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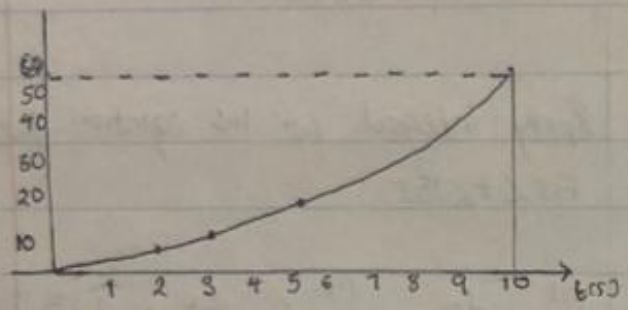
Fig 12-9



Find the velocity $v = ds/dt$

$0 \leq t \leq 6s$ sub $0.5t^3$ for S

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

$$= d/dt\,(0.5t^3)$$

$$= 0.5\,\frac{d}{dt}(t^3)$$

$$= 1.5t^2$$

Velocity at a point where $t = 6s$

$$V = 1.5t^2$$

$$= 1.5 \times 6^2 = 54\ m/s$$

$6s < t \leq 10s$ sub $10s$ for S in the equation

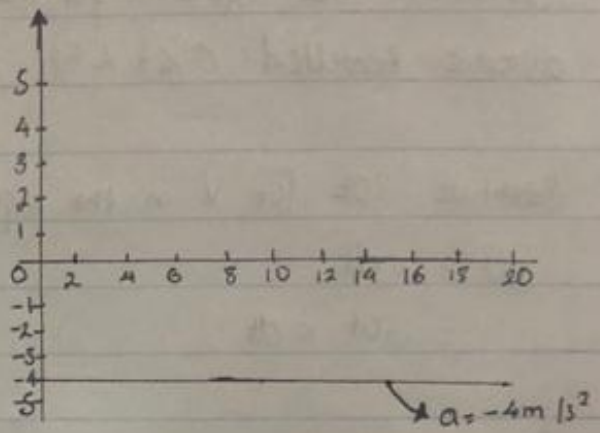
$$V = \frac{ds}{dt}$$

$$= \frac{d}{dt}(10s)$$

$$= 0$$

Fig 12-10

(a)



Equation for velocity of van

$V = ds/dt$ —(1), $ds = vdt$

V is velocity and S is displacement of van, t is the time

Substitute $(-4t + 80)$ for V in equation

$ds = vdt$

$ds = (-4t + 80)dt$ —(2)

Initial Conditions:

$S = 0m$ when $t = 0s$

Upper limits of displacement and time be s and t

Integrate equation (2)

