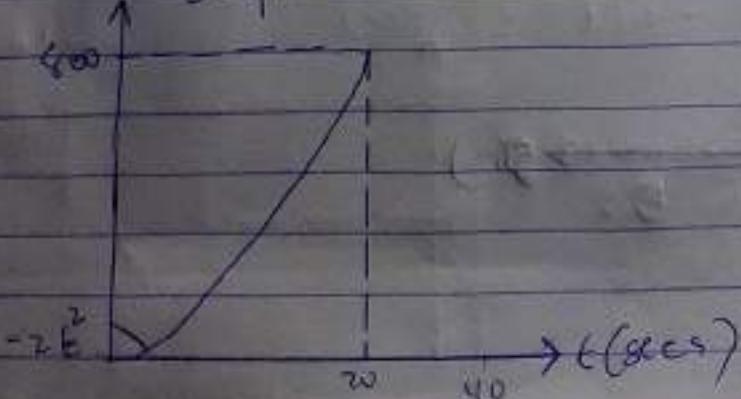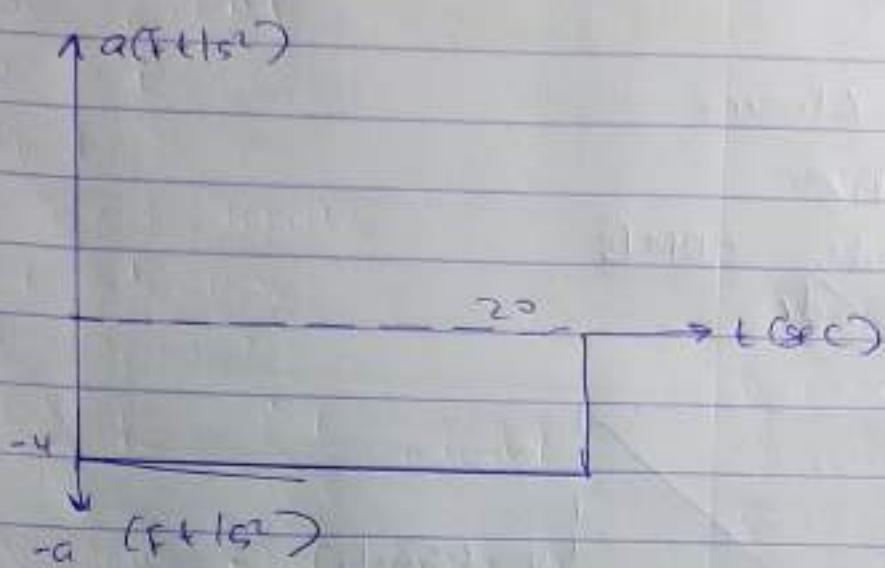
3) $V = (0.25S)\,m/s$

