1 Introduction

All velocity time problems can be solved the same way. Distance d is related to time t and velocity v by the relationship

$$d = vt \tag{1-1}$$

or distance equals velocity times time. If your car goes 100 km/h for 2 hours you will have gone 200 km. Using a subscript to denote the leg (or direction) of the journey

$$d_1 = v_1 t_1 \tag{1-2}$$
$$d_2 = v_2 t_2 \tag{1-3}$$

Each problem will have two unknowns which may be related to any of the six quantities in the above equations. Let the unknowns be x and y. You must write all the quantities in Equations 1-2 and 1-3 in terms of x and y. You then solve the resulting two simultaneous equations for x and y.

2 Problems

2.1 Problem 1

> Flying against a head wind a plane could fly 3000 km in 6 h. The plane would require only 5 h for the return trip.

Let the head wind be x and the plane speed be y then

$$v_1 = y - x \tag{2-4}$$
$$v_2 = y + x \tag{2-5}$$
$$t_1 = 6 \tag{2-6}$$
$$t_2 = 5 \tag{2-7}$$
$$d_1 = d_2 = 3000 \tag{2-8}$$

In direction 1 the wind slows the plane. In direction 2 it speeds the plane up.

Substituting into Equations 1-2 and 1-3

$$3000 = (y - x)6 \tag{2-9}$$
$$3000 = (y + x)5 \tag{2-10}$$

or

$$500 = y - x \tag{2-11}$$
$$600 = y + x \tag{2-12}$$

Rigorously you must solve one equation for y and substitute the result into the second equation to get an equation just in x. However in many cases is it easier to multiply both sides of one equation by a number and add the equations together to get one equation in one variable. In this case, just add the two equations

$$1100 = 2y \tag{2-13}$$
$$y = 550 \tag{2-14}$$

2.2 Problem 2

The air speed of a plane as 132 km/h. Flying with the wind the plane traveled twice the distance in 5 h as it traveled against the wind in 3 h. What was the wind speed?

Let x be the wind speed and y the distance in traveled against the wind in 3 h.

$$v_1 = 132 + x \tag{2-15}$$
$$v_2 = 132 - x \tag{2-16}$$
$$t_1 = 5 \tag{2-17}$$
$$t_2 = 3 \tag{2-18}$$
$$d_1 = 2y \tag{2-19}$$
$$d_2 = y \tag{2-20}$$

Substituting into Equations 1-2 and 1-3 we get

$$2y = (132 + x)5 \tag{2-21}$$
$$y = (132 - x)3 \tag{2-22}$$

Substitute the 2nd equation into the first equation to solve the problem.

$$6(132 - x) = (132 + x)5 \tag{2-23}$$
$$132 = 11x \tag{2-24}$$
$$x = \frac{132}{11} \tag{2-25}$$