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

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

$$|s|_0^s = |-2t^2 + 80t|_0^t$$

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

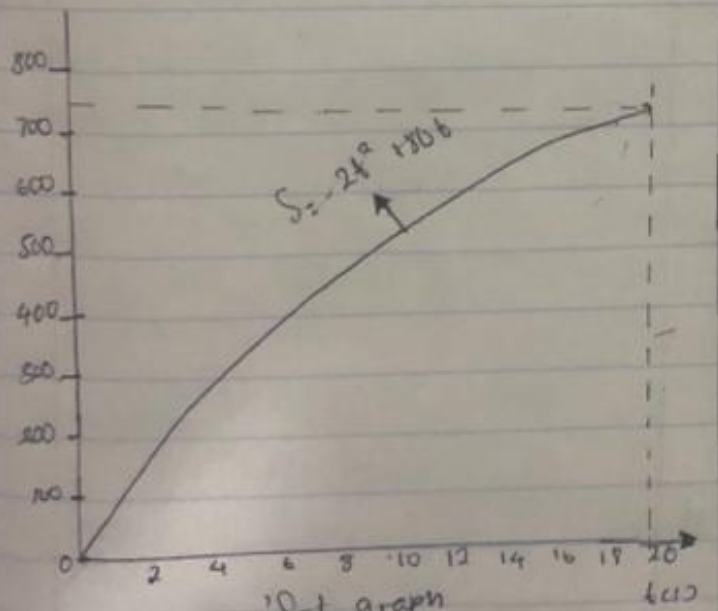
While eqn for acceleration

$a = dv/dt$

Substitute $(-4t + 80)$ for v

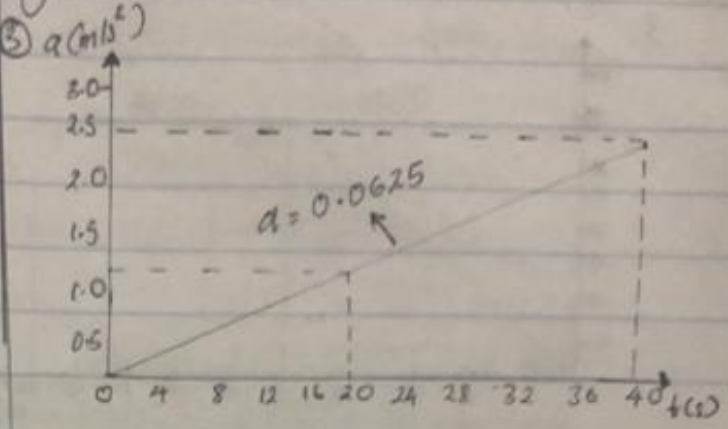
$$a = \frac{d}{dt}(-4t + 80)$$

$$= -4 ft/s^2$$



's-t graph

Fig 12-11



Acceleration of the bicycle is expressed as

$$a = v \frac{dv}{ds}$$

for $0 \le t < 40s$:

$v = 0.25s$

Accordingly, we have from (1)

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

$$a = (0.0625s) \quad (2)$$

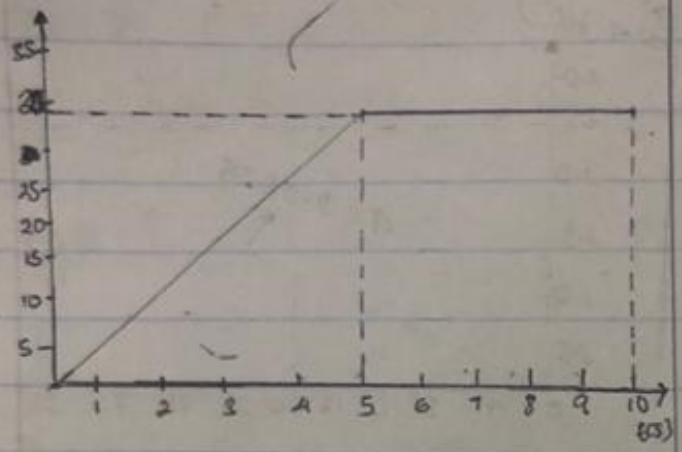
At $s = 40s$: we have from (2)

$a|_{40} = (0.0625 \times 40)$

$a|_{40} = 2.5 m/s^2$

Fig 12-12

3



Velocity of the car is expressed as

$V = ds/dt$ —(1)

for $0 \leq t \leq 5s$

$S = 3t^2$

Accordingly we have

$V = d/dt\ (3t^2)$

$V = 6t$ —(2)

At $t = 5s$

$V|t = 5s = 6 \times 5$

$V|t = 5s = 30 m/s$

$5s < t \leq 10s$

$S = 30t - 75$

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

$V = 30 m/s$ —(3)

Acceleration of the car is expressed as

$a = \frac{dv}{dt}$ —(4)

for $0 \leq t \leq 5s$

we have from 2 eq $V = 6t$

we have from

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

$a = 6 m/s^2$

for $5s < t \leq 10s$

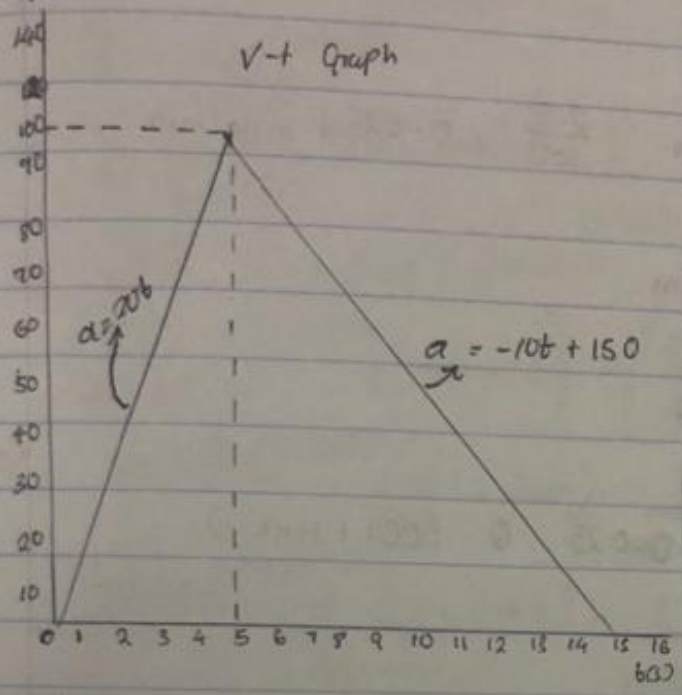
we have from (3) $V = 30 m/s$

$a = \frac{d}{dt}(30 m/s)$

$a = 0$

Fig 12-13

A (m/s)



