Unit 1: Forces & Motion

Motion Terms:

Scalars	vs	Vectors
- quantity that has magnitude only (with unit)		- also has direction
- mass, m		- displacement, $\vec{d}$
- volume, V		- position, $\vec{x}$
- density, D		- velocity, $\vec{v}$
- time, t		- acceleration, $\vec{a}$
- distance, d		- force, $\vec{F}$
- speed, v		

What **is** velocity / speed ?

Velocity (speed) is the displacement (distance covered) of (by) an object per unit of time.

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

$v = \frac{d}{t}$ d is in metres, m

t " " seconds, s

so v " " metres per second, $\frac{m}{s}$

Can also have v in $\frac{km}{h}$

$\frac{km}{h}$ ÷ 3.6 → $\frac{m}{s}$

$\frac{m}{s}$ × 3.6 → $\frac{km}{h}$

Average vs Instantaneous

Average → over a time interval

Instantaneous → at a specific moment in time

$$\vec{V}_{AV} = \frac{\vec{d}_{TOTAL}}{t_{TOTAL}}$$

In uniform motion, the velocity is constant, so

$$\vec{V}_{AV} = \vec{V}_{INST}$$

HW Section 1.1
Read + Do # 1, 2, 4, 6-10
(stop @ p. 13)

H/W Section 1.1

Read + Do # 1, 2, 4, 6-10

(stop @ p. 13)

10 b

7

6

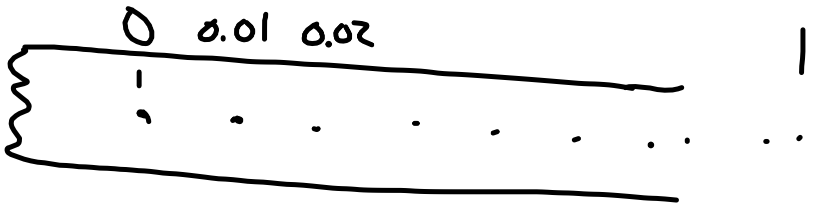
6. a) 60 Hz ⇒ 60 dots/s

period = $\frac{1}{60}$ s

b) $f = 30$ Hz, $T = \frac{1}{30}$ s

$f = \frac{1}{T}$

7. $T = 0.01$ s

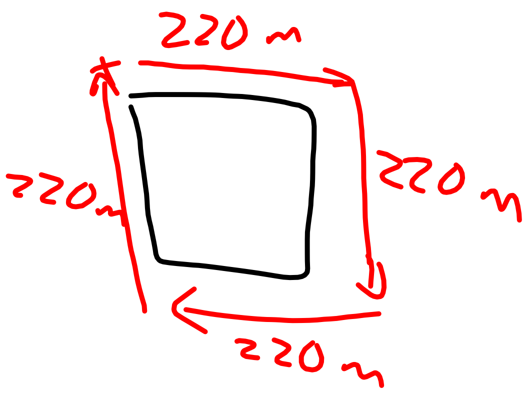


1 s

100 dots in 1 s

$f = 100$ Hz

10.



$d = 4 \times 220$ m ; $d = 880$ m

$= 880$ m

$t = 3.5$ min ; $t = 210$ s

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

$= \frac{880}{3.5}$

$= 251 \frac{m}{min}$

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

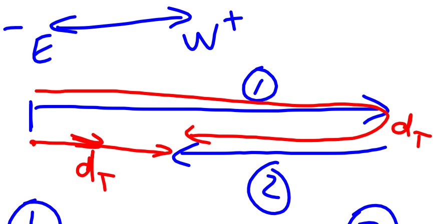
$= \frac{880}{210}$

$= 4.19 \frac{m}{s}$

Example:

A teacher leaves his office and walks at 1.5 $\frac{m}{s}$ [W] for 12 s. Realizing he forgot his attendance, he jogs back towards the office, covering 7.5 m [E] at 2.5 $\frac{m}{s}$. Determine...

a) the distance he covers.
b) his total displacement.
c) his average speed.
d) his average velocity.



(1)

$\vec{v} = 1.5 \frac{m}{s} [W]$
$= +1.5 \frac{m}{s}$
$t = 12\ s$

$v = \frac{d}{t}$
$d = vt$
$= (1.5)(12)$
$= 18\ m$
$\therefore \vec{d} = 18\ m\ [W]$ or $+18\ m$

(2)

$\vec{v} = 2.5 \frac{m}{s} [E]$
$= -2.5 \frac{m}{s}$
$\vec{d} = 7.5\ m\ [E]$
$= -7.5\ m$
$d = 7.5\ m$

$\vec{v} = \frac{\vec{d}}{t}$
$t = \frac{\vec{d}}{\vec{v}}$
$= \frac{-7.5\ m}{-2.5\ m/s}$
$= 3\ s$

(T)

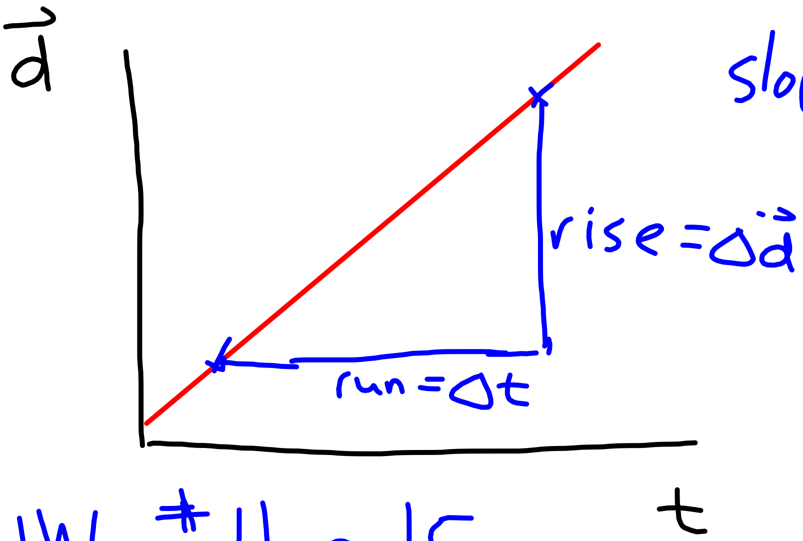
$d_T = d_1 + d_2$
$= ? + 7.5$
$= 18 + 7.5$
a) $d_T = 25.5\ m$

b) $\vec{d}_T = \vec{d}_1 + \vec{d}_2$
$= +18 + (-7.5)$
$= 10.5\ m$
or $10.5\ m\ [W]$

c) $v_{AV} = \frac{d_T}{t_T}$ → a)
$= \frac{25.5\ m}{15\ s}$
$= 1.7 \frac{m}{s}$

d) $\vec{v}_{AV} = \frac{\vec{d}_T}{t_T}$
$= \frac{10.5\ m\ [W]}{15\ s}$
$\vec{v}_{AV} = 0.7 \frac{m}{s} [W]$

Graphing Uniform Motion



$$slope = \frac{rise}{run} = \frac{\Delta\vec{d}}{\Delta t} = \vec{v}$$

∴ the slope of a $\vec{d}$-t graph <u>is</u> $\vec{v}$

HW #11 p.15
#4,6 p.16