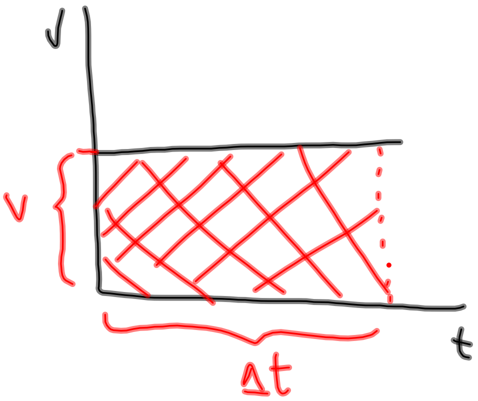
Acceleration + Displacement

Constant Velocity



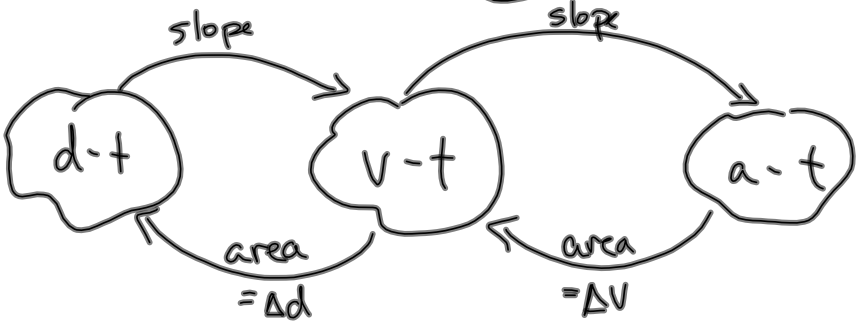
Area of Rectangle $= l \times w$

Area $= v\Delta t$

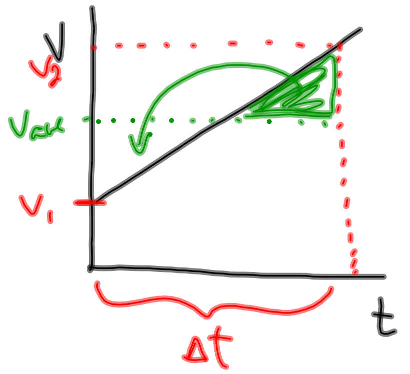
Recall: $v = \frac{\Delta d}{\Delta t}$

$\Delta d = v\Delta t$

$\therefore$ area (v-t) $= \Delta d$



Non-Constant Velocity (specifically Constant Acceleration)



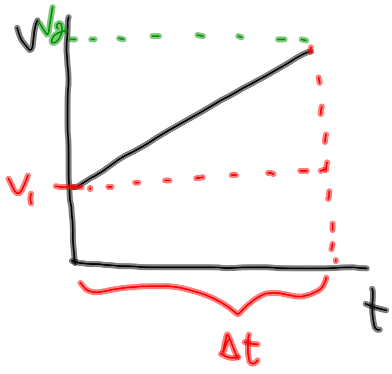
area of trapezoid $= \frac{1}{2}(h_1 + h_2)b$

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

area $= v_{ave}\Delta t$

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

Where $v_{ave} = \frac{v_1 + v_2}{2}$.



Another way:

area = area of ▭ + area of Δ

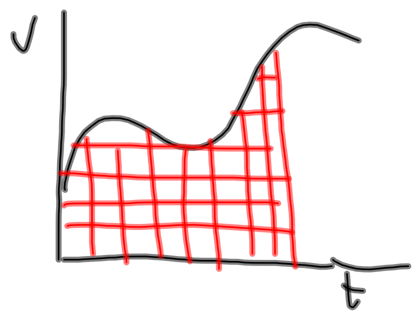
Maybe useful:

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

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

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

What if the acceleration is not constant?



area $= \Delta d$

× count squares!

mp|84

$\vec{v}_1 = 8.3\frac{m}{s}$ [down] (−)

$\Delta t = 6.9s$

$\Delta\vec{d} = ?$

$\vec{a} = 9.81\frac{m}{s^2}$ [down] (−)

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

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

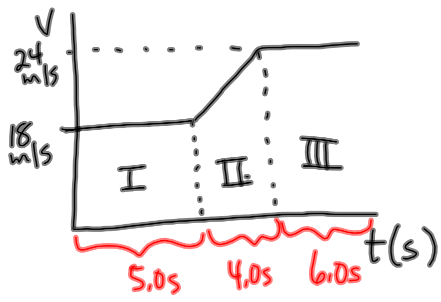
$\Delta d = -57.27\,m - 233.53\,m$

$\Delta d = -290.79705\,m$

$\Delta\vec{d} = 2.9\times10^2\,m$ [down]

The height of the cliff is $2.9\times10^2\,m$

MP|85



Section I: (constant velocity)

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

$\Delta d = v\Delta t$

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

$\Delta d = 90 m$ (2 sd)

Section II (constant acceleration)

$v_1 = 18 m/s$

$v_2 = 24 m/s$

$\Delta t = 4.0s$

$\Delta d = ??$

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

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

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

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

$\Delta d = \left(21\frac{m}{s}\right)(4.0s)$

$\Delta d = 84 m$

Section III (constant velocity)

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

$\Delta d = v\Delta t$

$\Delta d = \left(24\frac{m}{s}\right)(6.0s)$

$\Delta d = 144 m$

Overall:

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

$3.2 \times 10^2 m$

TO DO: PP|89 (not #5)