Physics 201 - Lecture 6

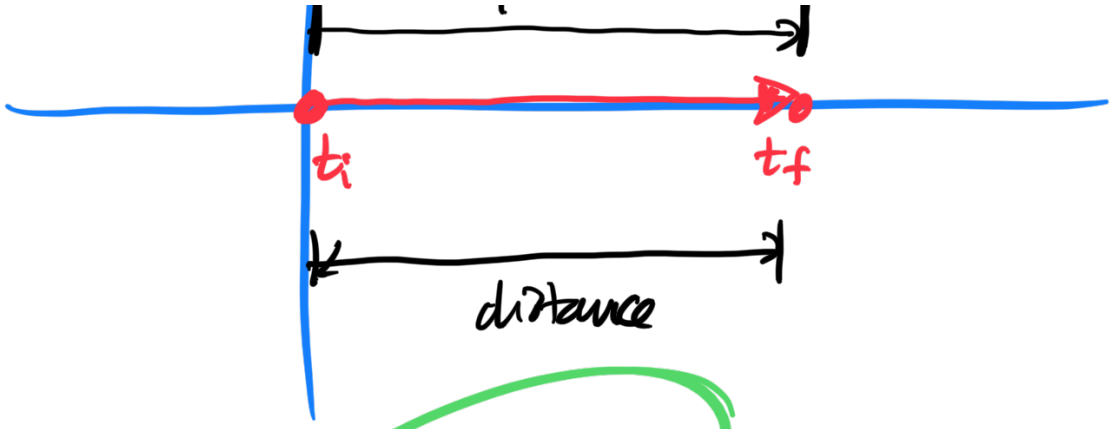
Please go to www.menti.com

Code: 40 56 207

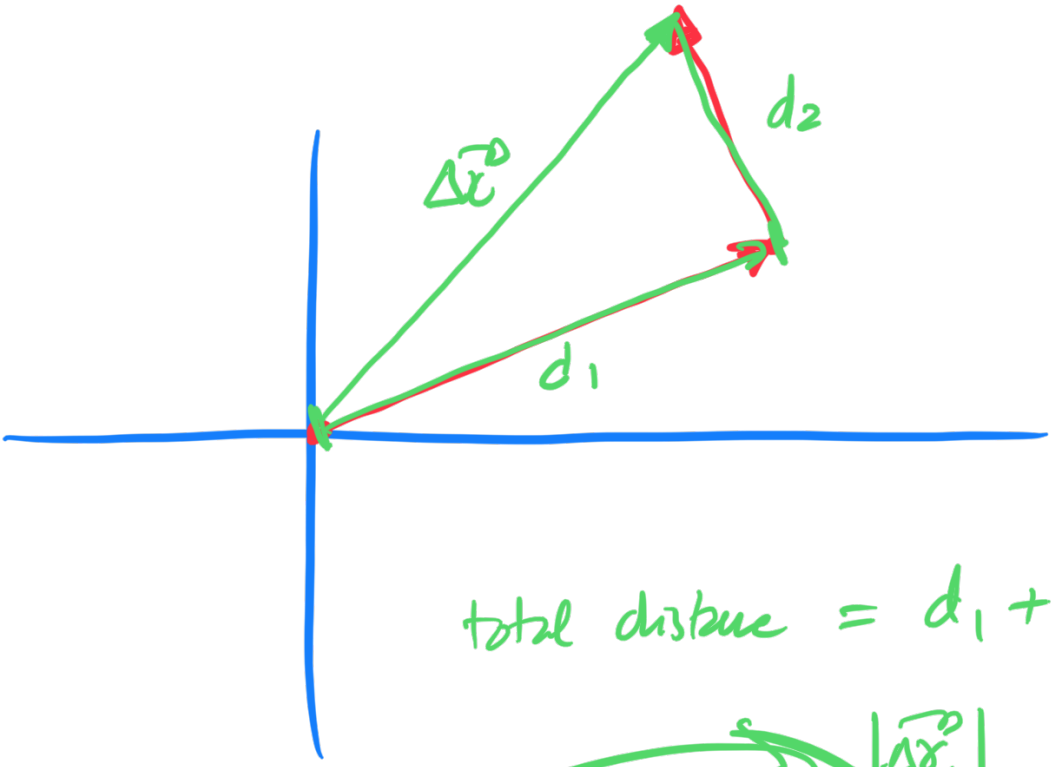
average speed $\equiv$ S_{avg} $= \dfrac{\text{total distance}}{\text{total time}}$

