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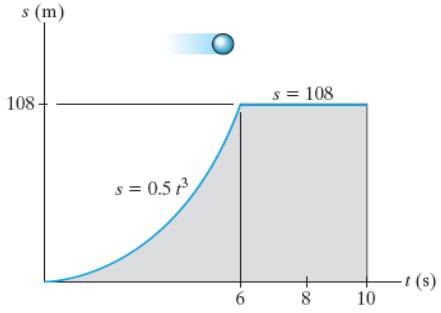
18/ENG04/070

ELECT-ELECT

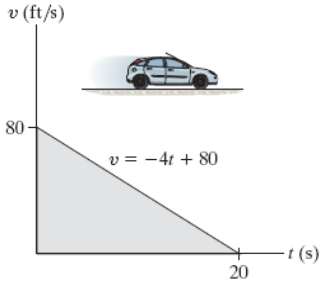
ANSWERS ARE BELOW THE QUESTIONS

F12–9. The particle travels along a straight track such that its position is described by the $s-t$ graph. Construct the $v-t$ graph for the same time interval.



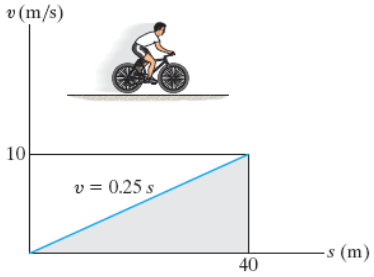
F12–9

F12–10. A van travels along a straight road with a velocity described by the graph. Construct the $s-t$ and $a-t$ graphs during the same period. Take $s = 0$ when $t = 0$.



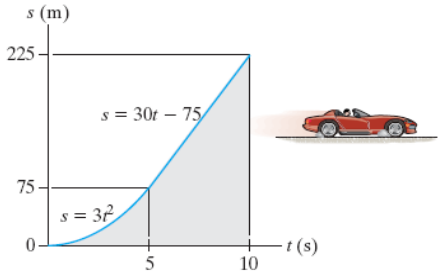
F12–10

F12–11. A bicycle travels along a straight road where its velocity is described by the $v-s$ graph. Construct the $a-s$ graph for the same time interval.



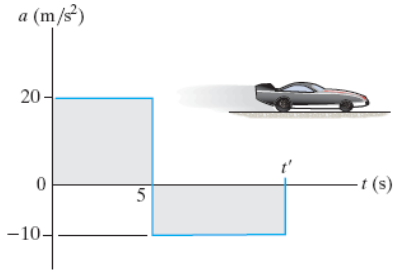
F12–11

F12–12. The sports car travels along a straight road such that its position is described by the graph. Construct the $v-t$ and $a-t$ graphs for the time interval $0 \le t \le 10$ s.



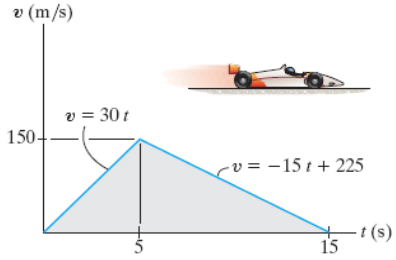
F12–12

F12–13. The dragster starts from rest and has an acceleration described by the graph. Construct the $v-t$ graph for the time interval $0 \le t \le t'$, where t' is the time for the car to come to rest.



F12–13

F12–14. The dragster starts from rest and has a velocity described by the graph. Construct the $s-t$ graph during the time interval $0 \le t \le 15$ s. Also, determine the total distance traveled during this time interval.

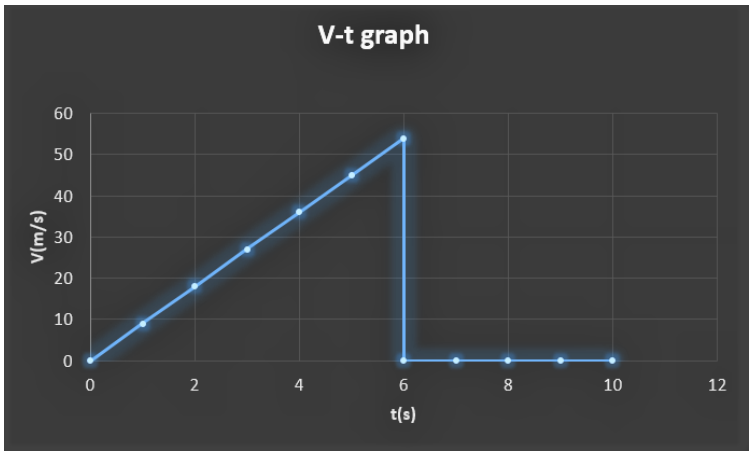


F12–14

NB: Please note, some of the graphs are drawn with free hand because they were quite difficult to draw with software.

