



## Stage 4 ★★

### Mixed Selection 1 - Solutions

#### 1. Hillwalking

If the distance along the flat was  $f$  km and the distance up the hill was  $h$  km, then since  $Speed = \frac{Dist.}{Time} \Rightarrow Time = \frac{Dist.}{Speed}$  the total time taken was:  $\frac{f}{4} + \frac{h}{3} + \frac{h}{6} + \frac{f}{4} = \frac{f}{2} + \frac{h}{2} = 2$ . Then, doubling this gives  $f + h = 4$ .

The total distance walked is  $2(f + h) = 2 \times 4 = 8$  km.

#### 2. Traffic jam

Write  $d$  for the distance of Emily's journey (note that this doesn't change), and  $t$  for the time it usually takes her. Then, in normal circumstances, her average speed is  $\frac{d}{t}$ .

Yesterday, her journey took 25% longer than usual, meaning an increase of  $0.25t$ , so the time was  $1.25t$ . The distance was the same as usual.

Her average speed was therefore  $\frac{d}{1.25t} = \frac{1}{1.25} \times \frac{d}{t} = 0.8 \frac{d}{t}$ . This means she travelled at 0.8 of her usual average speed, which is a reduction of 0.2 or 20%.

#### 3. Travelator

Relative to someone not on the walkway, Andrew is moving with a speed of  $6 + 4 = 10$  km/h. Bill is moving at the same 4 km/h of the walkway.

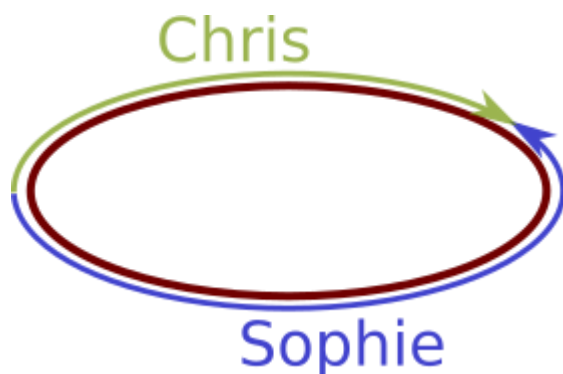
Since  $Speed = \frac{Distance}{Time}$ , we get that  $Time = \frac{Distance}{Speed}$ . Therefore, Andrew takes  $0.5 \text{ km} \div 10 \text{ km/h} = 0.05 \text{ h}$  to get to the end of the walkway. In this time, Bill has travelled  $0.05 \text{ h} \times 4 \text{ km/h} = 0.2 \text{ km} = 200 \text{ m}$ . Since Andrew has travelled 500 m, this means he is 300 m in front.

*These problems are adapted from UKMT Mathematical Challenge problems ([ukmt.org.uk](http://ukmt.org.uk))*



**4. Backwards laps**

In 24 seconds, the distance that Chris runs added to the distance that Sophie runs must be a whole lap. This is shown in the diagram below, which shows their journeys over 24 seconds.



In 24 seconds, Chris runs  $24/60 = 2/5$  of a lap, so Sophie must run  $3/5$  of a lap in 24 seconds. So she runs  $1/5$  of a lap in  $24 \div 3 = 8$  seconds, and so she runs a whole lap in  $8 \times 5 = 40$  seconds.

A fuller solution is available at: <https://nrich.maths.org/12890/solution>