1-5

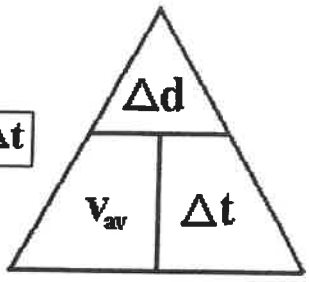
Calculating Average Speed, Distance, and Time

Use the average speed equation to calculate the unknown variable. Ask yourself, "What is this question asking me to find?" before you begin your calculation. Remember that "v_{av}" represents speed, "Δd" represents distance, and "Δt" represents time.

$v_{av} = \frac{\Delta d}{\Delta t}$

$\Delta d = v_{av} \Delta t$

$\Delta t = \frac{\Delta d}{v_{av}}$



1. Calculate the average speed of a car that travels 70 km in 1.5 hours.

Given:
$d = 70 km$
$t = 1.5 h$
$v = ?$

FORMULA: $v = d/t$
$= 70/1.5$
$= 46.7 km/h$

2. How long does it take a person running at a rate of 4 m/s to run a distance of 260 m?

$v = 4 m/s$
$d = 260 m$
$t = ?$

$t = d/v$
$= 260 m / 4 m/s$
$= 65 seconds$ ∴ $\div 60 = 1 min\ 5 sec.$

3. How far would a snowmobiler travel in 0.5 hours at a rate of 25 km/h?

$t = 0.5 h$
$v = 25 km/h$
$d = ?$

$d = vt$
$= 25 km/h \times 0.5 h$
$= 12.5 km$

4. Melanie ran the 100 meter race in 12 seconds. What was her average speed?

$d = 100 m$
$t = 12 s$
$v = ?$

$v = d/t$
$v = 100 m / 12 s$
$v = 8 m/s$

5. If a boat sailed for 6 hours at an average speed of 55 km/h, what distance did the boat travel?

$t = 6 h$
$v = 55 km/h$
$d = ?$

$d = vt$
$= (55 km/h)(6 h)$
$= 330 km$

6. How much time did it take a plane flying at 575 km/h to travel a distance of 1700 km?

$V = 575 km/h$
$d = 1700 km$
$t = ?$

$t = d/v$
$= 1700 km / 575 km/h$
$= 2.96 h$
$= 1 h\ 57 min\ 36 sec$
$1 h = 60 min \times 0.96 = 57 min$

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CHAPTER 10 PROBLEM SOLVING

Uniform Motion

BLM 10-5

Goal • Use the uniform motion formula to solve motion problems.

What to Do

Solve each problem in the space provided. Show all your work.

1. Use the uniform motion formula to complete the table below.

Δt	$\Delta \vec{d}$	$\vec{v}_{av}$
3.0 s	+12 m	+4.0 m/s
7.0 s	+28 m	+4.0 m/s
15.1 s	+30.2 m	+2.00 m/s
1.5 h	+80 km	+50 km/h
1.7 h	+84 km	+49 km/h
8.0 h	+120 km	+15 km/h

2. (a) A student rides a bicycle along a straight road for 30.0 s. She travels 254 m away from her home. Find her average velocity.

$t = 30.0\text{ s}$
$d = 254\text{ m}$
$\vec{v} = ?$

$\vec{v} = \frac{d}{t}$
$= \frac{254\text{ m}}{30.0\text{ s}}$
$= 8.47\text{ m/s [straight]}$

(b) A car is moving east, at 90 km/h, along a straight highway. Find the displacement of the car after 1.2 h.

treat as 90.0 km/h

$\vec{v} = 90\text{ km/h}$
$t = 1.2\text{ h}$
$\vec{d} = ?$

$\vec{d} = \vec{v}\,t$
$= 90\text{ km/h} \times 1.2\text{ h}$
$= 108\text{ km} \rightarrow 110\text{ km [East]}$

(c) A person is walking west at 4.2 m/s. How long will it take the person to go 110 m west?

$\vec{v} = 4.2\text{ m/s}$
$\vec{d} = 110\text{ m}$
$t = ?$

$t = \frac{\vec{d}}{\vec{v}}$
$= \frac{110\text{ m}}{4.2\text{ m/s}}$
$= 26\text{ s}$

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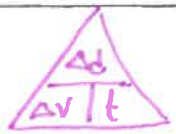
CHAPTER 10 PROBLEM SOLVING

Uniform Motion (continued)

BLM 10-5



3. A car starts from a position of 18 m at a time of 7.2 s. The velocity of the car is 17 m/s. Find the position of the car at a time of 9.8 s.

