1.2.1 In Class or Homework Exercise

1. Convert 95.0 km/h into m/s.

$$95.0km/h \times \frac{1m/s}{3.6km/h} = \boxed{26.4m/s}$$

2. Convert 23.2 m/s into km/h.

$$23.2m/s \times \frac{3.6km/h}{1m/s} = \boxed{83.5km/h}$$

3. At an average speed of 11.8 km/h, how far will a bicyclist travel in 175 min?

$v = 11.8km/h$
$t = 175\min = 2.92h$
$\Delta d = ?$

$$v = \frac{\Delta d}{t}$$
$$\Delta d = vt$$
$$= (11.8)(2.92)$$
$$= \boxed{34.5km}$$

4. If you average a speed of 45.0 km/h, how long will it take to travel a distance of 750 m?

$v = 45.0km/h = 12.5m/s$
$\Delta d = 750m$
$t = ?$

$$v = \frac{\Delta d}{t}$$
$$t = \frac{\Delta d}{v}$$
$$= \frac{750}{12.5}$$
$$= \boxed{60.s}$$

5. A confused person walks 5.0 km towards the east in 2.00 h, then 1.5 *km* towards the west in 0.50 h, and finally 10.0 km towards the east again in 2.25 h.
   a. What is the person's average speed?

$\Delta d_1 = 5.0km$
$\Delta d_2 = 1.5km$
$\Delta d_3 = 10.0km$
$t_1 = 2.00h$
$t_2 = 0.50h$
$t_3 = 2.25h$
$v = ?$

$\Delta d_t = \Delta d_1 + \Delta d_2 + \Delta d_3$
$= 5.0 + 1.5 + 10.0$
$= 16.5km$

$t_t = t_1 + t_2 + t_3$
$= 2.00 + 0.50 + 2.25$
$= 4.75h$

$v = \frac{\Delta d}{t}$
$= \frac{16.5}{4.75}$
$= \boxed{3.47\,km/h}$

b. What is the person's average velocity?

$\Delta \vec{d}_1 = 5.0km$
$\Delta \vec{d}_2 = -1.5km$
$\Delta \vec{d}_3 = 10.0km$
$t_1 = 2.00h$
$t_2 = 0.50h$
$t_3 = 2.25h$
$\vec{v} = ?$

$\Delta \vec{d}_t = \Delta \vec{d}_1 + \Delta \vec{d}_2 + \Delta \vec{d}_3$
$= 5.0 + (-1.5) + 10.0$
$= 13.5km$

$t_t = t_1 + t_2 + t_3$
$= 2.00 + 0.50 + 2.25$
$= 4.75h$

$\vec{v} = \frac{\Delta \vec{d}}{t}$
$= \frac{13.5}{4.75}$
$= \boxed{2.84\,km/h\ east}$

6. A person drove 4.0 km north, and then 6.4 km south.

a. If the person's average speed was 65 km/h, how long did the trip take?

$\Delta d_1 = 4.0km$
$\Delta d_2 = 6.4km$
$v_t = 65km/h$
$t_t = ?$

$\Delta d_t = \Delta d_1 + \Delta d_2$
$= 4.0 + 6.4$
$= 10.4\,km$

$v_t = \frac{\Delta d_t}{t_t}$
$65 = \frac{10.4}{t_t}$
$t_t = \boxed{0.16\,h}$

b. What was the person's average velocity?

$\Delta \vec{d}_1 = 4.0km$
$\Delta \vec{d}_2 = -6.4km$
$t_t = 0.16h$
$\vec{v}_t = ?$

$\Delta \vec{d}_t = \Delta \vec{d}_1 + \Delta \vec{d}_2$
$= 4.0 + (-6.4)$
$= -2.4\,km$

$\vec{v}_t = \frac{\Delta \vec{d}_t}{t_t}$
$= \frac{-2.4}{0.16}$
$= \boxed{-15km/h}$

The average velocity is 15 km/h south.

7. A rock thrown horizontally at a large bell 50.0 m away is heard to hit the bell 4.50 s later. If the speed of sound is 330 m/s, what was the speed of the rock?

This problem can be broken up into 2 parts, the rock moving and the sound coming back. Since we know more about the sound, start with that:

Sound

$\Delta d_s = 50.0\,m$

$v_s = 330 m/s$

$t_s = ?$

$$v_s = \frac{\Delta d_s}{t_s}$$

$$t_s = \frac{\Delta d_s}{v_s}$$

$$= \frac{50.0}{330}$$

$$= 0.15\,s$$

Rock

$\Delta d_r = 50.0m$

$t_r = 4.50 - 0.15s = 4.35s$

$v_r = ?$

$$v_r = \frac{\Delta d_r}{t_r}$$

$$= \frac{50.0}{4.35}$$

$$= \boxed{11.5\,m/s}$$

8. A person starts from home and drives with a velocity of 55 km/h east for 30 minutes. They then drive with a velocity of 73 km/h west for 45 minutes. Where are they?

Part 1

$\vec{v}_1 = 55km/h$

$t_1 = 30.\min = 0.50h$

$\Delta\vec{d}_1 = ?$

$$\vec{v}_1 = \frac{\Delta\vec{d}_1}{t_1}$$

$$55 = \frac{\Delta\vec{d}_1}{0.50}$$

$$\Delta\vec{d}_1 = 27.5\,km$$

Part 2

$\vec{v}_2 = -73km/h$

$t_2 = 45\min = 0.75h$

$\Delta\vec{d}_2 = ?$

$$\vec{v}_2 = \frac{\Delta\vec{d}_2}{t_2}$$

$$-73 = \frac{\Delta\vec{d}_2}{0.75}$$

$$\Delta\vec{d}_2 = -54.8\,km$$

Total

$$\Delta\vec{d}_t = \Delta\vec{d}_1 + \Delta\vec{d}_2$$

$$= 27.5 + (-54.8)$$

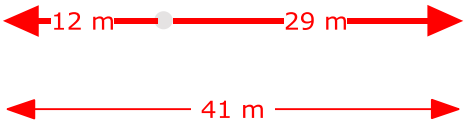
$$= -27.3km$$

$$= \boxed{-27km}$$

The person is 27 km west of their starting point.

