2.3 Speed and Velocity

2.1 I can interpret and analyze the motion of an object moving with constant velocity.

2.3 I can interpret, analyze, and create velocity vs. time graphs for objects moving with constant velocity.

Chapter In Review

Distance = Total Length of Travel

Displacement = Change in position

$= \Delta x = x_f - x_o$

Chapter In Review

Average Speed = $\frac{\text{distance}}{\text{time}}$

Average Velocity = $\frac{\text{displacement}}{\text{time}}$

VELOCITY

$$\vec{v} = \frac{\Delta \vec{x}}{\Delta t} = \frac{x_f - x_o}{t_f - t_o}$$

$$\vec{V} = \frac{\vec{x}_f - \vec{x}_o}{t}$$

$$t = \frac{x_f - x_o}{V}$$

$$V \cdot t + x_o = x_f$$

EXAMPLE PROBLEM

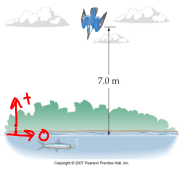
A kingfisher is a bird that catches a fish by plunging into water from a height of several meters. If a kingfisher dives from a height of 7.0 m with an average speed of 4.00 m/s, how long does it take for it to reach the water?

$x_o = 7.0\text{ m}$

$x_f = 0$

$\vec{V} = -4.00\text{ m/s}$

$t = ?$



$$t = \frac{x_f - x_o}{V} = \frac{0 - 7.0\text{ m}}{-4.00\text{ m/s}}$$

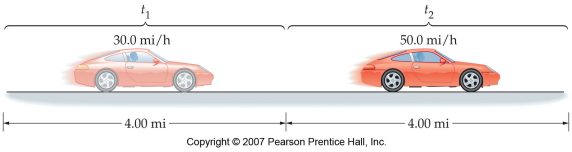
$t = 1.75\text{ s}$

$\frac{\text{m}}{\frac{\text{m}}{\text{s}}}$

$\text{m} \cdot \frac{\text{s}}{\text{m}}$

CONCEPTUAL CHECKPOINT

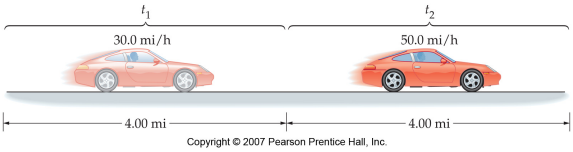
You drive 4.00 mi at 30.0 mi/h and then another 4.00 mi at 50.0 mi/h. What is your average speed for the 8.00 mi trip?



$V = \frac{\text{dist.}}{t} = \frac{8\text{ mi}}{?}$

CONCEPTUAL CHECKPOINT

You drive 4.00 mi at 30.0 mi/h and then another 4.00 mi at 50.0 mi/h. What is your average speed for the 8.00 mi trip?



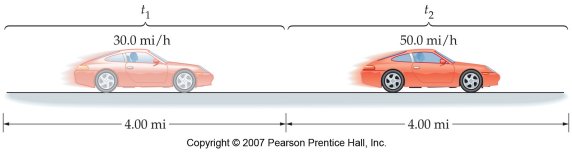
$\text{speed} = \frac{\text{distance}}{\text{time}}$

$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{4.00\text{ mi}}{30.0\text{ mi/h}}$

time = 0.133 hr

CONCEPTUAL CHECKPOINT

You drive 4.00 mi at 30.0 mi/h and then another 4.00 mi at 50.0 mi/h. What is your average speed for the 8.00 mi trip?



$\text{speed} = \frac{\text{distance}}{\text{time}}$

$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{4.00\text{ mi}}{30.0\text{ mi/h}}$

time = 0.133 hr

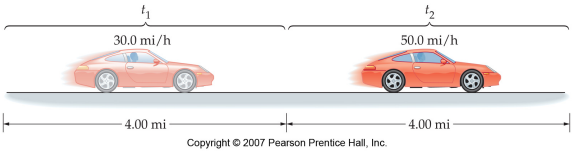
$\text{speed} = \frac{\text{distance}}{\text{time}}$

$\text{time} = \frac{4.00\text{ mi}}{50.0\text{ mi/h}}$

time = 0.0800 hr

CONCEPTUAL CHECKPOINT

You drive 4.00 mi at 30.0 mi/h and then another 4.00 mi at 50.0 mi/h. What is your average speed for the 8.00 mi trip?



$\text{speed} = \frac{\text{distance}}{\text{time}}$

$\text{time} = \frac{\text{distance}}{\text{speed}} = \frac{4.00\text{ mi}}{30.0\text{ mi/h}}$

time = 0.133 hr

$\text{speed} = \frac{\text{distance}}{\text{time}}$

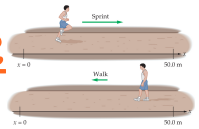
$\text{time} = \frac{4.00\text{ mi}}{50.0\text{ mi/h}}$

time = 0.0800 hr

$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{8.00\text{ mi}}{0.213\text{ hr}} = 37.6\text{ mi/h}$

Example

An athlete sprints 50.0 m in 8.00 s, stops, and then walks slowly back to the starting line in 40.0 s. The "sprint direction" is taken to be positive.



$\vec{V} = \frac{x_f - x_0}{t} = \frac{50 - 0}{8\text{ s}}$

$\vec{V} = 6.25\text{ m/s}$

$\vec{V} = \frac{x_f - x_0}{t} = \frac{0 - 50\text{m}}{40\text{ s}}$

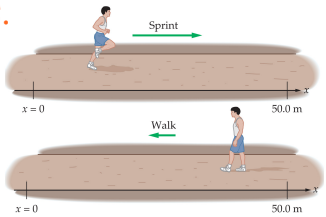
$\vec{V} = -1.25\text{ m/s}$

c.) What is the average velocity for the complete round trip?

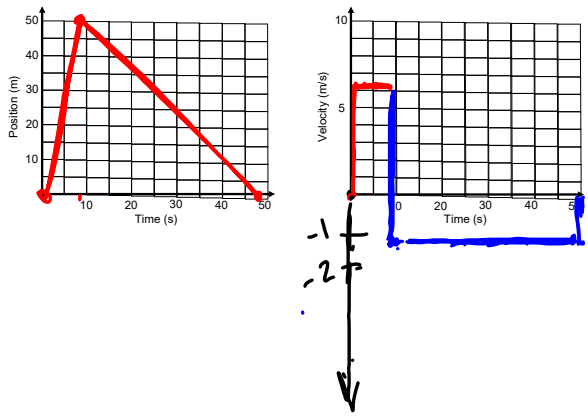
$\vec{V} = \frac{x_f - x_0}{t} = \frac{0 - 0}{48\text{s}} = 0\text{ m/s}$

Example

Create a position-time graph and a velocity-time graph that represents the motion of the person for the entire 48 seconds.



Graphing Motion With Constant Velocity



PRACTICE

UNIT 2 PROBLEMS (15-17)