Kinematics Review

Constant Velocity:

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} \qquad \left(v = \frac{\Delta d}{\Delta t} \right)$$ ← speed (scalar)

Acceleration:

$$\vec{v}_{ave} = \frac{\Delta \vec{d}}{\Delta t} \quad \text{and} \quad \vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

use only if → constant acc

$$\left(v_{ave} = \frac{v_1 + v_2}{2} \right) \qquad \left(\Delta v = v_2 - v_1 \right)$$

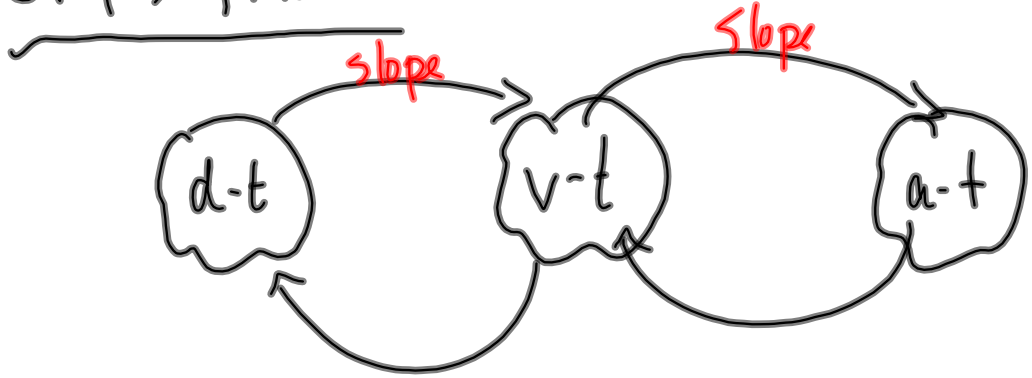
Maybe Useful Equations:

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

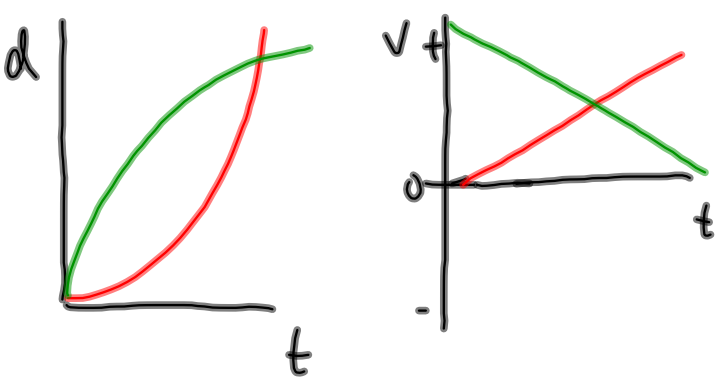
$$\Delta d = v_2 \Delta t - \frac{1}{2} a (\Delta t)^2$$

