

NAME: ABU DAVID

MARTIC NO: 18/ENG02/002

DEPT: COMPUTER ENGINEERING

MECHANICS ASSIGNMENT

ABU DAVID
18/ENG02/002
COMPUTER ENGINEERING
Fig 1.9

1. $0 \leq t < 6s$
 $v = \frac{ds}{dt} \quad s = 0.5t^2 \quad v = \frac{d}{dt}(0.5t^2)$
 $v = 1.5t^2$

$t = 6s$
 $v = 1.5(6)^2$
 $= 1.5 \times 36 = 54 \text{ m/s}$
 $6s < t \leq 10s$
 $s = 109$
 $v = \frac{ds}{dt} \quad v = \frac{d}{dt}(109)$
 $v = 0$

The v-t graph is drawn below

The graph shows velocity (v) in m/s on the vertical axis and time (t) in seconds on the horizontal axis. The vertical axis has a tick mark at 54. The horizontal axis has tick marks at 6 and 10. A straight line starts at the origin (0,0) and goes up to the point (6, 54). The equation $v = 1.5t^2$ is written next to this line. From t = 6 to t = 10, the velocity is constant at 0 m/s, represented by a horizontal line on the t-axis. The label $v = 0$ is written above this horizontal segment.

2. P12-10 - F12-10

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

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

$$0 \leq t \leq 20 \quad v = -4t + 120$$

$$s = \int_0^t (-4t + 120) dt$$

$$s = \left[\frac{-4t^2}{2} + 120t \right]_0^t$$

$$s = -2t^2 + 120t$$

at $t = 20$

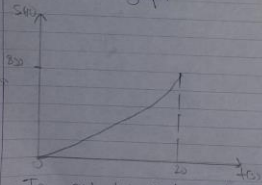
$$s = -2(20)^2 + 240(20) = -800 + 4800$$

$$s = 4000 \text{ ft}$$

at $t = 0$

$$s = -2(0)^2 + 120(0) = 0 \text{ ft}$$

The $s-t$ graph



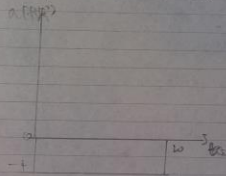
To get the $a-t$ graph

$$a = \frac{dv}{dt} \quad v = -4t + 120$$

$$a = \frac{d}{dt} (-4t + 120)$$

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

$$a = -4t + 120 \text{ so the car is decelerating}$$



3. P12-11

$$a ds = v dv$$

$$a = \frac{dv}{dt} \quad 0 \leq t \leq 40 \text{ m}, \quad v = 0.25t$$

$$a = 0.25 \text{ m/s}^2$$

$$a = 0.25 \times 0.25 = 0.25$$

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

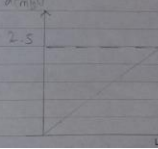
At $s = 40 \text{ m}$

$$a = 0.0625 \times 40$$

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

At $s = 0$

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



The $a-s$ graph

F12-12

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

$v = 6t \text{ m/s}$

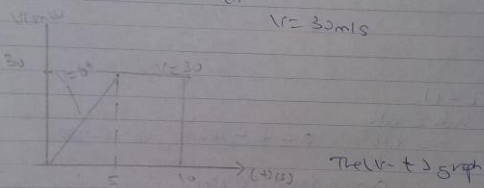
At $t = 5s$

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

for $5s < t \leq 10s$

$v = \frac{ds}{dt} = \frac{d}{dt}(30t - 7s)$

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



for the $a-t$ graph

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

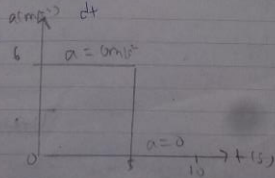
$0 \leq t < 5s, v = 6t$

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

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

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

The $a-t$ graph



5 F12-13

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

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

for $0 \leq t < 5$, $a = 20$

$$dv = a dt$$

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

$$v = 20t + 15$$

$$v = 20t + 15$$

At $t = 5$

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

$5 \leq t \leq 15$, $a = -10 \text{ m/s}^2$

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

$$dv = a dt$$

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

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

$$v = [-10t + 150]_{5}^t + 100$$

$$v = -10t - (-10(5)) + 100$$

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

$$v = -10t + 150$$

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

when $t = t'$, we require $v = 0$

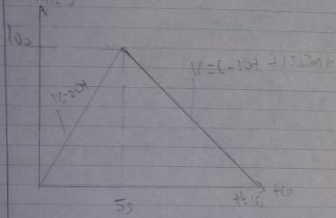
$$0 = -10t' + 150$$

$$10t' = 150$$

$$t' = 15$$

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

The $v-t$ graph



The $v-t$ graph

6. $F12 - 14$

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

$$0 \leq t \leq 15 \quad v = 2t$$

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

$$s = \int_0^t 2t dt$$

$$s = 2 \cdot \frac{t^2}{2} = t^2$$

$$s = 15^2 \text{ m}$$

At $t = 15$

$$s = 15^2 \text{ m}$$

$$s = 15 \cdot 25 = 375 \text{ m}$$

$$15 \leq t \leq 30 \quad v = -\frac{2}{3}t + 20$$

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

$$ds = v dt$$

$$\int_{375}^s ds = \int_{15}^t v dt$$

$$s - 375 = \int_{15}^t (-\frac{2}{3}t + 20) dt$$

$$s - 375 = \left[-\frac{1}{3}t^2 + 20t \right]_{15}^t$$

$$s - 375 = (-\frac{2}{3}t^2 + 20t) - (-\frac{2}{3}(15)^2 + 20(15))$$

$$s - 375 = -\frac{2}{3}t^2 + 20t - (-150 + 300)$$

$$s = -\frac{2}{3}t^2 + 20t + 150$$

$$s = -\frac{2}{3}(15)^2 + 20(15) + 150$$

$$s = -150 + 300 + 150 = 300$$

$$s = 1125 \text{ m}$$

The $s-t$ graph