$\vec{v}_{avg} = \dfrac{\Delta \vec{x}}{\Delta t}$

$|\vec{v}_{avg}| = \dfrac{|\Delta \vec{x}|}{\Delta t}$



$|\Delta \vec{x}| =$ distance



total distance $= d_1 + d_2$

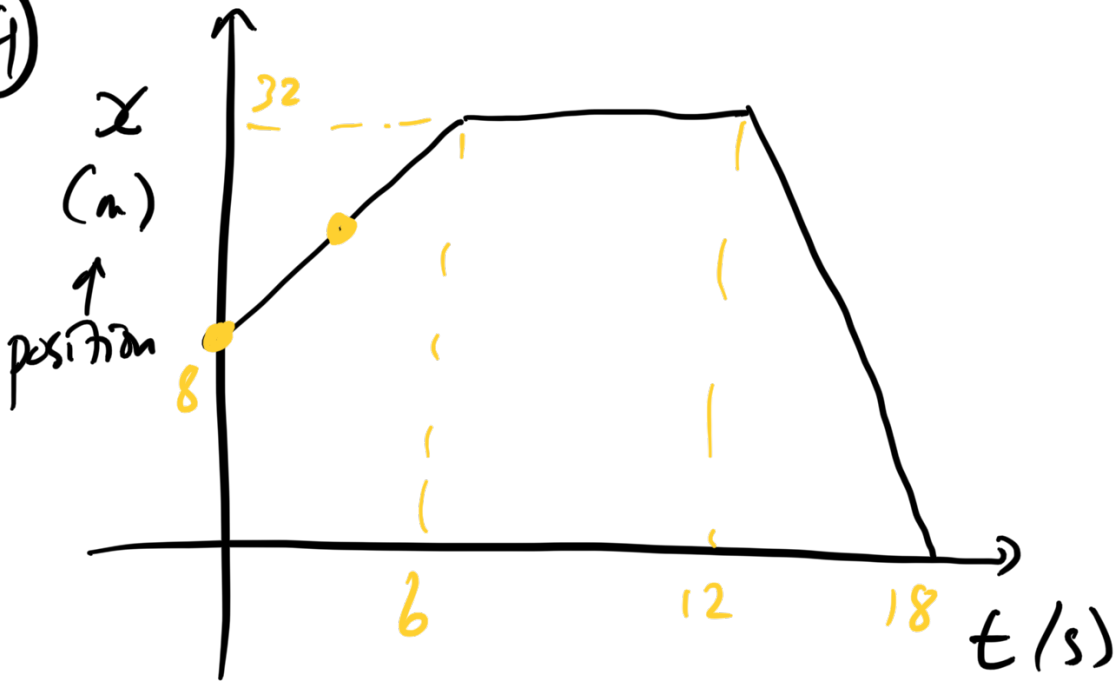
$s_{av} \geq |\vec{v}_{av}|$ $|\Delta \vec{x}|$

$$\vec{v} = c$$

$$\vec{a} = \frac{d\vec{v}}{dt} = 0$$

↑ How is the velocity changing?