ANSWERS

Question 1



V = ds/dt

$V = 1.5t^2$

$V = 1.5(6)^2$

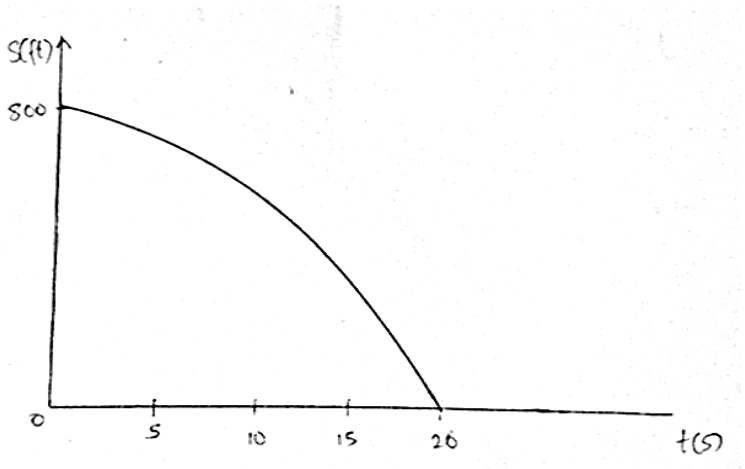
V = 1.5 x 36 = 54 m/s

Max velocity = 54 m/s @ 6 sec

When s = 128, V = ds/dt

V= 0

Question 2



i). V = -4t + 80

V = ds/dt

ds = Vdt

ds = (-4t + 80) dt

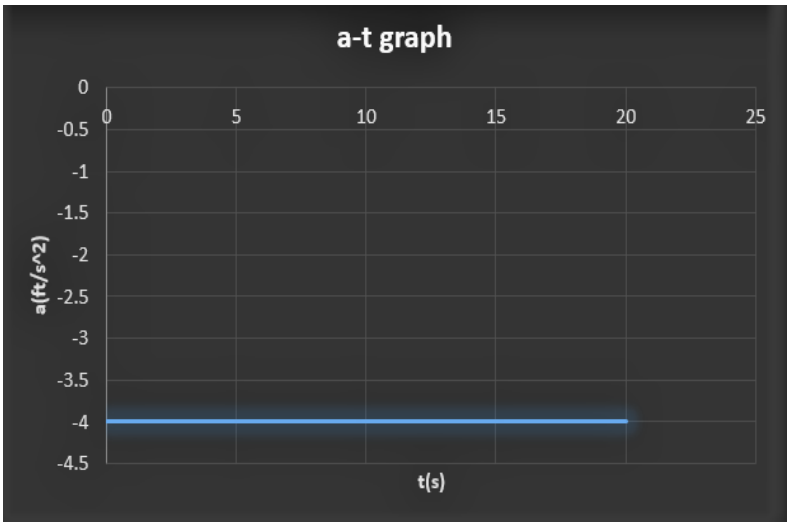
integrating;

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

$|s|_0^s = |-4t2/2 + 80t|_0^t$

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

@ t = 20 → $s = -2(20)^2 + 80(20) = 800$ ft.

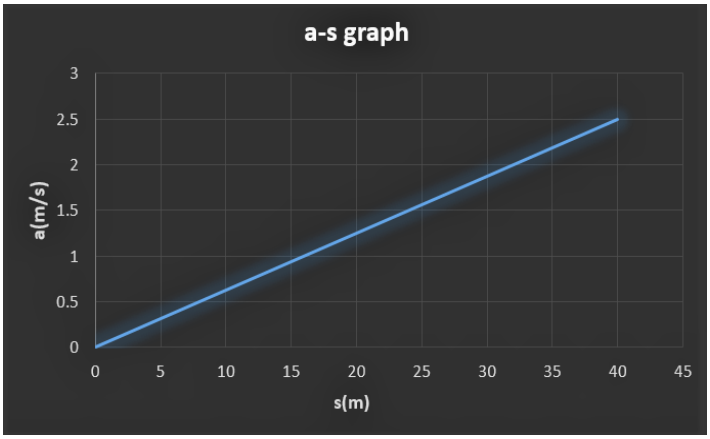


ii). a = dv/dt

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

∴ a = -4 ft/s.

