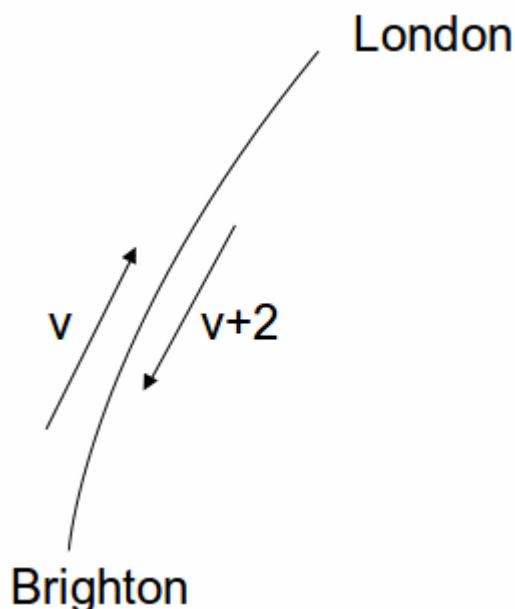


Speeds There and Back

Travelling to some place and back again might involve travelling twice the distance of only travelling there, but might well not mean taking twice as long. Going in one direction might mean travelling uphill or going against the wind or travelling in rush hour, meaning that this part of the total journey takes longer.

To find a total time or the speed over one or both parts of the journey can involve setting up an equation to be solved.

The distance from London to Brighton is 55 miles. The average speed from Brighton to London is v mph and the average speed from London to Brighton is $(v+2)$ mph. The total travel time is 2 hours. Find v .



$$t_1 = \frac{\text{distance}}{\text{time}} = \frac{55}{v}$$

The Brighton to London journey takes $\frac{55}{v}$ hours

$$t_2 = \frac{\text{distance}}{\text{time}} = \frac{55}{v+2}$$

The London to Brighton journey takes $\frac{55}{v+2}$ hours.

$$2 = t_1 + t_2 = \frac{55}{v} + \frac{55}{v+2}$$

The total journey takes 2 hours so

$$2 = \frac{55}{v} + \frac{55}{v+2}$$

We have to solve the equation

We can start by multiplying by $v(v+2)$ to clear all the fractions, giving

$$2v(v+2) = 55(v+2) + 55v \rightarrow 2v^2 + 4v = 110v + 110 \rightarrow 2v^2 - 106v - 110 = 0 \rightarrow v^2 - 53v - 55 = 0$$

$$v = \frac{53 \pm \sqrt{(-53)^2 - 4 \cdot 1 \cdot -55}}{2 \cdot 1} = \frac{53 \pm \sqrt{3029}}{2} = 54.02$$

or -1.018 mph. The second of these is obviously wrong so

$$v = 54.02 \text{ mph.}$$

