Student Name

Mathematics Stage 4

RATIOS AND RATES

Book 5 Interpret and construct distance-time graphs from authentic data

Version: 260207

Report mistakes & suggest improvements:
https://MrDingMaths.com

CONTENTS

OVERVIEW

SYLLABUS CONTENT

MA4-RAT-C-01 solves problems involving ratios and rates, and analyses distance–time graphs

Interpret and construct distance–time graphs from authentic data

- Interpret distance–time graphs made up of straight-line segments with a negative, zero or positive slope
- Calculate speeds for straight-line segments of given distance–time graphs
- Create distance–time graphs made up of straight-line segments

SUMMARY

Interpret Distance-Time Graphs

Speed Formula

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

Converting Units of Speed

1. Write the rate as a fraction with units.
2. Convert the quantities to the required units.
3. Simplify the fraction using a calculator.

Convert 60 km/h to m/s

1. $\frac{60\text{ km}}{1\text{ hr}} = \frac{(\quad)\text{m}}{(\quad)\text{s}}$
2. $= \frac{(60\times1000)\text{ m}}{(1\times60\times60)\text{ s}}$
3. $= 16.67\text{ m/s}$

Convert 12 m/s to km/h

1. $\frac{12\text{ m}}{1\text{ s}} = \frac{(\quad)\text{km}}{(\quad)\text{h}}$
2. $= \frac{(12\div1000)\text{ km}}{(1\div60\div60)\text{ h}}$
3. $= 43.2\text{ km/h}$

Converting Units of Time

Our number system is the **decimal** system, based on tens.
Time uses the **sexagesimal** system, based on sixties.

4 hours 30 minutes is **NOT** 4.3 hours, it is 4.5 hours.

Convert between decimal form and sexagesimal form using °′″

Convert 2 hours 37 minutes to decimal form

2 °′″ 3 7 °′″ = S⇔D S⇔D

Math ▲

2°37°

2.616666667

2 hours 37 minutes = 2.61$\dot{6}$ hours.

Convert 3.27145 hours to hours, min, sec.

3 • 2 7 1 4 5 = °′″

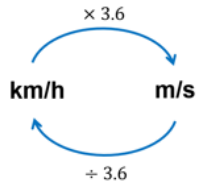
Math ▲

3.27145

3°16'17.22"

3.27145 hours = 3 hours 16 min 17.22 sec

Speed Conversion Shortcuts



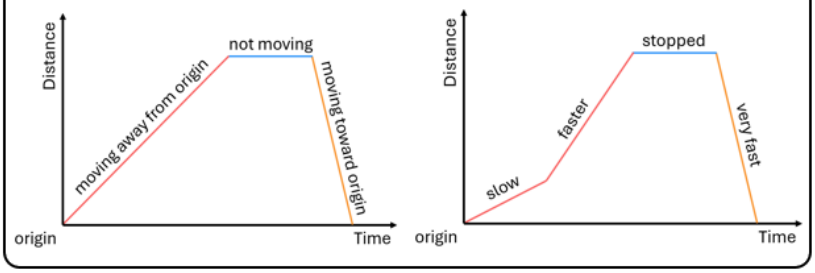
Calculating Speed Distance Time

1. Write the formula $s = \frac{d}{t}$
2. Substitute known values.
3. Solve the equation to find the unknown value.

OR use a shortcut formula

$s = \frac{d}{t}$ $\quad d = st \quad$ $t = \frac{d}{s}$

Distance-Time Graphs



REVIEW OF PRIOR KNOWLEDGE

1 Convert these units of distance.

a 6.3 km = …… m

b 124 m = …… km

c 12.421 km = …… m

2 Convert these units of time.

a 3 hours = …… min

b 68 s = …… min

c 12 hours = …… min

CONVERTING UNITS OF SPEED

- **Speed** is a rate that relates **distance** and **time**.

Speed Formula
$\text{speed} = \frac{\text{distance}}{\text{time}}$

- To convert units of speed:
  1. Write the rate as a fraction with units.
     Numerator is the first quantity. Denominator is 1.
  2. Convert the quantities to the required units.
  3. Simplify the fraction using a calculator.

Example Convert units of speed.