Question 3

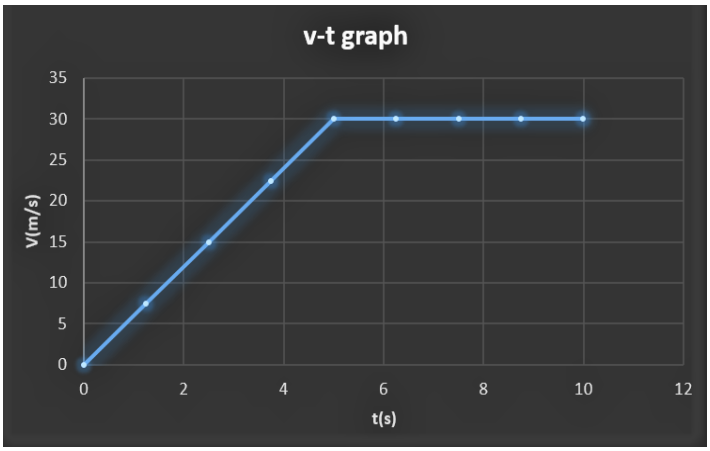


$a = V\frac{dv}{ds}$

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

$a = 0.0625\ m/s^2$

Question 4



From 0 – 5 sec;

$V = 3t^2$

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

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

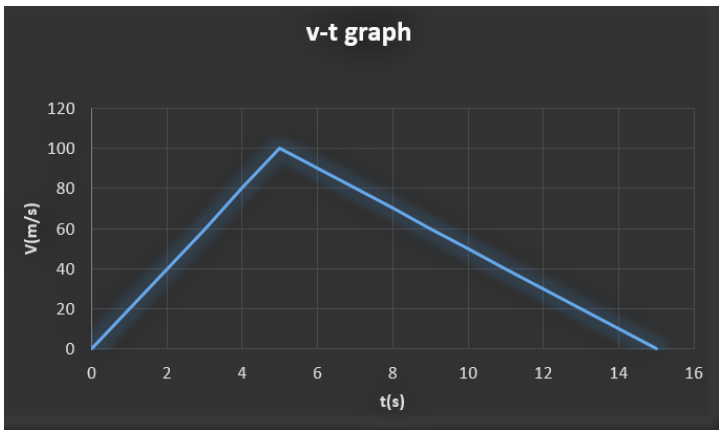
V = 6t m/s @ t = 5 $\rightarrow$ V = 6(5) = 30 m/s

From 5 – 10 sec

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

$\therefore$ V = 30 m/s

Question 5



a = dv/dt

dv = adt

when t = 5, a = 20

V = a(5)

$\int_0^v dv = \int_0^{t=5} 20\ dt$

$|v|_0^v = |20t|_0^5$

V = 20(5)

V = 100 m/s

When t = t', a = -10

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

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

V – 100 = -10t' = 10(5)

V – 100 = -10t' = 50

V = 150 – 10t'

V = 0 when the car is at rest

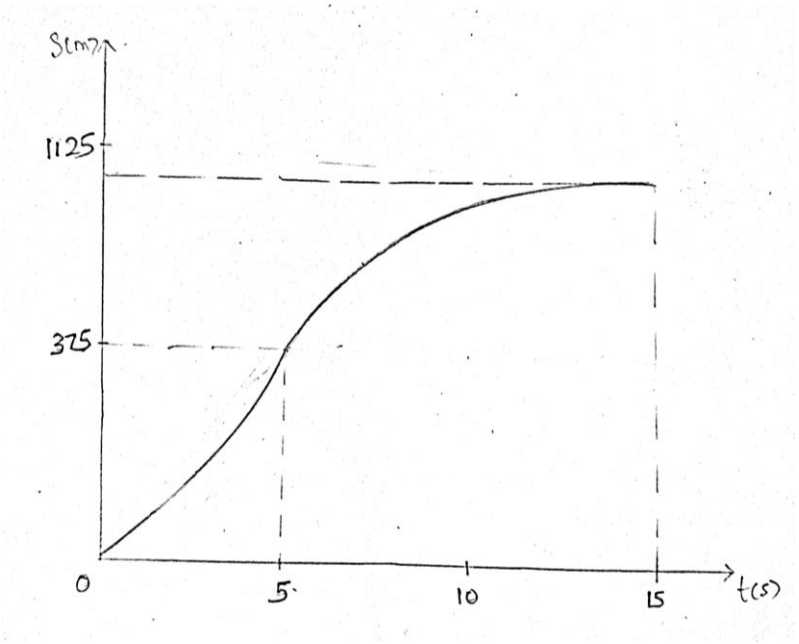
0 = 150 – 10t'

10t' = 150

$t' = \frac{150}{10}$

t' = 15 sec

Question 6



V = ds/dt

ds = vdt

From 0 – 5sec

$\int_0^s ds = \int_0^5 30t\ dt$

s = $|\frac{30t^2}{2}|_0^5 = |15t^2|_0^5$

s = $15(5)^2$ = 375m

From 5 – 15 sec

ds = (-15t + 225) dt

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

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

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

s = 5062.5 – 937.5 – 375

s = 1125 m