

## Distance-Time Graphs

### Starter

1. (Review of last lesson) Jane's top running speed is 15 km/h. Jessie's top running speed is 10 m/s. Who is faster?

**Working:** We either need to convert 15 km/h to m/s or 10 m/s to km/h

*Either...*

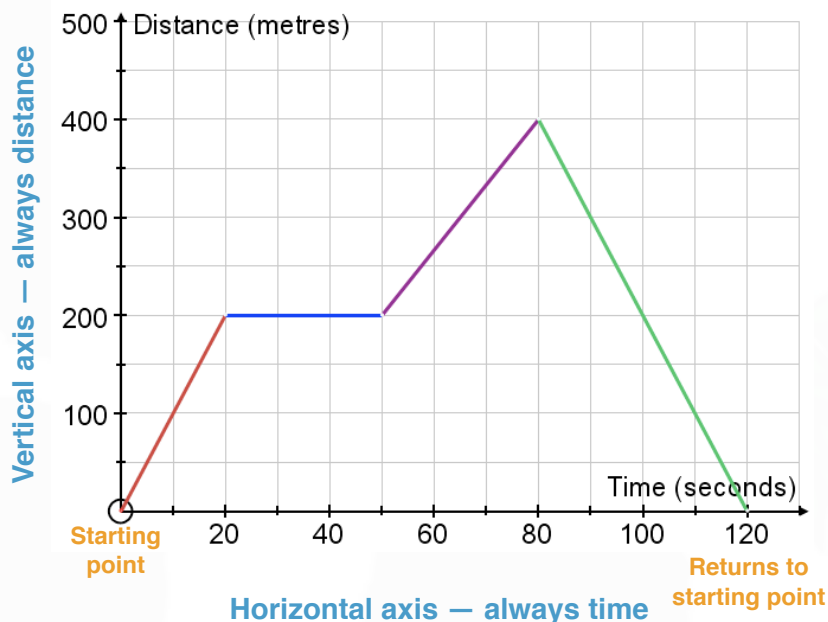
$$15 \text{ km/h} = \frac{15}{60} \text{ km/min} = \frac{15}{60 \times 60} \text{ km/s} = \frac{15 \times 1000}{60 \times 60} \text{ m/s} \approx 4.17 \text{ m/s}$$

Since  $10 \text{ m/s} > 4.17 \text{ m/s}$ , Jessie's top speed is faster.

*...Or...*

$$10 \text{ m/s} = 10 \times 60 \text{ m/min} = 10 \times 60 \times 60 \text{ m/h} = \frac{10 \times 60 \times 60}{1000} \text{ km/h} = 36 \text{ km/h}$$

Since  $36 \text{ km/h} > 15 \text{ km/h}$ , Jessie's top speed is faster.



**E.g. 1** Answer these questions based on the distance-time graph above.

- How long is the object **stationary** for?
- Calculate the speed indicated by the **purple** line.
- Calculate the speed on the **return** journey.
- What is the total distance travelled?

**Working:** (a) The object is stationary from 20 s to 45 s so 25 s

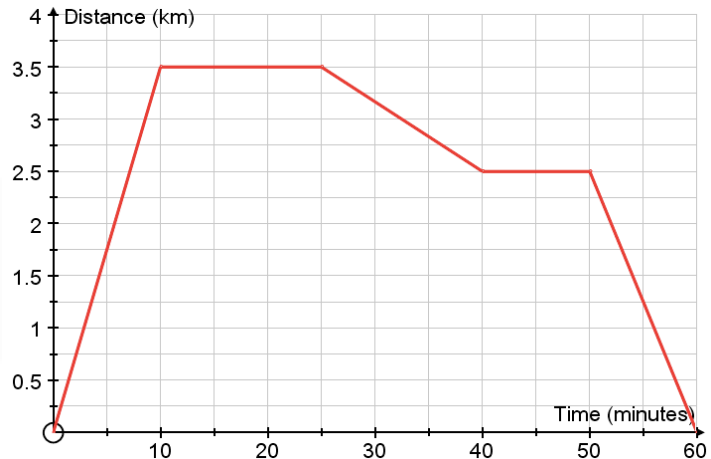
(b)  $\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{200}{30} = 6.67 \text{ m/s}$

(c)  $\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{400}{40} = 10 \text{ m/s}$

- (d) The object travels 400 m away from the starting point and then returns to the starting point.  
The total distance travelled is 800m

**E.g. 2** John went to his local shop to buy some food. On his way home he stopped to chat to a friend. The distance-time graph shows his journey. Based on the graph, answer these questions.

- (a) How long was John in the shop?
- (b) What was John's speed, in km/h, on the way to the shop?
- (c) How long did John stop to talk to his friend?
- (d) Apart from when John was stopped, when was his speed the lowest and how fast was he travelling in km/h?
- (e) State the total distance travelled.



**Working:**

- (a) John was in the shop from 10 minutes to 25 minutes. So he spent 15 minutes in the shop.

(b) John travelled for 10 minutes =  $\frac{10}{60} = \frac{1}{6}$  hour

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{3.5}{\frac{1}{6}} = 3.5 \times \frac{6}{1} = 21 \text{ km/h}$$

- (c) John spoke to his friend from 40 minutes to 50 minutes. So he spent 10 minutes speaking to his friend.

- (d) The lowest speed is when the line is the least steep — this will be from 25 to 40 minutes i.e. after leaving the shop.

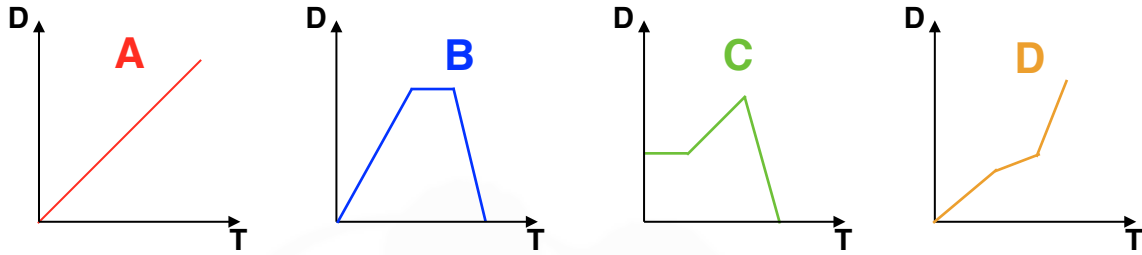
$$15 \text{ minutes} = \frac{15}{60} = \frac{1}{4} \text{ hour}$$

In this time he travels 1 km.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{1}{\frac{1}{4}} = 1 \times \frac{4}{1} = 4 \text{ km/h}$$

- (e) The total distance travelled is  $2 \times 3.5 = 7 \text{ km}$ .

**E.g. 3** Jack cycles along a flat road, then up a hill, then down the other side. Which Distance-Time graph best describes Jack's journey?



**Working:**

- Not **A** — it is unlikely will stay the same speed on the journey.
- Not **B** — the second part of the graph suggests Jack is stationary, which is not true. The third part has Jack returning to the starting point, which is also not true.
- Not **C** — the first part of the graph suggests Jack is stationary, which is not true. The third part has Jack returning to the starting point, which is also not true.
- D** is correct — the second part is the not as steep as the other parts since Jack is cycling up a hill. The third part is the steepest as we would expect Jack to be fastest going downhill.

**Video:** [Distance-time graphs](#)

[Solutions to Starter and E.g.s](#)

**Exercise**

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