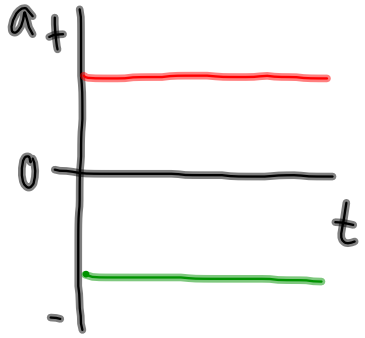
$$v_2^2 = v_1^2 + 2a\Delta d$$

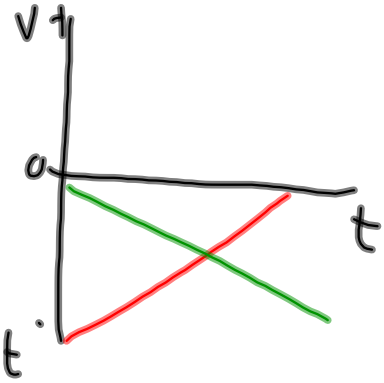
Graphs of Motion

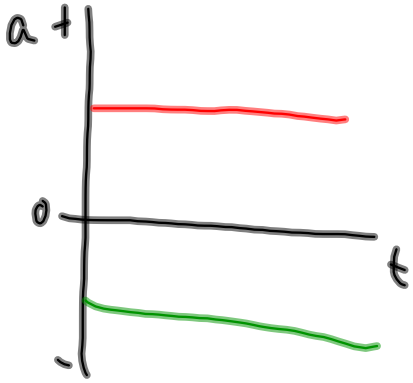


Δd = area area = Δv



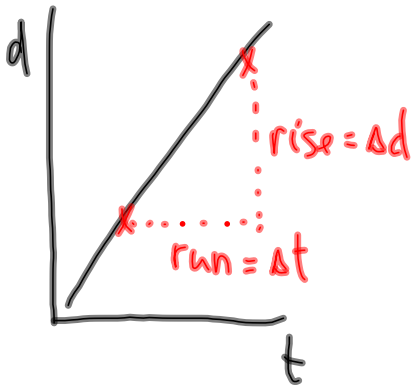






Constant | Average | Instantaneous Velocity

Constant Velocity - position-time graph is linear



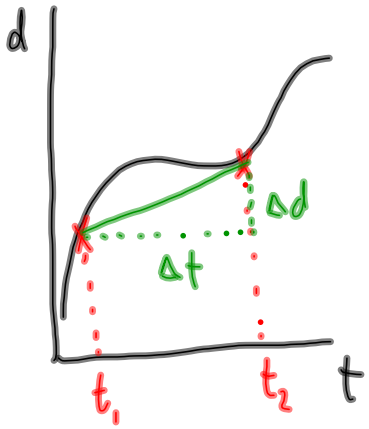
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{slope} = \frac{\Delta d}{\Delta t}$$

$$\text{Slope} = \text{Velocity}$$

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

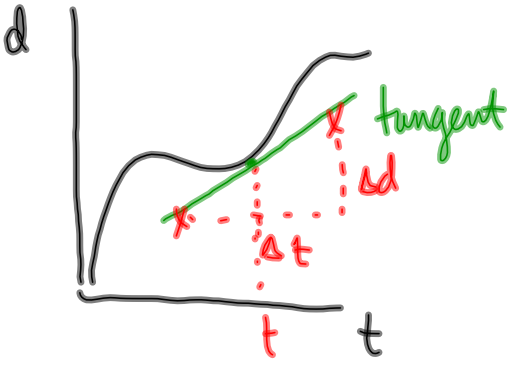
Changing Velocity



$$\text{slope} = \frac{\Delta d}{\Delta t}$$

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

Slope of the line joining two points on the graph



$$\text{slope} = \frac{\Delta d}{\Delta t}$$

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

slope of tangent at t.

Review Sheet.

recall: $\frac{km}{h} \rightarrow \frac{m}{s}$

$$x\,\frac{m}{s} = 78\,\frac{km}{h}\left(\frac{1000\,m}{1\,km}\right)\left(\frac{1\,h}{3600\,s}\right)$$

3. $V_1 = 25\,km/h$
$V_2 = 35\,km/h$
$\Delta t = 20\,s$
$a_{av} = ?$

$$a = \frac{\Delta V}{\Delta t}$$
$$a = \frac{V_2 - V_1}{\Delta t}$$
$$a = \frac{35\,km/h - 25\,km/s}{20\,s}$$
$$a = \frac{10\,km/h}{20\,s} \rightarrow m/s$$

5. $\vec{V}_1 = 200\,km/h\,[N]$
$\vec{a} = 5.0\,km/h/s\,[N]$
$\Delta t = 1.0\,min = 60\,s$
$\vec{V}_2 = ?$

m/s^2
$9.81\,m/s/s$

$$\vec{a} = \frac{\Delta \vec{V}}{\Delta t}$$
$$\vec{a} = \frac{\vec{V}_2 - \vec{V}_1}{\Delta t}$$
$$\vec{a}\,\Delta t = \vec{V}_2 - \vec{V}_1$$
$$\vec{V}_2 = \vec{V}_1 + \vec{a}\,\Delta t$$
$$\vec{V}_2 = 200\,\frac{km}{h}\,[N] + \left(5.0\,km/h/s\,[N]\right)(60\,s) \quad (\Delta V)$$
$$\vec{V}_2 = 200\,\frac{km}{h}\,[N] + 300\,\frac{km}{h}\,[N]$$
$$\vec{V}_2 = 500\,\frac{km}{h}\,[N]$$