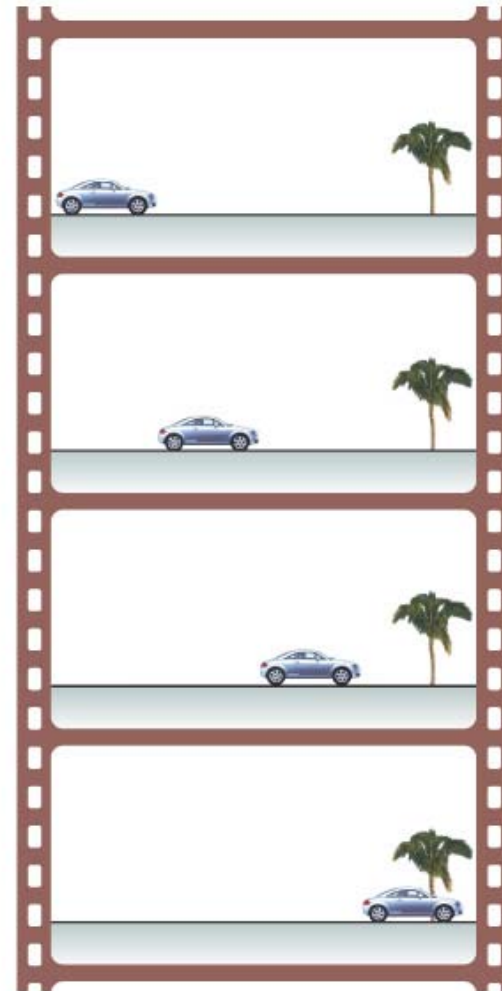
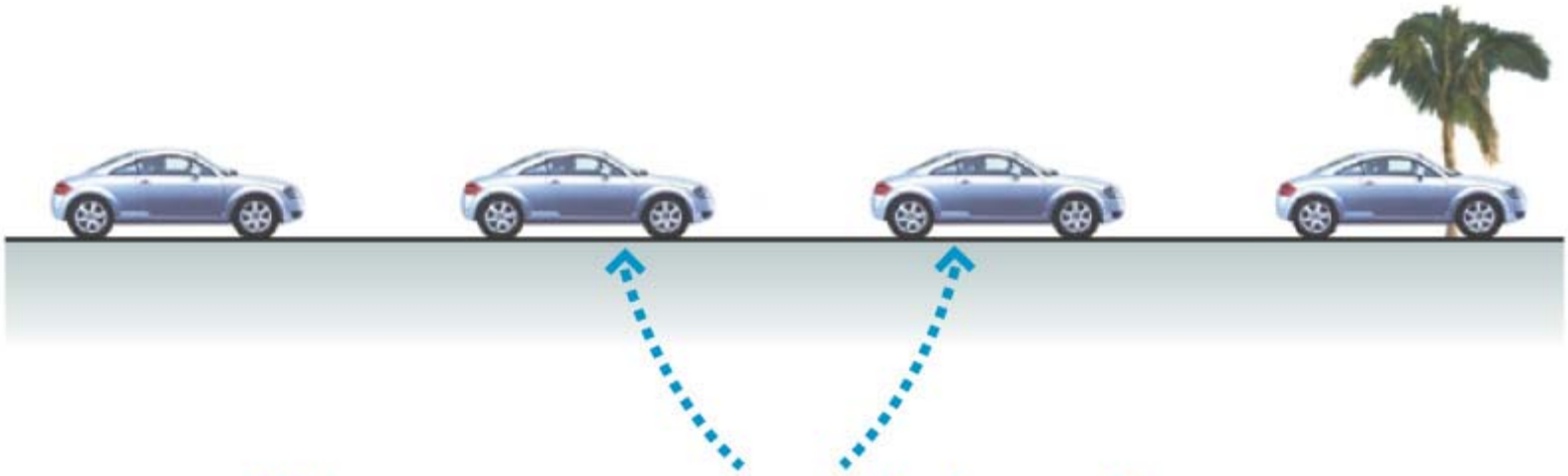


# Dot Motion Diagrams

- Simple representation of motion
- Use dots for objects position with time
- Assumes small time intervals
- Like a filmstrip





The same amount of time elapses  
between each image and the next.

