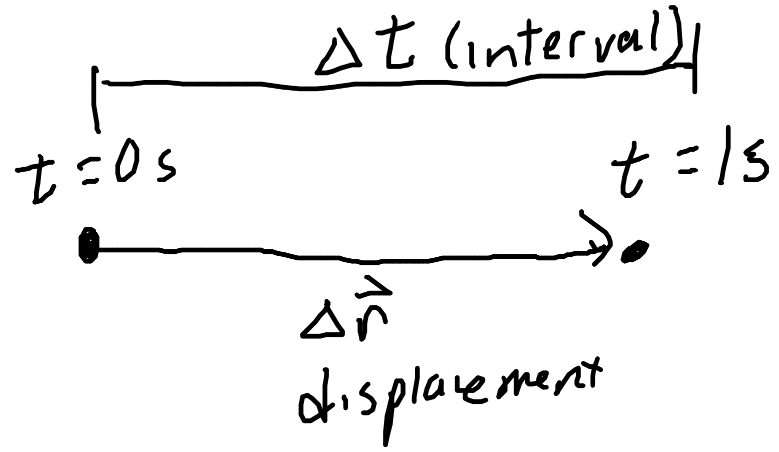
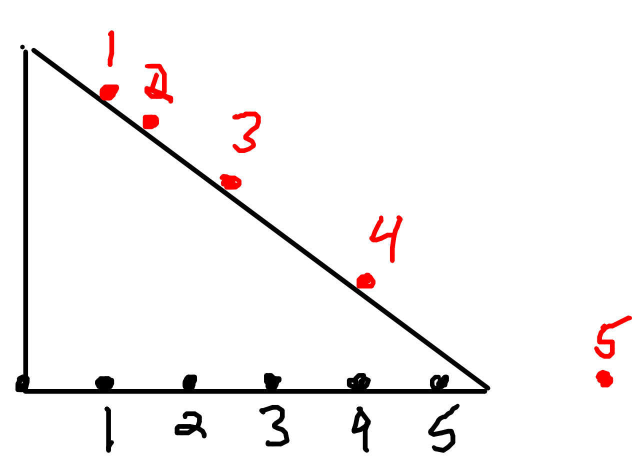


average velocity $\vec{v} = \frac{\Delta \vec{r}}{\Delta t}$ $\Delta \vec{r} = \vec{v}\,\Delta t$

velocity is a vector

speed is the magnitude of velocity
& is a non-negative number

$|\vec{v}| = v$



Two balls, & their motion graphs

Do these balls have same speed at any moment between 1s & 5s? C

A) No
B) At 1s
C) between 2s & 3s
D) at 4s
E) at 1s and 4s
F) between 4s & 5s

speed is proportional to displacement $|\Delta \vec{r}|$
-(distance between dots)

Same velocity? A (different directions)

Acceleration
- change in velocity

e.g. Every car has ___ controls that give it an acceleration.

A) 1 B) 2 C) 3 D) 4 E) 5 F) 6

③ accelerator/gas pedal
- (shift lever to go into reverse)

② brake
- emergency brake

③ steering wheel

We will avoid words accelerate & decelerate
instead "speed up" & "slow down"

$\vec{a} = \dfrac{\Delta \vec{V}}{\Delta t}$ average acceleration

e.g. 20mph - 40 mph in 5s

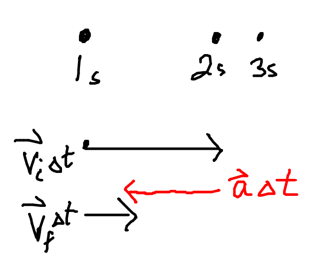
$|\vec{a}| = \dfrac{40mph - 20mph}{5s} = 4 \ mi/hr/s$

in SI units, $\vec{a}$ is $m/s^2 = \dfrac{m/s}{s}$

$\Delta \vec{V} = \vec{a}\Delta t$ $\Delta \vec{V} = \vec{V}_f - \vec{V}_i$

$\vec{V}_f = \vec{V}_i + \vec{a}\Delta t$

e.g.

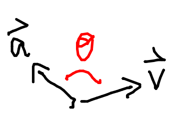


Direction of $\vec{a}$

A) → $\boxed{\text{B) ←}}$

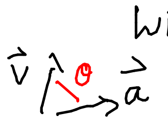
C) ↑ D) ↓

E) 0

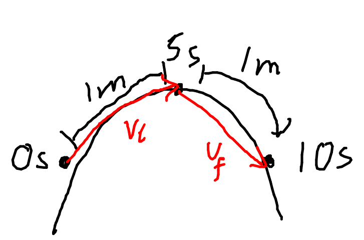


When object is slowing down, acceleration points in opposite-ish direction from velocity. $\theta > 90^\circ$

When object speeds up, acceleration points in same-ish direction as velocity. $\theta < 90^\circ$



e.g.



accelerating at $t=5s$?

A) Yes B) No

changing direction

$\vec{a}$ points

A) → B) ← C) ↑

D) ↓ E) ↙ F) ↘