④



1D ← x_i, x_f, a, v_i, v_f, t

Δx

a) ~~t~~ = 0, 3, 9, 18 s

inst. $x = 8, 20, 32, 0$ (m)

b) $\Delta x\ (0 \to 6s)$

$\equiv x_f - x_i$

$= 32 - 8 = 24\ m$

$\Delta x\ (6-12s)$

$= 32 - 32 = 0\ m$

$\Delta x\ (12-18) = 0 - 32$

$= -32\ m$

$\Delta x\ (0-18s) = x_f - x_i$

$= 0 - 8$

$= -8\ m$

c) Distance

$d(0-6s) = 32-8$

$= 24\ m$ +

$d(6-12s) = 32-32 = 0m$

+

$d(12-18s) = |0-32| = 32$

$d(0-18s) = 56\ m$

↑ total distance

d) $\vec{v}_{avg} = \frac{\Delta \vec{x}}{\Delta t}$

$v_{avg} = \frac{\Delta x}{\Delta t}$

$$V_{avg}\ (0-6\,s) = \frac{\Delta x_{0-6}}{\Delta t}$$

$$= \frac{24\ m}{6\ s} = 4.0\ m/$$

$$V_{avg}\ (6-12\,s) = \frac{\Delta x_{6-12}}{\Delta t} = \frac{0m}{6s} = 0$$

$$V_{avg}\ (12-18\,s) = \frac{\Delta x_{12-18}}{\Delta t} = \frac{-32\ m}{6s}$$

$$= -5.33\ m/s$$

$$V_{avg}\ (0-18s) = \frac{\Delta x_{0-18}}{\Delta t} = \frac{-8m}{18\ s}$$

$$= -0.444\ m/$$

total distance

e) $s_{avg} \equiv \frac{\text{total distance}}{\text{total time}}$

$$s_{avg}(0\text{-}6) = \frac{24\,m}{6\,s} = 4\,m/s$$

$$s_{avg}(6\text{-}12) = \frac{0\,m}{6\,s} = 0\,m/s$$

$$s_{avg}(12\text{-}18) = \frac{32\,m}{6\,s} = 5.33\,m/$$

$$s_{avg}(0\text{-}18\,s) = \frac{56\,m}{18\,s} = 3.11\,m/$$

	$\lvert \vec{v}_{avg} \rvert$		s_{avg}
0–6 s	$\lvert 4.0 \rvert = 4.0$	=	4.0 ←
6–12 s	$\lvert 0 \rvert = 0$	=	0 ←

0s – 12s

12s – 18s $|-5.33| = 5.33 = 5.33$ ←

0 – 18s $|-0.444| = .444 < 3.11$ ✗

$$S_{avg} \geq |\vec{v}_{avg}|$$ ←

the size of vector sum $\neq$ sum of the vector sizes.

$$|\vec{a} + \vec{b} + \vec{c}| \neq |\vec{a}| + |\vec{b}| + |\vec{c}|$$

1D with

6. ✓ $|\vec{a}| = 6.8\ m/s$ constant acceleration

(4) ✓ $V_i = 1.7\ m/s^2$ Rule of 3

$t = ?$

✓ $\Delta x = 4.8\ m$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$4.8 = 1.7t + 3.4t^2$$

$$at^2 + bt + c = 0$$

$$\boxed{3.4t^2 + 1.7t - 4.8 = 0}$$

Quadratic formula

✓ → $t = -1.46\ s$ X

✓ → or $\boxed{t = 0.964\ s}$

Physics

Problem started at $t = 0$!

b) $v_f = ?$

$$v_f = v_i + at$$

$$= 1.7 + (6.8)(.964)$$

$$v_f = 8.26 \text{ m/s} \quad (-6 \text{ m/s}$$

$$\text{Speed} = |\vec{v}_f| = 8.26 \text{ m/s} \quad 6 \text{m}$$

$a, v_i, \Delta x$ (3)