Convert 60 km/h to m/s	Convert 12 m/s to km/h
1. $\frac{60\text{ km}}{1\text{ hr}} = \frac{(\quad)\text{ m}}{(\quad)\text{ s}}$	1. $\frac{12\text{ m}}{1\text{ s}} = \frac{(\quad)\text{ km}}{(\quad)\text{ h}}$
2. $= \frac{(60\times1000)\text{ m}}{(1\times60\times60)\text{ s}}$	2. $= \frac{(12\div1000)\text{ km}}{(1\div60\div60)\text{ h}}$
3. $= \frac{16.6\dot{6}\text{ m}}{1\text{ s}}$	3. $= \frac{43.2\text{ km}}{1\text{ h}}$
$16.6\dot{6}$ m/s	43.2 km/h

Convert these units of speed.

a	Convert 75 km/h to m/s $\frac{60\text{ km}}{1\text{ hr}} = \frac{\quad\text{m}}{\text{s}}$ $=$ $20.8\dot{3}$ m/s	**b**	Convert 5 m/s to km/h 18 km/h	**c**	Convert 40 km/h to m/s $11.\dot{1}$ m/s
d	Convert 900 km/h to m/s 250 m/s	**e**	Convert 300 000 m/s to km/h 1080 000 km/h	**f**	Convert 100 m / 9.58 s to km/h 37.58 km/h

1 Convert these units of speed to metres per second. Round to 1 d.p.

a 70 km/h

19.4̇ m/s

b 45 km/h

12.5 m/s

c 76 km/h

21.1̇ m/s

d 40 km/h

11.1̇ m/s

2 Convert these units of speed to kilometres per hour.

a 8 m/s

28.8 km/h

b 15 m/s

54 km/h

c 12.5 m/s

45 km/h

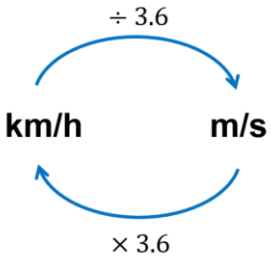
d 25 m/s

90 km/h

3 Amy notices a pattern:

To convert from m/s to km/h, multiply by 3.6
To convert from km/h to m/s, divide by 3.6

Convert these speeds using the rule.



a 40 km/h to m/s

11.1̇ m/s

b 80 km/h to m/s

22.2̇ m/s

c 65 km/h to m/s

18.05̇ m/s

d 10 m/s to km/h

36 km/h

e 6 m/s to km/h

21.6 km/h

f 18.5 m/s to km/h

66.6 km/h

g 85 km/s to m/s

23.61̇ m/s

h 120 km/h to m/s

33.3̇ m/s

i 8.6̇ m/s to km/h

31.2 km/h

j 50 km/s to m/s

13.8̇ m/s

k 40 m/s to km/h

144 km/h

l 100 km/h to m/s

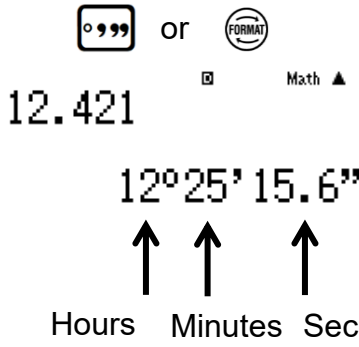
27.7̇ km/h

CONVERTING UNITS OF TIME

- Our number system is called the **decimal** system based on tens.
  - Ten ones are ten. Ten tens are a hundred. Ten hundreds is a thousand…
- Time uses the **sexagesimal** system, based on sixties.
  - Sixty seconds are a minute. Sixty minutes are an hour.

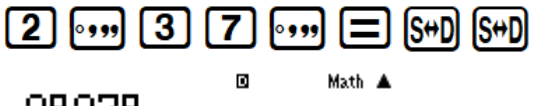
Sexagesimal Notation

Convert between decimal form and sexagesimal form by using the buttons:



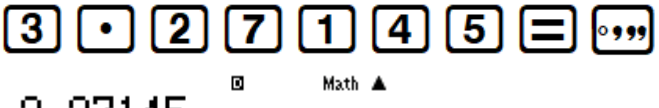
Example Converting time between decimal and DMS form.

Convert 2 hours 37 minutes to decimal form



2 hours 37 minutes = 2.61$\dot{6}$ hours.

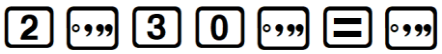
Convert 3.27145 hours to hours, min, sec.