Start



0



1

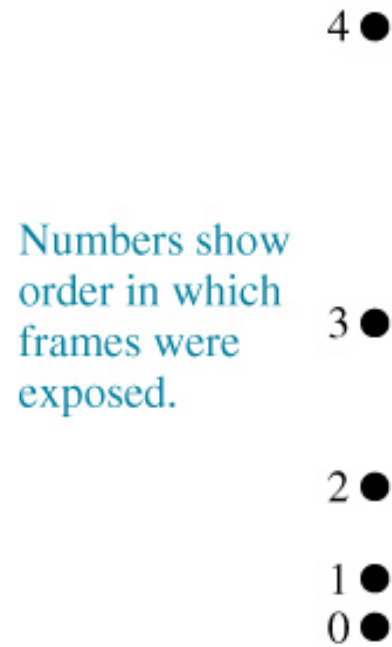


2

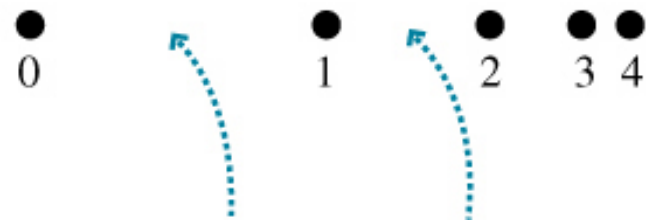


3

(a) Motion diagram of a rocket launch



(b) Motion diagram of a car stopping

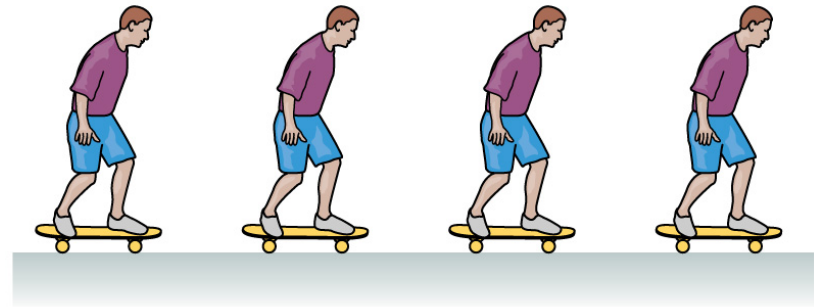


The same amount of time elapses between each image and the next.



(A)

Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley



(B)

Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley



(C)

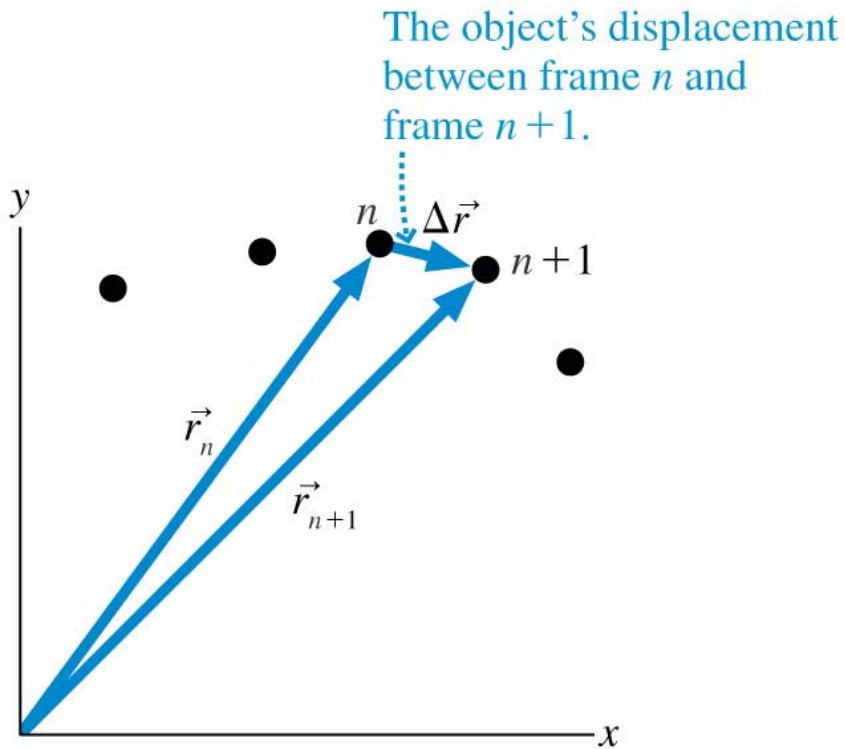
Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley