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

$$V_f^2 = (1.7)^2 + 2(6.8)(4.8)$$

$$V_f^2 = 68.17$$

$$V_f = \pm 8.26 = 8.26 \text{ m/s}$$

Physics

$V_i = 1.7$ $\quad a = 6.8$

Speeding up

(a) $t = ?$

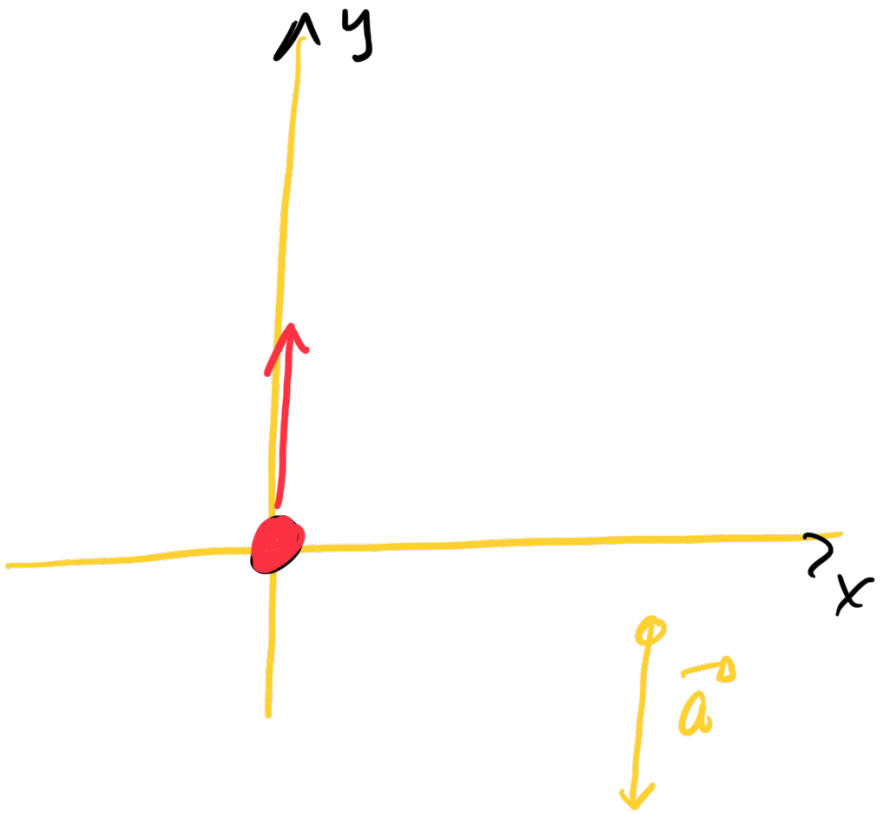
$$\boxed{V_f = V_i + at}$$ linear.

$$t = \frac{v_f - v_i}{a} = \frac{8.26 - 1.7}{6.8}$$

$$= 0.964 \text{ s}$$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$ ← QF

9.



$v_i = 16.4 \text{ m/s}$ (1)

v_i ... t ✓✓

$$a = -9.8 \text{ m/s}^2$$ (2)

a) $t = 0.545 \text{ s}$ (3)

$\Delta x = ?$

$v_f = ?$

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

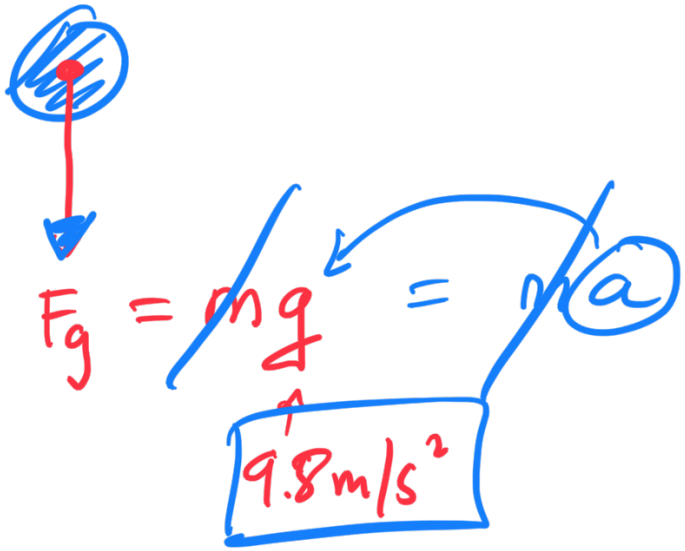
$$= (16.4)(.545) - 4.9(.545)^2$$

$$= 7.48 \text{ m}$$

$$v_f = v_i + at$$

$$= 16.4 - 9.8(.545)$$

$$= 11.1 \text{ m/s}$$



Earth.

$$g = \frac{G\,m_{Earth}}{R_E^2} = 9.8\ m/s^2$$