$a\,ds = v\,dv$

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

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

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

$$a = 0.0625S\,m/s^2$$

At $S = 40\,m = 0.0625(40)$

$$a = 2.5\,m/s^2$$

4) S_{12-12}
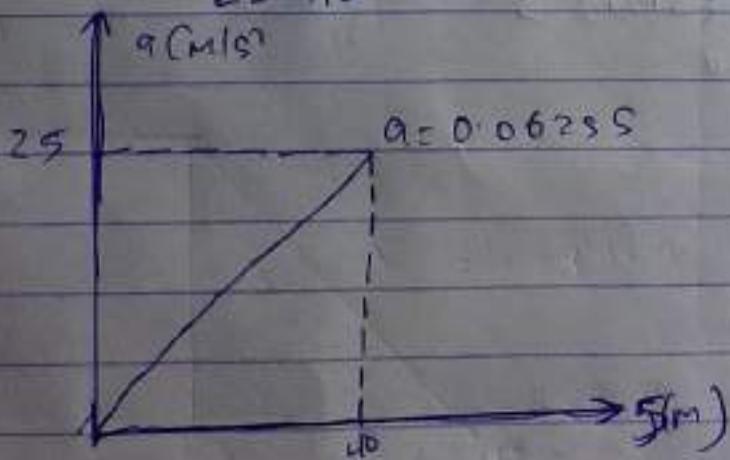
for $0 \leq t \leq 5s$

$$S = 3t^2$$

$$ds/dt = v = 6t \, m/s$$

at $t = 5s$

$$v = 6(5) = 30 m/s$$

for $5s \leq t \leq 10s$

$$v = \frac{\Delta S}{\Delta t} = \frac{275m - 75m}{10s - 5s} = 30 m/s$$

for a-t graph

$$0 \leq t \leq 5s \quad v = 6t \, m/s \quad a = dv/dt = 6 \, m/s$$

$$5 \leq 6 \leq 10s$$

$$v = 30 m/s$$

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

$v (m/s)$ $v = 30 (m/s)$

$v = 6t$

$v-t$ graph

$t(s)$

5   10

6

$t(s)$

5   10

5. $0 \leq t \leq 5 \, secs$

$a = 20 \, m/s^2$

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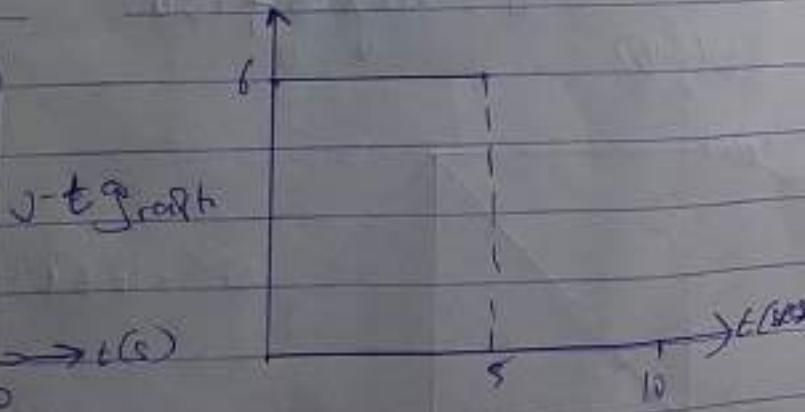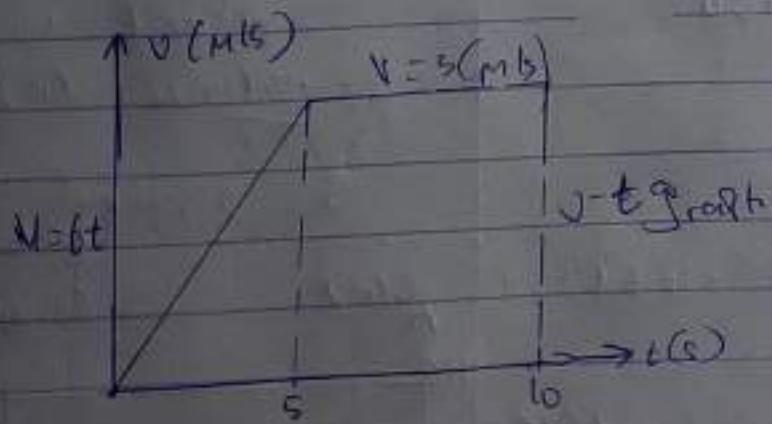
$\int_0^v dv = \int_0^t 20 \, dt$

$v = 20 \, t$

when $t = 5$

$v = 20 \wedge 5 = 100 \, m/c$

$5 \leq t \leq 15 \, secs$

$a = -10 \, m/s^2$

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

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

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

$v - 100 = -10t + 50$

$v = -10t + 150$

when $v = 0$

$0 = -10t + 150$

$10t = 150$

$t = \dfrac{150}{10} = 15 \, sec$

$5 \leq t \leq t'$ $t' = 15 \, secs$

$v = -10 \times 15 + 150$

$v = 0$

$v \, (m/s)$

$100 \, m/s$

$5 \, s$

$v = -10t + 150$

$6 = 15 \, s$

$t \, secs$

6) $F_{12 - 14}$

$= 20 \leq t \leq 15 \, c$

$v = 30t \, m/s$

$\int_0^s ds = \int_0^t 30t$
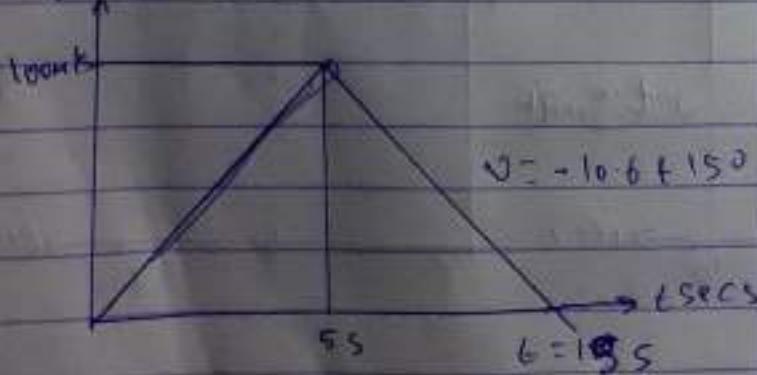
$s = 15 t^2 \, m$

when $t = 5s, \; s = 15(5)^2$

$= 375 \, m$

$5 \leq t \leq 15 \, s$

$v = (-15t + 225)$

$\int_{375}^s ds = \int_{50}^t (-15t + 225) \, dt$

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

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

$s - 375 = \dfrac{-15t^2}{2} + 225t + 1512.5$

$s = \dfrac{-15t^2}{2} + 225t + 1512.5 + 375$

$s = \dfrac{-15t^2}{2} + 225t + 1687.5$

when $t = 15$

$s = \dfrac{-15(15)^2 + 225(15)}{2} + 1687.5$

$s = 3375 \, m \; (total \; distance \; covered)$

$s(m)$