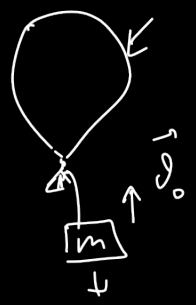
Homework 4

N1.

d, m	0.66	1.01	1.43
t, s	0.381	0.407	0.547



$$\boxed{d = \frac{1}{2} g t^2} \Rightarrow \boxed{g = \frac{2d}{t^2}}$$

1: $1.73 \frac{m}{s^2}$, $9.09 \frac{m}{s^2}$, $9.09 \frac{m}{s^2}$,

2: $8.52 \frac{m}{s^2}$; 3: $9.56 \frac{m}{s^2}$.

$$g_{avg.} = \frac{g_1 + g_2 + g_3}{3}$$

$$\boxed{g_{avg.} = 9.0 \frac{m}{s^2}}$$

N2

$$a = 2 \frac{m}{s^2}, \quad v_f = 80 \frac{m}{s}$$

a) $v_f = v_i + a \cdot t \Rightarrow t = \frac{v_f}{a} = 40 s.$

b) $d = a \cdot \frac{t^2}{2} = 2 \frac{m}{s^2} \cdot \frac{1}{2} \cdot 1600 s^2$

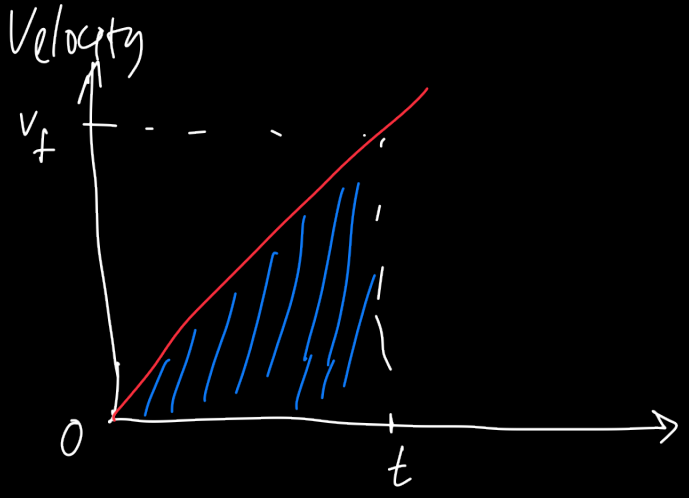
$= 1600 m \simeq 1 mile$

runway: $L \simeq 3200 m \simeq 2 miles.$

$v_{average} = \frac{0 + v_f}{2} = 40 \frac{m}{s}.$

Acceleration and Displacement

Recall: $\vec{v}_{average} = \frac{\vec{v}_0 + \vec{v}_f}{2}$

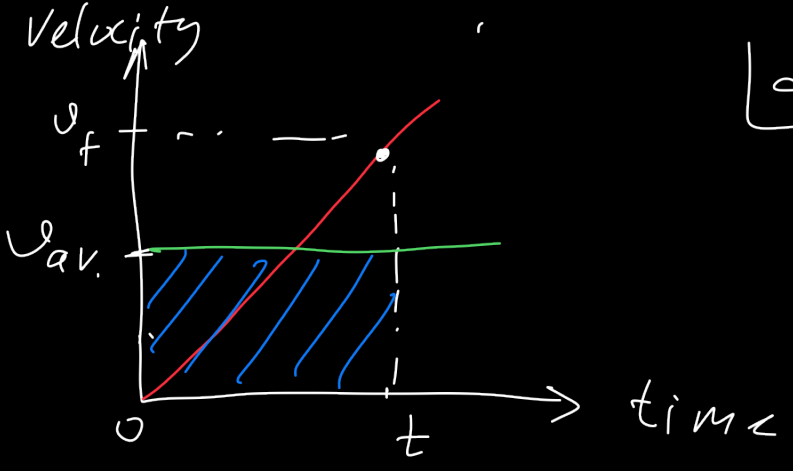


$v = a \cdot t$

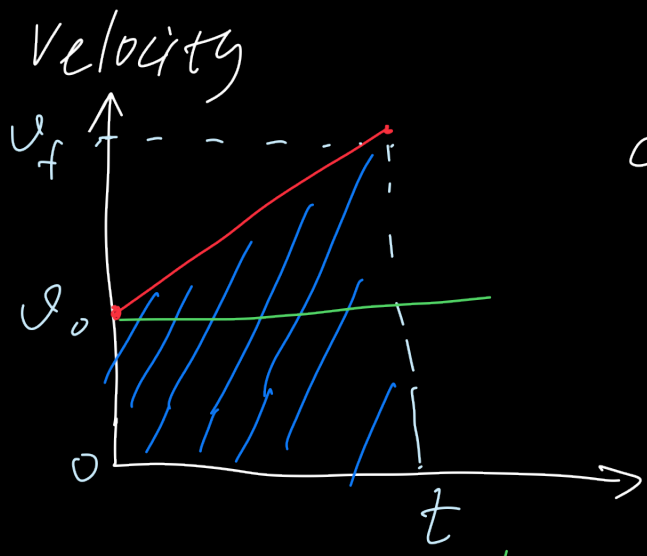
$d = \text{Area}$

$d = \frac{1}{2} v_f \cdot t$

$v_{av.} = \frac{d_{tot.}}{t} = \frac{1}{2} v_f$



$d_{tot} = v_{av.} \cdot t$



$$d_{tot} = v_0 \cdot t + (v_f - v_0) \cdot t \cdot \frac{1}{2} = \frac{1}{2}(v_0 + v_f) \cdot t$$