Given: $d_i = 18m$, $t_i = 7.2s$, $t_f = 9.8s$, $\vec{v} = 17m/s$, $d_f = ?$

To find d_f we need to find Δd because $d_f = d_i + \Delta d$

$\vec{\Delta d} = \vec{\Delta v} \times \Delta t$

① find Δt ② find Δd ③ find d_f

① $\Delta t = t_f - t_i$
$= 9.8 - 7.2$
$= 2.6s$

② $\vec{\Delta d} = \vec{\Delta v} \times \Delta t$
$= 17m/s \times 2.6s$
$= 44.2m$

③ $d_f = d_i + \Delta d$
$= 18m + 44.2m$
$= 62.2m \rightarrow$ 62m [straight]

4. A student is walking with a constant velocity along a straight sidewalk. At a time of 1.4 s, his position is 31.4 m. Later, at a time of 6.1 s, his position is 9.6 m.

(a) What is the student's velocity?

Given: $t_i = 1.4s$, $d_i = 31.4m$, $t_f = 6.1s$, $d_f = 9.6m$

$\vec{\Delta v} = \frac{\vec{\Delta d}}{\Delta t} = \frac{d_f - d_i}{t_f - t_i} = \frac{9.6 - 31.4m}{6.1 - 1.4s} =$ -4.6m/s [straight]

(b) What is his position at 4.4 s? * this is a new t_f

$t_f = 4.4s$, $t_i = 1.4s$, $d_i = 31.4m$, $\vec{v} = -4.6$, $d_f = ?$

① find Δt ② find Δd ③ find d_f (new position)

① $\Delta t = t_f - t_i$
$= 4.4 - 1.4$
$= 3s$

② $\vec{\Delta d} = \vec{\Delta v} \times \Delta t$
$= (-4.6m/s)(3s)$
$= 73.9m$

③ $d_f = d_i + \Delta d$
$= 31.4 + -13.9m$
$= 17.5m \rightarrow$ 18m [straight]

(c) At what time is the student's position 12.0 m? * new d_f given

$t_i = 1.4s$, $d_i = 31.4$, $d_f = 12.0m$, $\vec{v} = -4.6$, $t_f = ?$

① find Δd ② find Δt ③ find t_f

① $\Delta d = d_f - d_i$
$= 12.0m - 31.4m$
$= -19.4m$

② $\Delta t = \frac{\vec{\Delta d}}{\vec{v}}$
$= \frac{-19.4m}{-4.6m/s}$
$= 4.2s$

③ $t_f = t_i + \Delta t$
$= 1.4s + 4.2s$
$=$ 5.6s

keep all #s 1-8

Speed Machines

1. Nascar driver, Jeff Gordon, has a car that is one of the fastest on the circuit. If it travels 960 km in 4 hours, what is his cruising speed?

$$v = \frac{d}{t} = \frac{960\ km}{4\ h} = 240\ km/h$$

with 8 — 200 km/h

2. The fastest car on earth, a German-made *Thrust SSC*, would win every Nascar race in America. If it takes 0.5 hours (30 minutes) to travel 608 km, what is its speed?

$$v = \frac{d}{t} = \frac{608\ km}{0.5\ h} = 1216\ km/h$$

3. The fastest train on Earth, the *TGV* from France, can travel at faster speeds than trains in the Canada. During a speed test, the train traveled 1280 km in 2.5 hours. What is its speed?

$$v = \frac{d}{t} = \frac{1280\ km}{2.5\ h} = 512\ km/h$$

510 km/h

4. *Spirit of Australia*, a hydroplane boat, made speed records by traveling 382.4 km in 0.75 hours. What is its record-breaking speed?

$$v = \frac{d}{t} = \frac{382.4\ km}{0.75\ h} = 510\ km/h$$

5. The fastest plane ever made, the *Lockhead SR71*, was able to travel 3520 km per hour. Based on this speed, how far could it travel in: $d = v \cdot t$

a) 2 hours? 7040 km

B) 3 hours? 10560 km

C) 5 hours? 17,600 km

6. Challenge: Out of all the machines on this worksheet, which one is the fastest?

1-8

7. Fill in the boxes and use a calculator to determine how long it would take each machine to get to travel 96 kilometers.

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

A. Jeff Gordon's Car = 0.40 h

B. *Thrust SSC* Car = 0.079 h

C. *TGV* (France) Train = 0.19 h

D. *Spirit of Australia* Boat = 0.19 h

E. *Lockhead SR71* Airplane = 0.027 h