(D)

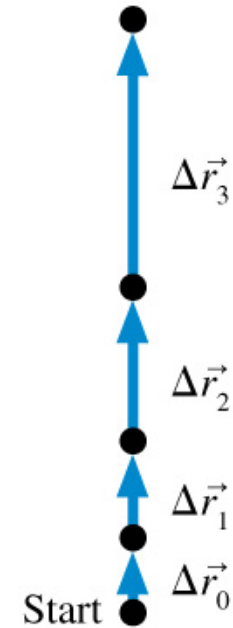
Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley

# Displacement $\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$

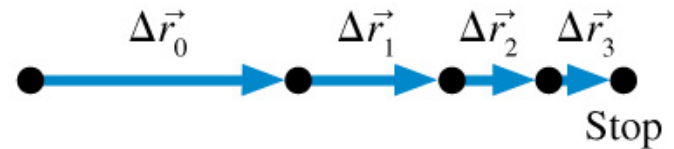


Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley

(a) Rocket launch



(b) Car stopping

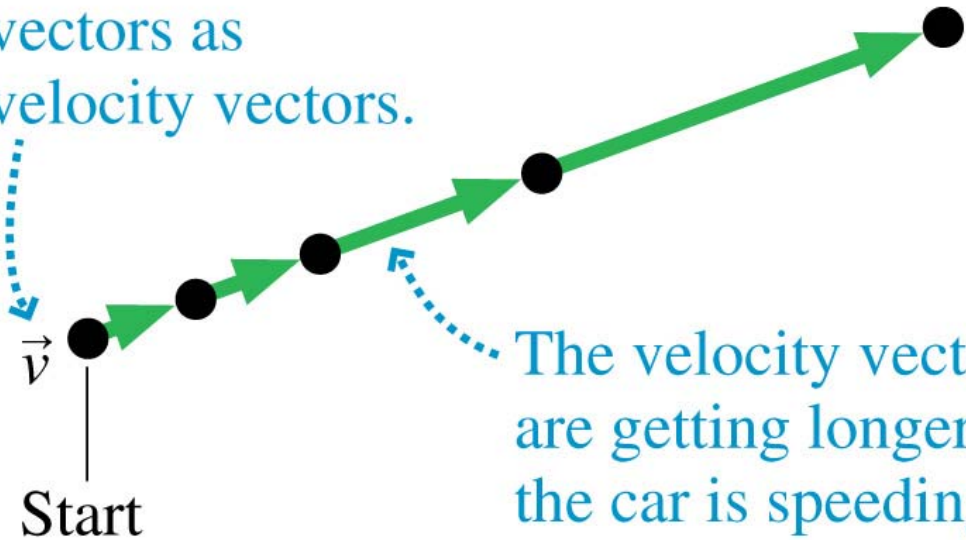


Copyright © 2004 Pearson Education, Inc., publishing as Addison Wesley