3.27145 hours = 3 hours 16 min 17.22 sec

Convert these times to hours in decimal form using a calculator.

a 2 hours 30 minutes



2.5 hours

b 4 hours 15 minutes

4.25 hours

c 0 hours 45 minutes

0.75 hours

d 1 hour 33 minutes 27 seconds

1.5575 hours

e 13 minutes 25 seconds

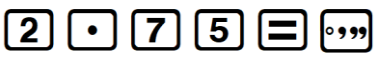
0.22361$\dot{1}$ hours

f 7 hours 16 minutes 44 seconds

7.27$\dot{8}$ hours

Convert these times to hours, minutes, and seconds using a calculator.

a 2.75 hours



2 h 45 m

b 3.5 hours

3 h 30 m

c 3.3 hours

3 h 18 m

d 15.282 hours

15 h 16 m 55.2 s

e 0.281 hours

16 m 51.6 s

f 2.$\dot{6}$ hours

2 h 40 m

1 Convert these times to hours in decimal form using the sexagesimal button on a calculator.

a 0 hours 30 minutes

0 ° ‘ ” 3 0 ° ‘ ” = ° ‘ ”

0.5 h

b 0 hours 15 minutes

0.25 h

c 0 hours 20 minutes

$0.\dot{3}$ h

d 1 hour 40 minutes

$1.\dot{6}$ h

e 1 hour 45 minutes

1.75 h

f 245 minutes

$4.08\dot{3}$ h

g 3 hours 40 minutes

$3.\dot{6}$ h

h 5 hours 10 minutes

$5.1\dot{6}$ h

i 128 minutes

$2.1\dot{3}$ h

j 2 hours 35 minutes 48 seconds

$2.59\dot{6}$ h

k 25 minutes 13 seconds

0.4203 h

l 12 hours 6 minutes 4 seconds

$12.10\dot{1}$ h

2 Convert these to hours, minutes, and seconds using the sexagesimal button on a calculator.

a 1.3 hours

1 • 3 = ° ‘ ”

1 h 18 m

b 1.5 hours

1 h 30 m

c 0.25 hours

0 h 15 min

d 0.2 hours

0 h 12 m

e 1.6 hours

1 h 36 m

f 1.875 hours

1 h 52 m 30 s

g 8.125 hours

8 h 7 m 30 s

h $0.\dot{6}$ hours

0 h 40 m

i $9.\dot{1}$ hours

9 h 6 m 40 s

j $2.3\dot{6}$ hours

2 h 22 m

k 7.15 hours

7 h 9 m

l $0.7\dot{6}$ hours

0 h 46 m

CALCULATING SPEED DISTANCE TIME

Speed Formulas		
$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$	$\text{Distance} = \text{Speed} \times \text{Time}$	$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$

1. Write the formula.
2. Substitute known values and evaluate.

Example Calculate speed, distance, time.

Worked Example	Your Turn
A plane travels 2800 km in 4 hours. Calculate its speed in km/h. 1. $s = \frac{d}{t}$ 2. $= \frac{2800}{4}$ $= \frac{700\text{ km}}{1\text{ h}}$ $= 700$ km/h	A car travelled 800 km in 9 hours. Calculate its speed in km/h. $88.\dot{8}$ km/h
A car travels at 60 km/h for 2.5 hours. How far does it travel? 1. $d = st$ 2. $= 60 \times 2.5$ $= 150$ km	A car travels at 55 km/h for 3.75 hours. How far does it travel? 206.25 km
A plane is flying from Sydney to Singapore at a speed of 800 km/hr. How long will it take to get there if the two cities are 6300 km apart? 1. $t = \frac{d}{s}$ 2. $= \frac{6300}{800}$ $= 7.875$ hours $= 7\text{ h }52\text{ min }30\text{ s}$	A train is travelling from Central to Blacktown at a speed of 85 km/h. How long would the journey take if the stations are 45 km apart? 31 minutes 45.88 seconds

Key ideas

1. Speed is a rate that compares …… and ……
2. If two quantities are known, the third can be found by …… the speed formula.

