Calculating Speed, Distance and Time

Starter

1. **(Review of last lesson)** A Formula 1 car travels 435 km in 1h 25m. Calculate its average speed to the nearest km/h.

Working: ***Convert the time into hours:*** $1\text{h } 35\text{m} \equiv 1\frac{25}{60} = 1\frac{5}{12}$ hours

$$\text{Average speed} = \frac{\text{Distance travelled}}{\text{Time taken}} = \frac{435}{1\frac{5}{12}} = 307 \text{ km/h}$$

2. Travelling at 60 mph, how far would you travel in:
(a) 3 hours (b) 30 minutes?

Working: (a) 60 mph means 60 miles in 1 hour
So in 3 hours, you would travel $60 \times 3 = 180$ miles

(b) 30 minutes $\equiv \frac{1}{2}$ an hour

$$\text{Distance travelled} = 60 \times \frac{1}{2} = 30 \text{ miles}$$

3. A train's average speed is 90 km/h. How long would it take to cover
(a) 270 km (b) 144 km?
For (b) give your answer in hours and minutes.

Working: (a) 90 km/h means covering 90 km in 1 hour
Therefore, to cover 270 km it would take $\frac{270}{90} = 3$ hours

(b) To cover 144 km it would take $\frac{144}{90} = 1.6$ hours
To convert to hours and minutes multiply the decimal part by 60:
1.6 hours $\equiv 1\text{h } (0.6 \times 60)\text{m} = 1\text{h } 36\text{m}$

E.g. 1 An albatross is cruising at an average speed of 85 km/h. What distance does it cover in
(a) 2 hours (b) 55 minutes?

Working: (a) $S = 85, T = 2$
Using $D = S \times T$: $D = 85 \times 2 = 170$
The distance covered is 170 km.

(b) ***Convert the times to hours:*** 55 minutes $\equiv \frac{55}{60} = \frac{11}{12}$ hours

$S = 85, T = \frac{11}{12}$

Using $D = S \times T$: $D = 85 \times \frac{11}{12} = 77\frac{11}{12} \approx 77.9$

The distance covered is $77\frac{11}{12} \approx 77.9$ km.

E.g. 2 A train travels at an average speed of 120 km/h between two stations. If it sets off at $06:40$, what times does it reach its destination given that the stations are 80 km apart.

Working: $S = 120, D = 80$

Using $T = \frac{D}{S}$***:*** $T = \frac{80}{120} = \frac{2}{3}$ hour

Convert to minutes: $\frac{2}{3}\text{h} \equiv \frac{2}{3} \times 60 = 40$ minutes

$06:40 + 00:40 = 07:20$

The train arrives at $07:20$.

E.g. 3 A cyclist goes uphill for 5 minutes at 15 km/h. He then turns around and cycles down the hill and it takes 2 minutes. What was his average speed to go up and down the hill?

Working: Uphill: Convert 5 minutes to hours: $5\text{m} \equiv \frac{5}{60} = \frac{1}{12}\text{h}$

$T = \frac{1}{12}, S = 15$

Using $D = S \times T$: $D = \frac{1}{12} \times 15 = \frac{5}{4} = 1.25$ km

Total distance (uphill and downhill) $= 2 \times 1.25 = 2.5$ km

Total time (uphill and downhill) $= 5 + 2 = 7\text{m} \equiv \frac{7}{60}\text{h}$

Using $S = \frac{D}{T}$: $S = \frac{2.5}{\frac{7}{60}} = \frac{150}{7} = 21\frac{3}{7} \approx 21.4$

The average speed to go up and down the hill is $21\frac{3}{7} \approx 21.4$ km/h

E.g. 4 A bus travels the 195 km from Cardiff to Exeter at an average speed of 75 km/h. It then travels back to Cardiff at an average speed of 81 km/h. If the bus spent half an hour at Exeter before returning, how long did the trip take, to the nearest minute?

Working: **Cardiff to Exeter:** $D = 195, S = 75$

Using $T = \frac{D}{S}$***:*** $T = \frac{195}{75} = 2.6$ h

Convert to hours and minutes: $2.6\text{ h} \equiv 2\text{h}(0.6 \times 60)\text{m} = 2\text{h } 36\text{m}$

In Exeter: $T = 30\text{m}$

Exeter to Cardiff: $D = 195, S = 81$

Using $T = \frac{D}{S}$***:*** $T = \frac{195}{81} = 2\frac{11}{27}$ h ***fractions avoid rounding errors***

Convert to hours and minutes: $2\frac{11}{27}\text{ h} \equiv 2\text{h}\left(\frac{11}{27} \times 60\right)\text{m} \approx 2\text{h } 24\text{m}$

Total time $= 2\text{h } 36\text{m} + 30\text{m} + 2\text{h } 24\text{m} = 5\text{h } 30\text{m}$

The trip took $5\text{h } 30\text{m}$

Video: Speed, distance and time

Video: Converting times

Solutions to Starter and E.g.s

Exercise

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