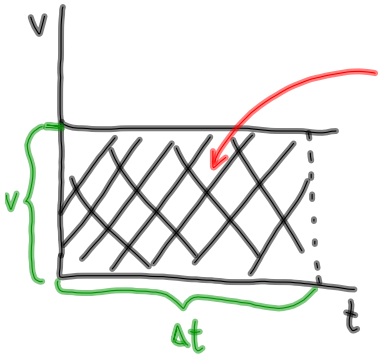
Acceleration + Displacement

Constant Velocity



Area of Rectangle = l x w

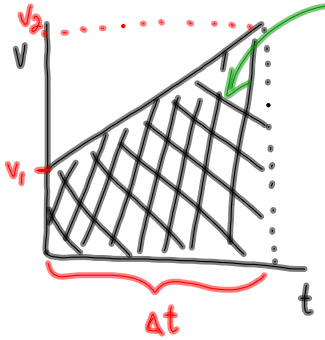
Area = $v\Delta t$

$\Delta d = v\Delta t$

Recall $v = \frac{\Delta d}{\Delta t}$

Area v-t graph = Δd

Constant Acceleration



Area of Trapezoid = $\frac{1}{2}(h_1 + h_2)b$

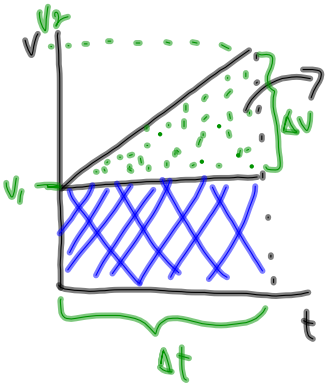
Area = $\frac{1}{2}(v_1 + v_2)\Delta t$

Area = $\left(\frac{v_1 + v_2}{2}\right)\Delta t$

Area = $v_{ave}\,\Delta t$

$\Delta d = v_{ave}\,\Delta t$

Recall $\left(v_{ave} = \frac{\Delta d}{\Delta t}\right)$



Area = Area of □ + Area of Δ

Area = $v_1\Delta t + \frac{1}{2}(\Delta v)(\Delta t)$

Area = $v_1\Delta t + \frac{1}{2}(a\Delta t)(\Delta t)$

Area = $v_1\Delta t + \frac{1}{2}a(\Delta t)^2$

$a = \frac{\Delta v}{\Delta t}$

$\Delta v = a\Delta t$

$\Delta d = v_1\Delta t + \frac{1}{2}a(\Delta t)^2$ maybe useful

$\Delta d = v_2\Delta t - \frac{1}{2}a(\Delta t)^2$

$v_2^2 = v_1^2 + 2a\Delta d$

MP 84

$\vec{V}_1 = 8.3\,m/s\,[down]$ ⊖

$\Delta t = 6.9\,s$

$\vec{a} = 9.81\,m/s^2\,[down]$ ⊖

$\vec{\Delta d} = ?$ (height)

$$\Delta d = v_1 \Delta t + \frac{1}{2} a (\Delta t)^2$$

$$\Delta d = -8.3\,\frac{m}{s}(6.9\,s) + \frac{1}{2}\left(-9.81\,m/s^2\right)(6.9\,s)^2$$

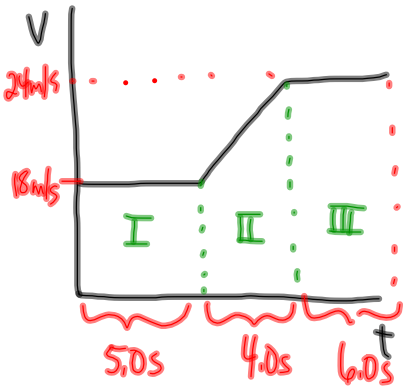
$$\Delta d = -57.27\,m - 233.53\,m$$

$$\Delta d = -290.80\,m$$

$$\vec{\Delta d} = 2.9 \times 10^2\,m\,[down]$$

The height of the cliff is $2.9 \times 10^2\,m$

MP|85



Section I - constant velocity

$v = 18\ m/s$
$\Delta t = 5.0\ s$
$\Delta d = ??$

$$v = \frac{\Delta d}{\Delta t}$$

$$\Delta d = v\,\Delta t$$

$$\Delta d = (18\ m/s)(5.0\ s)$$

$$\boxed{\Delta d = 90\ m}$$

Section II - constant acc

$v_1 = 18\ m/s$
$v_2 = 24\ m/s$
$\Delta t = 4.0\ s$
$\Delta d = ??$

$$v_{ave} = \frac{\Delta d}{\Delta t}$$

$$\Delta d = v_{ave}\,\Delta t$$

$$\Delta d = \left(\frac{v_1 + v_2}{2}\right)\Delta t$$

$$\Delta d = \left(\frac{18\ m/s + 24\ m/s}{2}\right) 4.0\ s$$

$$\Delta d = (21\ m/s)(4.0\ s)$$

$$\boxed{\Delta d = 84\ m}$$

Section III - constant velocity

$v = 24\ m/s$
$\Delta t = 6.0\ s$
$\Delta d = ?$

$$v = \frac{\Delta d}{\Delta t}$$

$$\Delta d = v\,\Delta t$$

$$\Delta d = (24\ m/s)(6.0\ s)$$

$$\Delta d = 144\ m$$

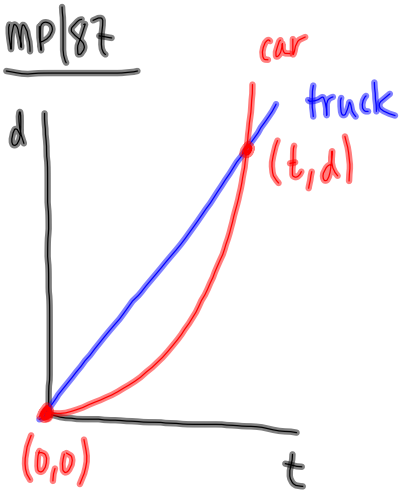
TOTAL

$$\begin{array}{r} 90\ m \\ 84\ m \\ +\ 144\ m \\ \hline 318\ m \end{array}$$

$$\vec{\Delta d} = 3.2 \times 10^2\ m\ [E]$$

The displacement for the whole trip was $3.2 \times 10^2\ m\ [E]$

mp187



Truck - constant velocity

$v = 22\,m/s$

$\Delta d = v\Delta t$

$d = (22\,m/s)\,t$

Car - constant acceleration

$a = 4.8\,m/s^2$

$v_1 = 0$

$\Delta d = \cancel{v_1 \Delta t}^{0} + \frac{1}{2}a(\Delta t)^2$

$d = \frac{1}{2}(4.8\,m/s^2)\,t^2$

$d = (2.4\,m/s^2)\,t^2$

$22t = 2.4t^2$

$0 = 2.4t^2 - 22t$

$0 = t(2.4t - 22)$

$t = 0$ and $2.4t - 22 = 0$

$2.4t = 22$

$t = \frac{22\,m/s}{2.4\,m/s^2}$

$t = 9.2\,s$

Sub $t = 9.2s$ into: $d = (22\,m/s)\,t$

$d = (22\,m/s)(9.2s)$

$d = 2.0 \times 10^2\,m$

$\vec{d} = 2.0 \times 10^2\,m\ [N]$