1. Axel and Lethna are driving along a motorway.

They see a road sign.
The road sign shows the distance to Junction 8
It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

"We will have to drive faster than the speed limit to drive 30 miles in 26 minutes."

Is Lethna right?
You must show how you get your answer.

70 mph means 70 miles in 60 minutes

30 miles in 26 minutes ← we want to work out what speed in mph this represents

$60 \div 26 = \frac{30}{13}$ (1) ← working out what to multiply 26 by to get 60

$26 \times \frac{30}{13} = 60$ ← minutes

$30 \times \frac{30}{13} = \frac{900}{13} = 69.23$ (2dp) ← miles (1)

69.23 miles in 60 minutes which is 69.23 mph

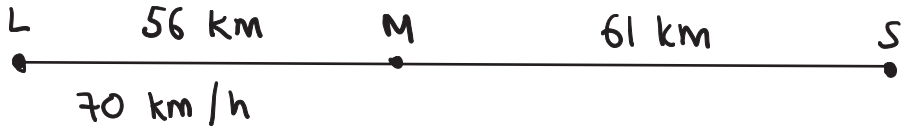
69.23 mph is less than 70 mph so NO
Lethna is wrong (1)

3 marks

2. Olly drove 56 km from Liverpool to Manchester.
He then drove 61 km from Manchester to Sheffield.

Olly's average speed from Liverpool to Manchester was 70 km/h.
Olly took 75 minutes to drive from Manchester to Sheffield.

(a) Work out Olly's average speed for his total drive from Liverpool to Sheffield.



Speed = distance / time

$70 = \frac{56}{t}$

$t = \frac{56}{70} = 0.8$ hours (1)

1.25 hours.

Total time L → S = 2.05 hours (1)

Total distance L → S = 56 + 61 = 117 km (1)

$\text{Speed} = \frac{117}{2.05} = 57.0731...$

$\approx$ 57 km/h.

57 (1)

..... km/h

(4)

Janie drove from Barnsley to York.

Janie's average speed from Barnsley to Leeds was 80 km/h.
Her average speed from Leeds to York was 60 km/h.

Janie says that the average speed from Barnsley to York can be found by working out the mean of 80 km/h and 60 km/h.

(b) If Janie is correct, what does this tell you about the two parts of Janie's journey?

Both parts of the journey must have taken the same amount of time.

(1)

(Total for Question is 5 marks)

3. A train travelled along a track in 110 minutes, correct to the nearest 5 minutes.

Jake finds out that the track is 270 km long.
He assumes that the track has been measured correct to the nearest 10 km.

(a) Could the average speed of the train have been greater than 160 km/h?
You must show how you get your answer.

↳ upper bound

Speed = distance / time

U.B. for division = upper bound / lower bound

Distance: 265 ← 270 km → 275 (1)

Time: 107.5 ← 110 mins → 112.5

max. speed = 275 / (107.5 ÷ 60) = 153.4883721 (1) (1)

NO, because the max. speed is 153.488 km/h, and this is less than 160 km/h. (1)

(4)

Jake's assumption was wrong.
The track was measured correct to the nearest 5 km.

(b) Explain how this could affect your decision in part (a).

Less distance is covered in the same amount of time, and so the max. speed will decrease. (1)

(1)

(Total for Question is 5 marks)

0·24646... 0·24656... 0·246246... 0·246000...

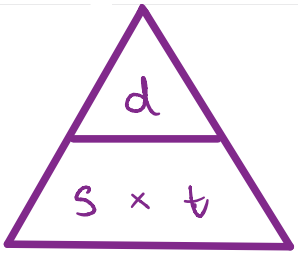
0·246 , 0·246 , 0·246 , 0·246

4. James and Peter cycled along the same 50 km route.
James took $2\frac{1}{2}$ hours to cycle the 50 km.

Peter started to cycle 5 minutes after James started to cycle.
Peter caught up with James when they had both cycled 15 km.

James and Peter both cycled at constant speeds.

Work out Peter's speed.



James $\frac{50}{2.5} = \frac{100}{5} = 20$ km/h ✓

$\frac{15}{20} = \frac{3}{4}$ hrs = 45 mins ✓

$15 \div \frac{2}{3}$

$= \frac{15}{1} \div \frac{2}{3}$

$= \frac{15}{1} \times \frac{3}{2}$ ✓

$= \frac{45}{2}$

Peter $45 - 5 = 40$ mins

$\frac{2}{3}$ hrs ✓

22.5 ✓ ..... km/h

(Total for Question is 5 marks)

120 × 5 = 600 minutes
1 tap takes 600 minutes
600 ÷ 3 = 200 minutes ✓

200 ✓

Each tap fills up pool at the same rate ✓

5. A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

213 → 200

200 miles per 1 hour
200 miles per 60 minutes
200 miles per 3600 seconds ✓
÷200 ÷200
1 mile per 18 seconds ✓

18 ✓ seconds

(3)

(b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

Overestimate, because we rounded the speed down ✓

(1)

(Total for Question is 4 marks)

6. In May 2019, the distance between Earth and Mars was 3.9×10^7 km.

In May 2019, a signal was sent from Earth to Mars.
Assuming that the signal sent from Earth to Mars travelled at a speed of 3×10^5 km per second,

(a) how long did the signal take to get to Mars?

$$\text{speed} = \frac{\text{distance}}{\text{time}} \quad \therefore \quad \text{time} = \frac{\text{distance}}{\text{speed}}$$

$$\text{time} = \frac{3.9 \times 10^7}{3 \times 10^5} \quad \therefore \quad \text{time} = 130 \text{ seconds}$$

(1) (1)

130 seconds

(2)

The speed of the signal sent from Earth to Mars in May 2019 was actually less than 3×10^5 km per second.