$$\boxed{v_{av.} = \frac{d_{tot}}{t} = \frac{v_0 + v_f}{2}}$$

$$\boxed{\vec{v}_{av} = \frac{\vec{v}_0 + \vec{v}_f}{2}} \quad \vec{a} = \text{const.}$$

$\vec{a} = \text{const.}$: $\boxed{\vec{v}_f = \vec{v}_0 + \vec{a} \cdot t}$

$$\vec{d} = \vec{v}_{av} \cdot t = \frac{\vec{v}_0 + \vec{v}_0 + \vec{a} \cdot t}{2} \cdot t$$

$$\Rightarrow \boxed{\vec{d} = \vec{v}_0 \cdot t + \frac{\vec{a} \cdot t^2}{2}}$$

Ex. 1.

$\rightarrow \vec{v}_0 = 8 \frac{m}{s}$

$\rightarrow \vec{a} = 4 \frac{m}{s^2}$

$$\boxed{\vec{d} = \vec{v}_0 t + \frac{\vec{a} t^2}{2}}$$

$$\Rightarrow \quad d = v_0 t + \frac{a t^2}{2} \; ; \begin{cases} v_0 = 8 \frac{m}{s} \\ a = 4 \frac{m}{s} \end{cases}$$

t, s	0	1	2	3
d, m	0	10	24	42

10 14 18

$$d_2 = \left(8 \cdot 2 + \frac{4 \cdot 4}{2}\right) m = 24 m$$

$$d_3 = \left(8 \cdot 3 + 4 \cdot \frac{9}{2}\right) m = 42 m$$

EX. 2

$\vec{v}_0 = 12 \frac{m}{s}$

$\vec{a} = -4 \frac{m}{s^2}$

$\rightarrow \boxed{a = 4 \frac{m}{s^2}}$

$\Rightarrow \boxed{\vec{d} = \vec{v}_0 \cdot t + \frac{\vec{a} t^2}{2}}$

$\boxed{d = v_0 \cdot t - \frac{a t^2}{2}}$

t, s	0	1	2	3	4
d, m	0	10	16	18	16

$+10 \quad +6 \quad +2 \quad -2$