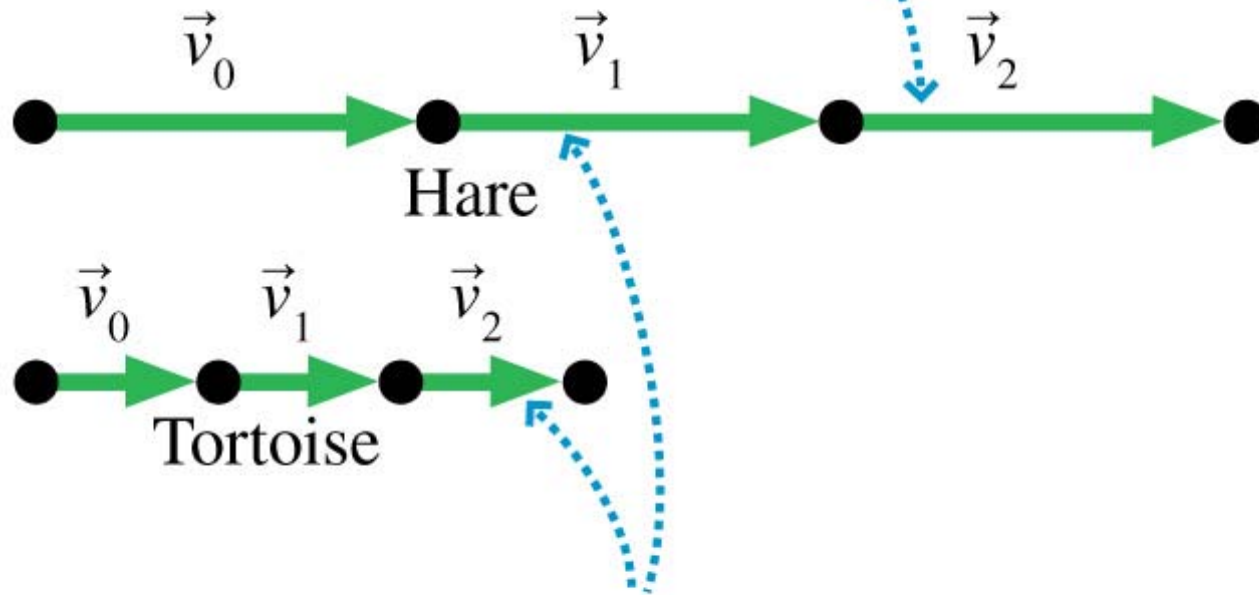
# Average Velocity

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

This labels the whole row of vectors as velocity vectors.



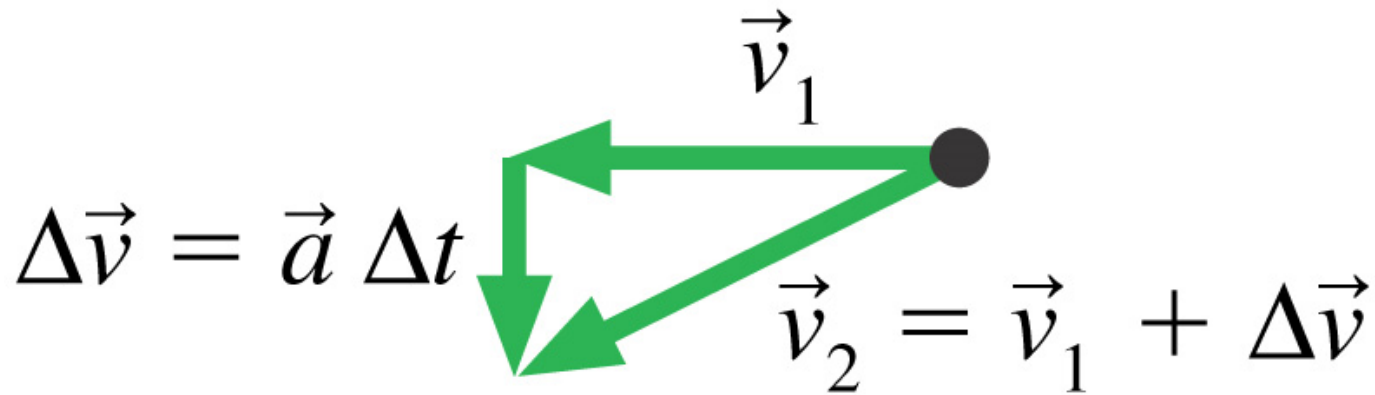
These are average velocity vectors.



The length of each arrow represents the average speed. The hare moves faster than the tortoise.

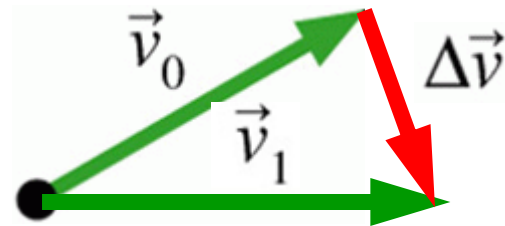
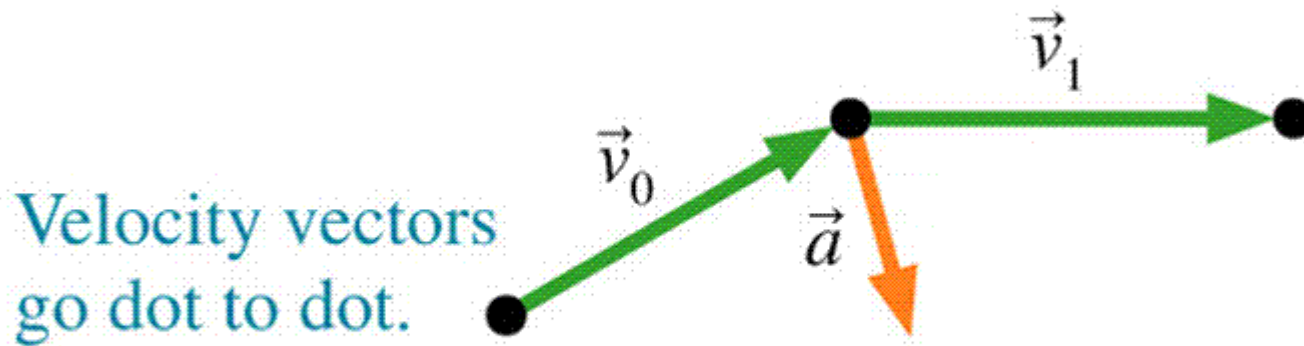
# Acceleration

