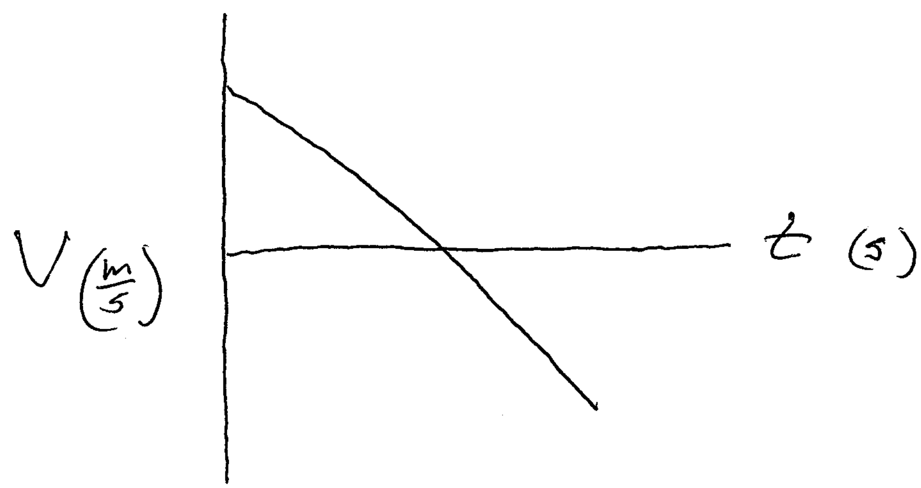
Interpreting Graphical Information



On any graph you have 3 pieces of information:

1) Reading the points

In this case velocity and time

2) Slope

In this case

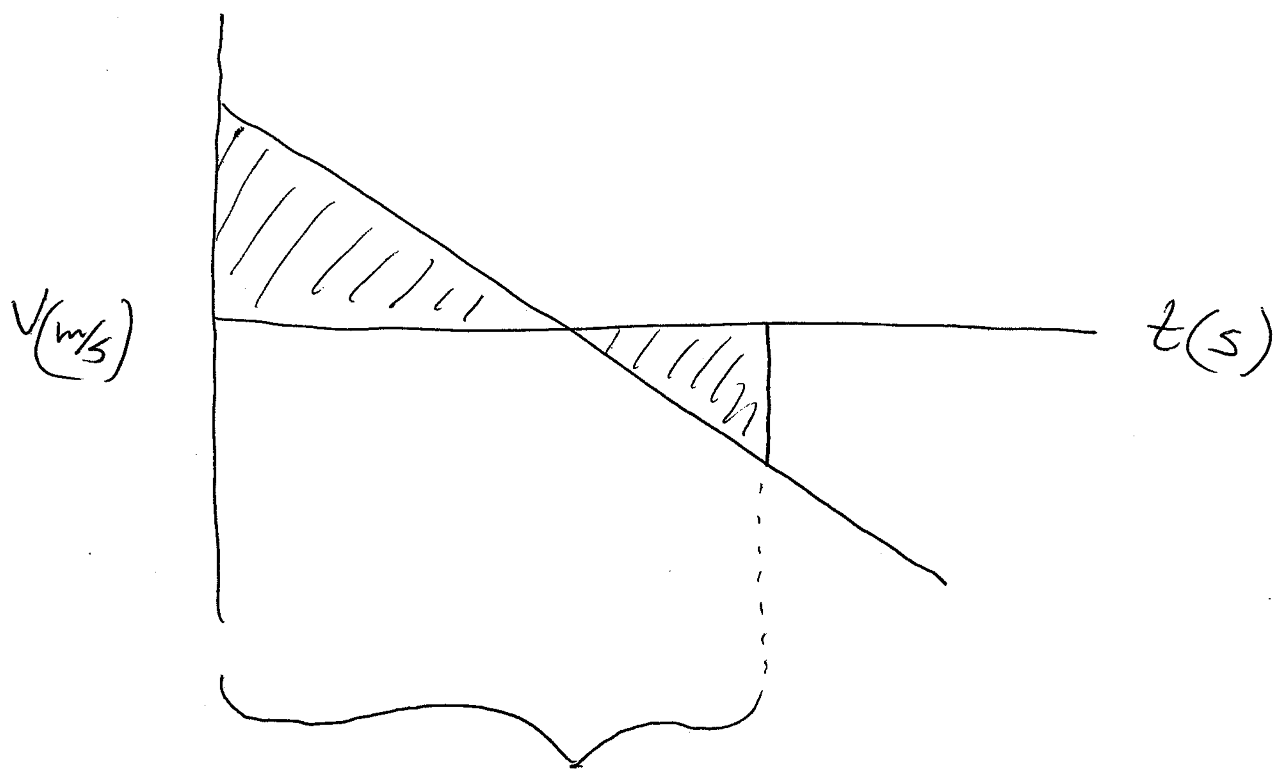
$a = \frac{\Delta v}{\Delta t}$ <u>unit analysis</u> $\frac{m/s}{s}$