Acceleration of the dragster is expressed

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

$$dv = a\,dt$$

for $0 \le t < 5s$

Integrating (1) we have

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

$$|v|_0^v = |20t|_0^t$$

Applying limits, we have

$$v = (20t)\ m/s$$

At $t = 5s$

$$v|_{t=5s} = 20 \times 5$$

$$v|_{t=5s} = 100\ m/s$$

for $5s < t \le t$

Integrating (2) we have

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

$$|v|_{100}^{v} = |-10t|_5^t$$

By applying the limits, we have

$$(v - 100) = (-10t + 10 \times 5)\ m/s$$

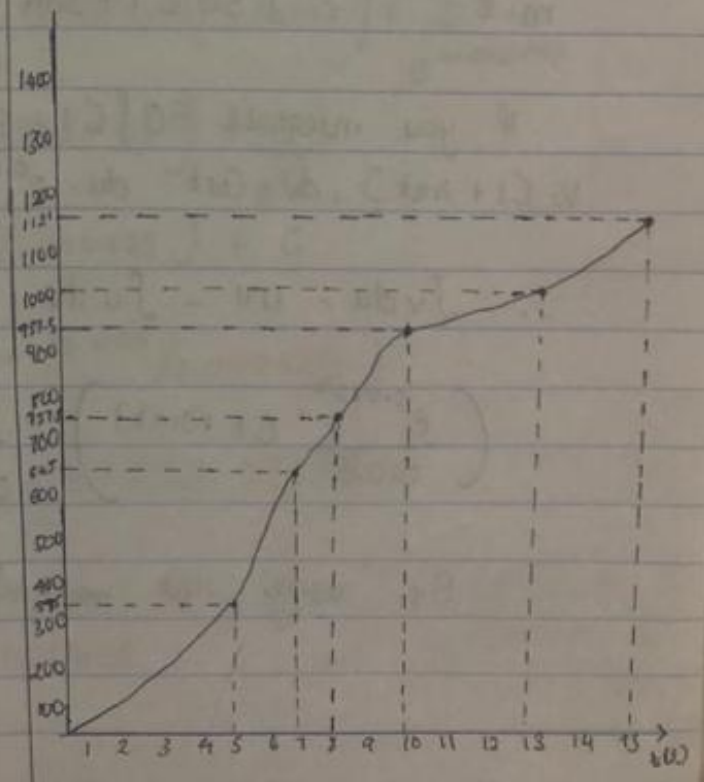
$$v = (150 - 10t)\ m/s \quad -(2)$$

when the car is at rest

$$0 = (150 - 10t')$$

$$t' = 5s$$

Fig 12-14



F12-14

Calculate the equation for the velocity

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

$ds = v\,dt$

Calculate the equation for the distance travelled $0 < t < 5s$

Substitute $30t$ for V in the equation

$ds = v\,dt$

$= 30t \times dt$

Applying integral for the equation for the region $0 \leq t < 5s$

$\int_0^s ds = \int_0^t 30t\,dt$

$\int_0^s ds = \int_0^{5\,sec} 30t\,dt$

$s = \left[30 \times \frac{t^2}{2}\right]_0^5$

$s = [15t^2]_0^5$

$= 15 \times 5^2 = 375m$

Calculate equ of distance travelled $5s < t \leq 15s$

Substitute $(-15t + 225)$ for V in the equation

$ds = v\,dt$

$= (-15t + 225)dt$

Apply integral for the equation for $5s < t \leq 15s$

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

$|s|_{375}^{s} = \left|\frac{-15t^2}{2} + 225t\right|_5^t$

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

$(s - 375) = (-7.5t^2 + 225t) - 937.5$

$s = (-7.5t^2 + 225t - 562.5)m$

Substitute 15 sec for t in equ (2) to calculate distance travelled

$s = (-7.5 \times 15^2 + 225 \times 15 - 562.5)m$

$s = 1125m$

∴ Total distance travelled in this time interval

$0s < t \leq 15s = 1125m$