9. Two people start at the same location. One person jogs with a velocity of 3.5 m/s east; the other person jogs with a velocity of 1.5 m/s west. How far apart are they after 8.2 s?

Person 1	**Person 2**
$\vec{v}_1 = 3.5 m/s$	$\vec{v}_2 = -1.5 m/s$
$t_1 = 8.2 s$	$t_2 = 8.2 s$
$\Delta\vec{d}_1 = ?$	$\Delta\vec{d}_2 = ?$
$\vec{v}_1 = \frac{\Delta\vec{d}_1}{t_1}$	$\vec{v}_2 = \frac{\Delta\vec{d}_2}{t_2}$
$3.5 = \frac{\Delta\vec{d}_1}{8.2}$	$-1.5 = \frac{\Delta\vec{d}_2}{8.2}$
$\Delta\vec{d}_1 = 29 m$	$\Delta\vec{d}_2 = -12 m$



As can be seen, the two people will be $\boxed{41m}$ apart.

10. You drive a car 2.0 h at 40. km/h, then 2.0 h at 60. km/h.

a. What is your average speed?

Part 1	**Part 2**	**Total**
$v_1 = 40. km/h$	$v_2 = 60. km/h$	$\Delta d_t = 2\bar{0}0 km$
$t_1 = 2.0 h$	$t_2 = 2.0 h$	$v_t = ?$
$\Delta d_1 = ?$	$\Delta d_2 = ?$	$t_t = 4.0 h$
$v_1 = \frac{\Delta d_1}{t_1}$	$v_2 = \frac{\Delta d_2}{t_2}$	$v_t = \frac{\Delta d_t}{t_t}$
$40. = \frac{\Delta d_1}{2.0}$	$60. = \frac{\Delta d_2}{2.0}$	$= \frac{2\bar{0}0}{4.0}$
$\Delta d_1 = 80. km$	$\Delta d_2 = 120. km$	$= \boxed{50. km/h}$

Notice that in this case the average speed actually is the same as the answer that would be obtained by averaging the two speeds together; **this is only because the time spent at each speed was equal.**

b. Do you get the same answer if you drive $1\bar{0}0$ km at each of the two speeds above (equal distances instead of equal times)?

Part 1	**Part 2**	**Total**
$v_1 = 40. km/h$	$v_2 = 60. km/h$	$\Delta d_t = 2\bar{0}0 km$
$t_1 = ?$	$t_2 = ?$	$v_t = ?$
$\Delta d_1 = 1\bar{0}0 km$	$\Delta d_2 = 1\bar{0}0 km$	$t_t = 4.17 h$

$v_1 = \frac{\Delta d_1}{t_1}$ $\quad$ $v_2 = \frac{\Delta d_2}{t_2}$ $\quad$ $v_t = \frac{\Delta d_t}{t_t}$

$40. = \frac{1\bar{0}0}{t_1}$ $\quad$ $60. = \frac{1\bar{0}0}{t_2}$ $\quad$ $= \frac{2\bar{0}0}{4.17}$

$t_1 = 2.5h$ $\quad$ $t_2 = 1.67h$ $\quad$ $= \boxed{48\,km/h}$

No, you do not obtain the same answer since different times were spent at each speed.

11. You plan a 200. km trip on which you want to average a speed of 90. km/h. You cover the first half of the distance at an average speed of only 48 km/h. What must your average speed be in the second half of the trip to meet your goal?

Total

$\Delta d_t = 200.km$

$v_t = 90.km/h$

$t_t = ?$

$v_t = \frac{\Delta d_t}{t_t}$

$90. = \frac{200.}{t_t}$

$t_t = 2.22h$

Part 1

$v_1 = 48\,km/h$

$\Delta d_1 = 100.km$

$t_1 = ?$

$v_1 = \frac{\Delta d_1}{t_1}$

$48 = \frac{100.}{t_1}$

$t_1 = 2.08h$

Part 2

$t_2 = 2.22 - 2.08 = 0.14h$

$\Delta d_2 = 100.km$

$v_2 = ?$

$v_2 = \frac{\Delta d_2}{t_2}$

$= \frac{100.}{0.14}$

$= \boxed{710\ km/h}$

Obviously, it would not be possible to meet the goal of an average speed of 90 km/h, since almost all of the time was used up in the first part of the race.

12. A biker rides around a track twice. The track has a radius of 70.0 *m*. The first trip around the track is completed in 26.8 *s*, while the second lap takes 32.4 *s*.

a. What is the average speed of the biker?

Since the radius of the track is given, the circumference of the track must be calculated:

$C = 2\pi r$

$= 2\pi(70.0)$

$= 440.m$

$\Delta d_t = 880.m$

$t_t = 59.2\,s$

$v = ?$

$$v = \frac{\Delta d}{t}$$
$$= \frac{880.}{59.2}$$
$$= \boxed{14.9\,m/s}$$

b. What is the average velocity of the biker?

Since the biker is going around a circular track, he returns to his starting point and therefore has a displacement of zero.

$$\vec{v} = \frac{\Delta \vec{d}}{t}$$
$$= \frac{0}{59.2}$$
$$= \boxed{0km/h}$$