$\frac{m}{s^2}$

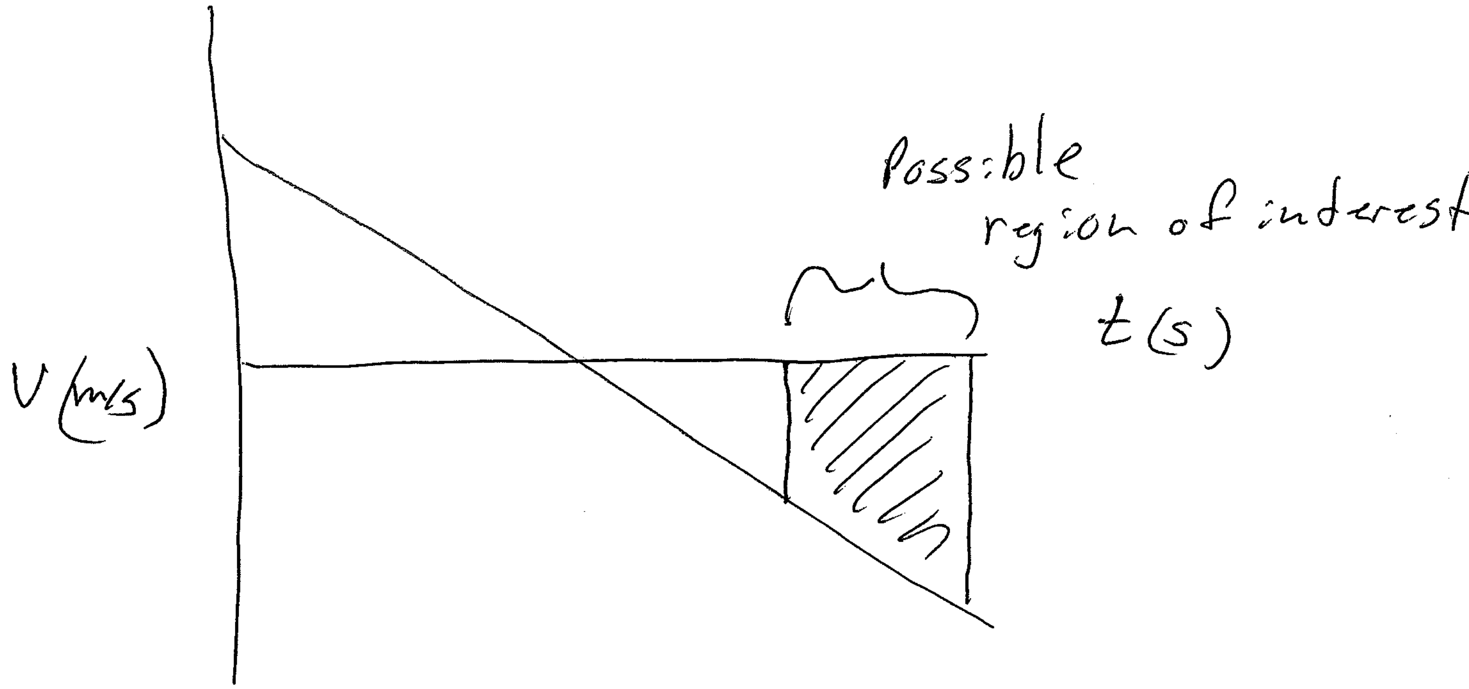
Identify by form or unit

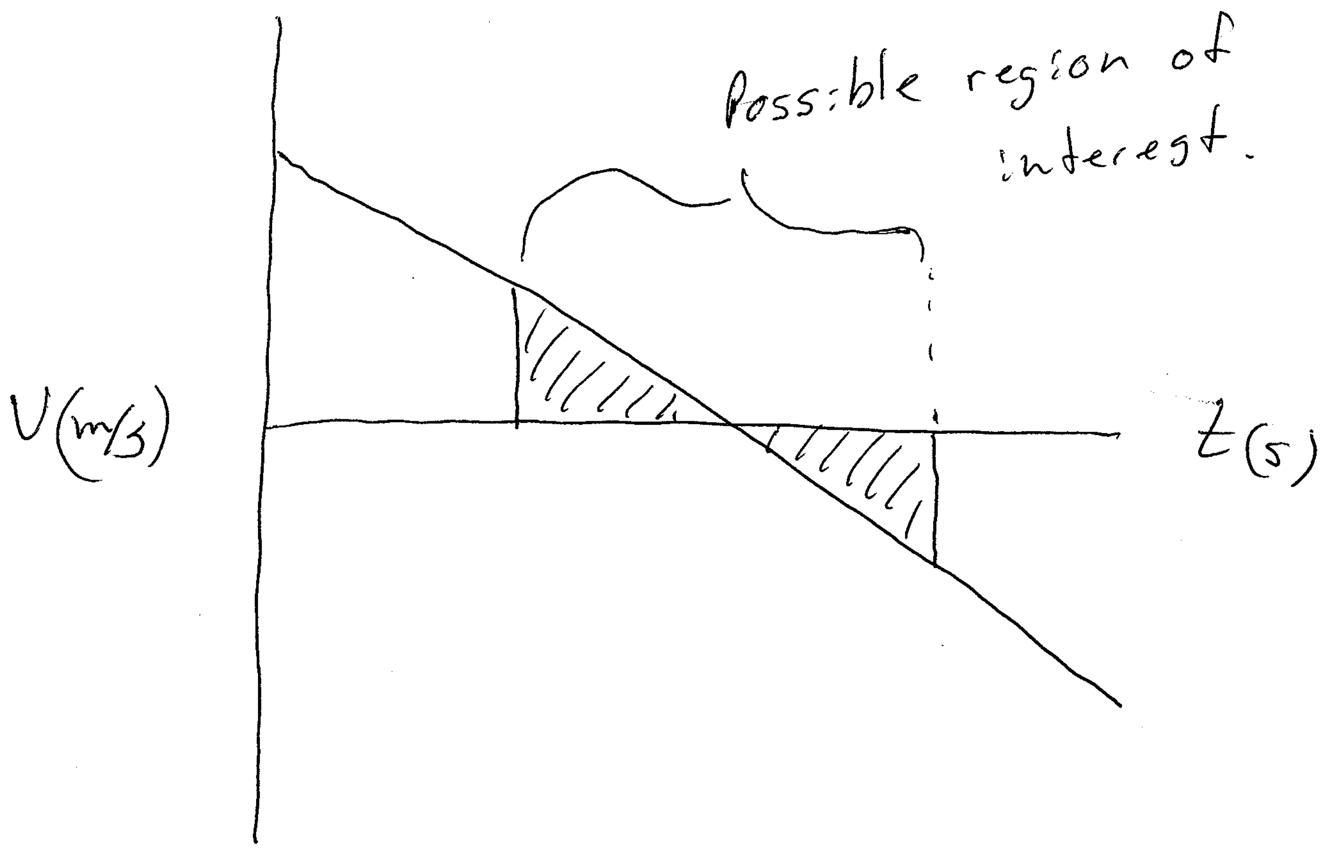
3) Area

* The "area" is the region bounded by the curve/line and the horizontal axis.



Possible region of interest


Possible
region of interest
t (s)
V (m/s)


Possible region of
interest.
t (s)
V (m/s)

In this case we have two possible general area equations

$A = \frac{1}{2}bh$ triangular

or

$A = \frac{1}{2}bh + bh$ triangular + rectangular

Unit analysis

$A = \frac{1}{2}bh \quad (\cancel{s})\left(\frac{m}{\cancel{s}}\right) = \underline{\underline{m}}$

$A = \frac{1}{2}bh + bh$

$(\cancel{s})\left(\frac{m}{\cancel{s}}\right) + \cancel{s}\left(\frac{m}{\cancel{s}}\right)$

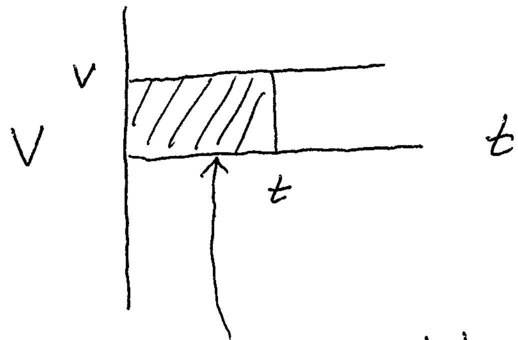
$m + m = \underline{\underline{m}}$

* Constants do not affect unit analysis!