$$\vec{a}_{average} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t} \quad \vec{v}_2 - \vec{v}_1 = \vec{a} \Delta t \quad \vec{v}_2 = \vec{v}_1 + \vec{a} \Delta t$$



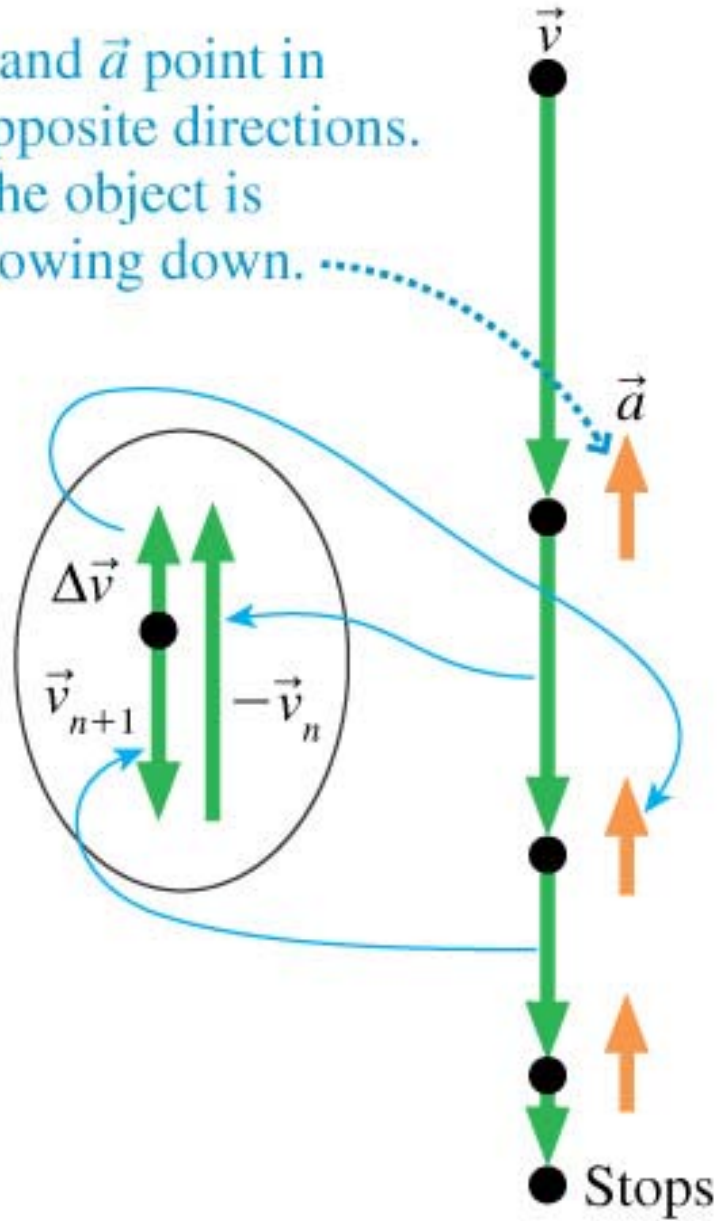


Dots show positions at equal time intervals.



$\Delta\vec{v}$  and  $\vec{a}$  are parallel. This is an average acceleration so it is the acceleration at the middle instant or dot.

$\vec{v}$  and  $\vec{a}$  point in opposite directions. The object is slowing down.



OHQ

- Speeding up  $\vec{a} \uparrow\uparrow \vec{v}$  *parallel*
- Slowing down  $\vec{a} \uparrow\downarrow \vec{v}$  *antiparallel*
- Constant  $\vec{a} = 0$
- Turning  $\vec{a} \angle \vec{v}$