(b) How will this affect your answer to part (a)?

The answer to part (a) will be bigger. (1)

(1)

(Total for Question is 3 marks)

7. The accurate scale drawing shows the positions of port P and a lighthouse L.

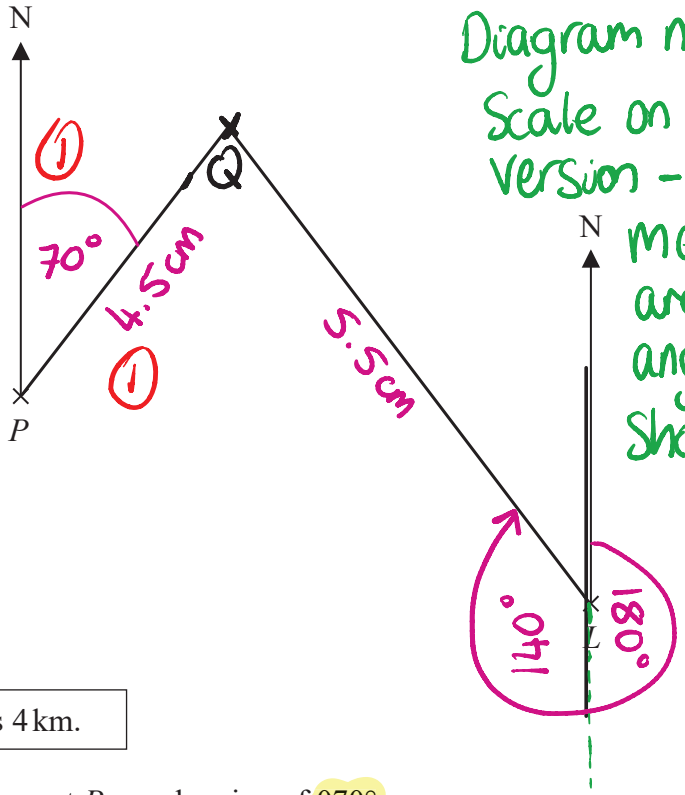


Diagram not drawn to scale on this digital version - purple measurements are lengths and angles that they should be

Scale: 1 cm represents 4 km.

Aleena sails her boat from port P on a bearing of 070°

She sails for $1\frac{1}{2}$ hours at an average speed of 12 km/h to a port Q.

Find

(i) the distance, in km, of port Q from lighthouse L,

(ii) the bearing of port Q from lighthouse L.

i) distance = speed x time

distance = 12 x 1.5 = 18 km (1)

1 cm : 4 km
x4.5 ↓ ↓ x4.5
4.5cm : 18 km

1 cm : 4 km
x5.5 ↓ ↓ x5.5
5.5 cm : 22 km

ii) bearing of port Q from lighthouse L

180° + 140° = 320°

distance QL = 22 (1) km

bearing of Q from L = 320 (1) °

8. A car travels for 18 minutes at an average speed of 72 km/h.

(a) How far will the car travel in these 18 minutes?

distance = speed x time (1)

60 minutes = 1 hour

÷60 ↓ 1 minute = $\frac{1}{60}$ hours ↓ ÷60

x18 ↓ 18 minutes = $\frac{18}{60}$ hours ↓ x18

↑

Need to be working in same units so converting 18 minutes to hours

distance = $72 \times \frac{18}{60}$

$= 72 \times \frac{9}{30}$

$= 72 \times \frac{3}{10}$ $\quad 72 \times 3 = 216$

$= \frac{72 \times 3}{10} = \frac{216}{10} = 21.6$ km

21.6 (1) km

(2)

David says,

"72 kilometres per hour is faster than 20 metres per second."

(b) Is David correct?

You must show how you get your answer.

Convert 72 km/h to m/s

$\frac{km}{h} \rightarrow \frac{m}{s}$ $\quad \times \frac{1000}{60 \times 60} = \frac{10}{6 \times 6} = \frac{10}{36} = \frac{5}{18}$

x1000 gets from m to km

x60x60 gets from s to h

To convert from km/h to m/s need to $\times \frac{5}{18}$

$72 \times \frac{5}{18} = \frac{72 \times 5}{18} = \frac{360}{18} = 20$ m/s

(2)

No because 72 km/h = 20 m/s

$1\text{ cm} = 10\text{ mm}$

$1^3\text{ cm}^3 = 10^3\text{ mm}^3$

$1\text{ cm}^3 = 1000\text{ mm}^3$ ×37

$1\text{ cm}^3 = 1000\text{ mm}^3$ ×37

$37\text{ cm}^3 = 37000\text{ mm}^3$ (1)

37000

9. Nimer was driving to a hotel.
He looked at his Sat Nav at 13 30

Time	13 30
Distance to destination	65 miles

Nimer arrived at the hotel at 14 48

Work out the average speed of the car from 13 30 to 14 48
You must show all your working.

14 - 13 (1) 48 - 30

Between 13:30 18 there is 1 hour 18 minutes

Convert everything to h (1)

1 hour 18 minutes → 1 hour + $\frac{18}{60}$ hours → $1 + \frac{18}{60}$ hours → 1.3 hours

Speed = $\frac{\text{distance}}{\text{time}}$ (1)

Speed = $\frac{65}{1.3}$ = 50 mph

50 (1) mph