[redacted]

Motion and the Equations that Describe it.

Standard Model 1: Constant velocity (nonzero)



Area = bh = $t v$

Unit analysis

$s\left(\frac{m}{s}\right) = m$

Area = position change = Δx

$\Delta x = v t$

$\Delta x = x - x_i$

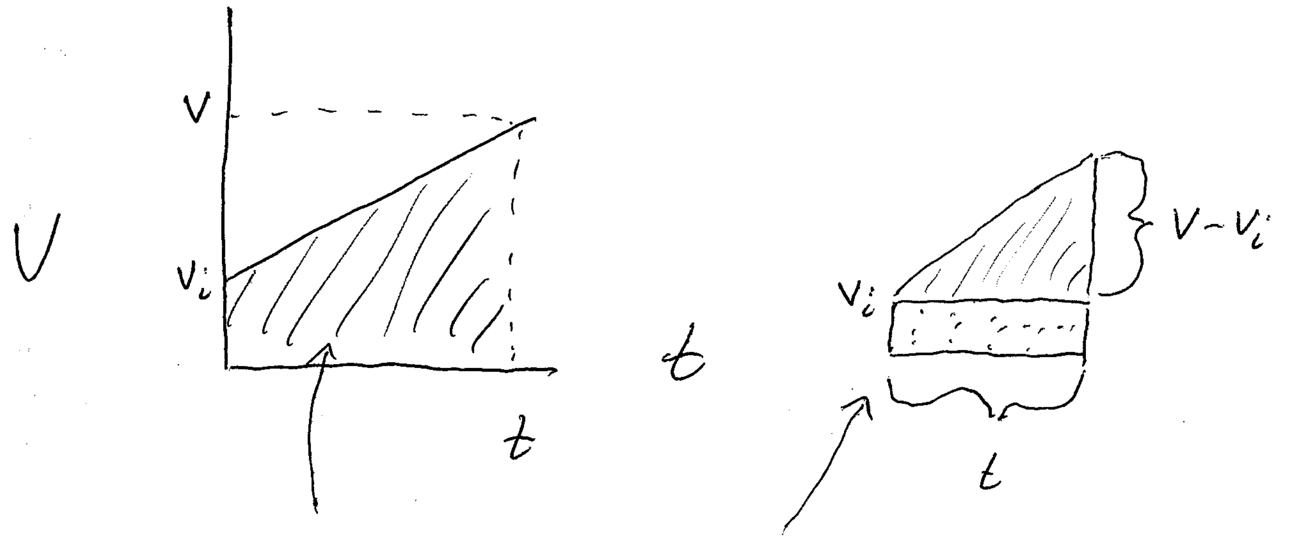
<u>Equation Set</u>

$x = v t + x_i$

v = constant

$a = 0$

Standard Model 2: Constant Acceleration (nonzero)



$$\text{Area} = \tfrac{1}{2} b h_1 + b h_2$$

$$= \tfrac{1}{2} t (v - v_i) + t v_i$$

$$= \tfrac{1}{2} t \Delta V + t V_i$$

Unit analysis

$$s\left(\frac{m}{s}\right) + s\left(m/s\right)$$

$$m + m = m$$

$$\text{Area} = \Delta x$$

$$\Delta x = \tfrac{1}{2} \Delta V t + V_i t$$

$$x = \tfrac{1}{2} \Delta V t + V_i t + x_i$$

Since V vs T is linear it fits the general model

$$y = mx + b$$

$$V = \left(\frac{\Delta V}{\Delta t}\right) t \quad v_i$$

$$\left(\frac{\Delta V}{\Delta t}\right) \rightarrow a$$

$$V = at + v_i$$

$$\Delta V = \left(\frac{\Delta V}{\Delta t}\right)(t) = at$$

$$x = \tfrac{1}{2}(at)\, t + v_i t + x_i$$

<u>Equation set</u>

$$x = \tfrac{1}{2}at^2 + v_i t + x_i$$

$$V = at + v_i$$

$$a = \text{constant}$$