Position – Displacement – Δx or $d_f - d_i$

Velocity = $V_{av} = \frac{\Delta d}{\Delta t} = \frac{d_f - d_i}{t_f - t_i}$

Instantaneous Velocity = slope of tangent Line @ point on d vs t

Acceleration = $a_{av} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$

Instantaneous Accel. = slope of tangent line @ point V vs t

For a constant acceleration

$$a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{\Delta t} \quad \frac{m/s}{s/1} = m/s \cdot \frac{1}{s} = m/s^2$$

$$\Delta t \cdot a = \frac{V_f - V_i}{\Delta t} \cdot \Delta t$$

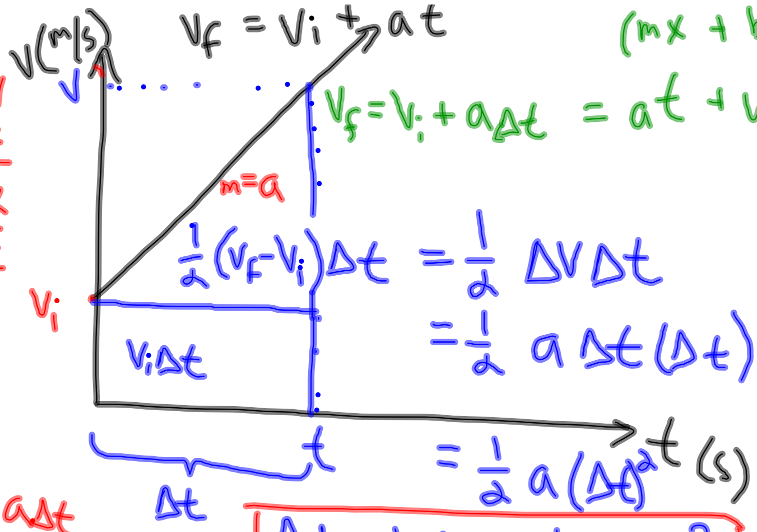
Kinematic Equation

$$a\Delta t = V_f - V_i$$
$$+V_i \qquad +V_i$$

$$\boxed{V_f = V_i + a\Delta t} \quad V = (m/s)$$

$$y = b + mx \quad a\,(m/s^2)$$

$v_f = v_i + at$ (mx + b)



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

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

$v_f = v_i + a\Delta t = at + v_i$

$\frac{1}{2}(v_f - v_i)\Delta t = \frac{1}{2}\Delta v \Delta t$

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

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

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

$\Delta v = a\Delta t$

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

$\cancel{\Delta t}\frac{\Delta d}{\cancel{\Delta t}} = v \cdot \Delta t \Rightarrow \Delta d = v\Delta t$ = Area under V vs T curve

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

$d_f - \cancel{d_i} = v_i t + \frac{1}{2}at^2$

$+\cancel{d_i} \quad +d_i$

$$\boxed{d_f = d_i + v_i t + \frac{1}{2}at^2}$$

Sub $\Delta t = \frac{\Delta v}{a} \Rightarrow \Delta d = \frac{v_i(\Delta v)}{a} + \frac{1}{2} a \left(\frac{\Delta v}{a}\right)^2$

$\left(\Delta d = \frac{v_i(\Delta v)}{\cancel{a}} + \frac{1}{2}\cancel{a}\frac{(\Delta v)^2}{\cancel{a^2}}\right)a$

$a\Delta d = v_i(\Delta v) + \frac{1}{2}\Delta v^2$ $\quad (v_f - v_i)(v_f - v_i)$

$a\Delta d = v_i(v_f - v_i) + \frac{1}{2}(v_f - v_i)^2$

$v_f^2 - 2v_iv_f + v_i^2$

$a\Delta d = \cancel{v_iv_f} - v_i^2 + \frac{1}{2}v_f^2 - \cancel{v_iv_f} + \frac{1}{2}v_i^2$

$\left(a\Delta d = \frac{1}{2}v_f^2 - \frac{1}{2}v_i^2\right)2$

$$\boxed{2a\Delta d = v_f^2 - v_i^2}$$

How to solve

1. Read problem
2. Pull out / highlight / underline important info.
3. Draw a picture
4. Label Pic.

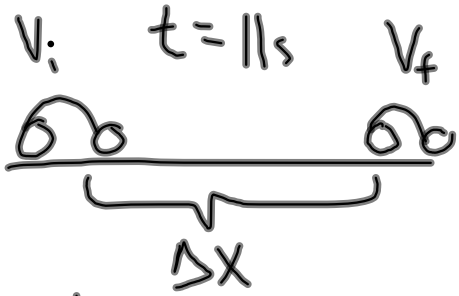
* 5. write knowns + unknowns *
(you might have to infer some)
ie. rest $V_0 = 0$

6. Figure out which eq to use
   - know all variables but 1
7. Solve
8. Check Work + Units
9. Circle answer

#27 $V_i = 44\ m/s$ $\quad a = \text{constant } (-)$

$V_f = 22\ m/s$ $\quad t = 11\ s$

Δx?



$a = -2\ m/s^2$

$$V_f = V_i + at$$
$$22 = 44 + a(11)$$
$$-44 \quad -44$$
$$\frac{-22}{11} = \frac{11a}{11}$$

$$\Delta x = V_i t + \frac{1}{2} a t^2$$
$$= 44(11) + \frac{1}{2}(-2)(11)^2$$
$$= 484 - 121$$
$$= 363\ m$$

28 $a = \text{constant}$ (+)

$V_i = 15\ m/s$

$V_f = 25\ m/s$

$\Delta x = 125\ m$

$t = ?$

$$V_{av} = \frac{\Delta x}{\Delta t}$$

$$\frac{25+15}{2} = 20\ m/s = \frac{125\ m}{t\ s}$$

$$\boxed{t = \frac{125}{20} = 6.25\ s}$$

$$V_f^2 = V_i^2 + 2a\Delta x$$

$$25^2 = 15^2 + 2a(125)$$

$$625 = 225 + 250a$$

$$-225 \quad -225$$

$$400 = 250a$$

$$a = 1.6\ m/s^2$$

$$V_f = V_i + at$$

$$25 = 15 + (1.6)t$$

$$\frac{10}{1.6} = \frac{1.6t}{1.6}$$

$$\boxed{t = 6.25\ s}$$

29. $a = \text{constant}$

$v_f = 7.5 \text{ m/s}$

$t = 4.5 \text{ s}$

$\Delta x = 19 \text{ m}$

$v_{av} = \frac{\Delta x}{\Delta t} = \frac{19}{4.5} = 4.2 \cdot 2$

$\frac{v_f + v_i}{2}$

$v_f + v_i = 8.4$

$7.5 + v_i = 8.4$

$-7.5 \quad -7.5$

No $v_i = 0.9 \text{ m/s}$

$7.5 = v_i + a(4.5)$

$19 = v_i(4.5) + \frac{1}{2} a (4.5)^2$

$19 = 4.5 v_i + \frac{1}{2} 4.5 a \cdot 4.5$

$7.5 = v_i + 4.5a$

$-v_i \quad -v_i$

$7.5 - v_i = 4.5a$

$19 = 4.5 v_i + 2.25(7.5 - v_i)$

$19 = 4.5 v_i + 16.875 - 2.25 v_i$

$-16.875 \quad -16.875$

$\frac{2.125}{2.25} = \frac{2.25 v_i}{2.25} = .94 \text{ m/s}$