1 Complete the table

Speed $s = \frac{d}{t}$	**Distance** $d = st$	**Time** $t = \frac{d}{s}$
52 km/h	104 km	2 hours
17 km/h	51 km	3 hours
62 km/h	248 km	From 10:30 am to 2:30 pm
300 km/h	750 km	$2\frac{1}{2}$ hours
6 km/h	7.5 km	$1\frac{1}{4}$ hours
45 km/h	90 km	2 hours
60 km/h	180 km	3 hours
5.5 km/h	22 km	13:00 to 17:00
10 km/h	15 km	$1\frac{1}{2}$ hours
52 km/h	26 km	07:52 to 8:22
3 km/h	12 km	0.5 h
11 km/h	55 km	4 h
7 km/h	21 km	3 h
400 km/h	1000 km	2.5 h
18 km/h	10 km	$0.\dot{5}$ h or 33 m 20 s

2 Find the average speed in km/h of a vehicle that travels:

a 180 km in 2 hours — 90 km/h

b 485 km in 5 hours — 97 km/h

c 360 km in 4.5 hours — 80 km/h

d 21 km in $\frac{1}{4}$ hour — 84 km/h

e 240 km in $2\frac{1}{2}$ hours — 96 km/h

f 16 km in 20 minutes — 48 km/h

3 Find the distance in km travelled by a car with these average speed and time.

a 3 h 30 min at 64 km/h 224 km	**b** 3 h 20 min at 56 km/h 186.$\dot{6}$ km	**c** 5 h 47 min at 82 km/h 474.2$\dot{3}$ km
d 2 h 13 min at 75 km/h 166.25 km	**e** $2\frac{3}{4}$ hours at 56 km/h 154 km	**f** $3\frac{1}{2}$ hours at 82 km/h 287 km

4 How long will it take to travel these distances? Answer to the nearest minute.

a 160 km at 80 km/h 2 h	**b** 150 km at 60 km/h 2 h 30 min	**c** 120 km at 50 km/h 2 h 24 min
d 225 km at 45 km/h 5 h	**e** 240 km at 40 km/h 6 h	**f** 80 km at 95 km/h 51 min

5 Caitlin lives in Wollongong and travels to Sydney daily.

The car trip requires her to travel at different speeds.

She travels 30 kilometres at 60 km/h and 40 kilometres at 100 km/h.

a What is the total distance of the trip?

70 km

b How long (in hours) does the trip take?

0.9 h

c What is her average speed (in km/h) when travelling to Sydney?
Find average speed by dividing *total* distance by *total* time.
Answer correct to two decimal places.

77.$\dot{7}$ km/h

6 Calculate the unknown quantity in each of these scenarios.
Round to 2 decimals for distance and to the nearest minute for time.

a Find the average speed (in km/h) of a vehicle that travels 500 km in 6 hours and 10 minutes.

81.08 km/h

b Find the distance travelled by a car whose average speed is 68 km/h if the journey lasts 1 hour 20 minutes.

90.67 km

c How long will it take a vehicle to travel 50 km at a speed of 60 km/h?

50 min

d Find the average speed (in km/h) of a vehicle that travels 36000 m in 45 minutes.

48 km/h

e How long will it take a vehicle to travel 15 km at a speed of 40 km/h?

22 m 30 s

f Find the distance travelled by a car whose average speed is 70 km/h if the journey lasts 50 minutes.

58.33 km

7 The land speed record is 20.4 km/min.

a Express this speed in km/h.

1224 km/h

b How far does this vehicle travel in 5 minutes?

102 km

c How far does this vehicle travel in 1 second?

0.34 km

d How long would it take for this vehicle to travel from Sydney to Brisbane (982 km)? Answer to the nearest minute.

48 min

8

a The first automobile, developed in 1886, could reach a speed of 16 km/h.
Calculate the time taken to travel 1228 km at this speed, to the nearest minute.

76 h 45 m

b Thrust SuperSonic Car is the fastest land vehicle. It can travel at a speed of 1228 km/hr.
Calculate the time taken to travel 16 km at this speed.

47 s

9 The distance from Broken Hill to Tibooburra is 360 km. A motorist travels from Broken Hill to Tibooburra at a mean speed of 90 km/h and returns at a mean speed of 60 km/h.
What is the average speed of the motorist for the whole journey?

72 km/h

10 Brothers Marco and Matthew start riding from home into town, which is 30 km away.
Marco rode at 10 km/h and Matthew took 20 minutes longer to complete the trip.
Assuming that they both rode at a constant speed, how fast was Matthew riding?

9 km/h

11 Shari travels at 50 km/h for 10 km. For the next 10 km she wants to drive fast enough to make her average speed 100 km/h over the 20 km trip.
Advise Shari about reaching this average speed.

For 100 km/h over 20 km, she must complete the whole journey in 20 minutes.
She has already spent 20 minutes to travel 10 km at 50 km/h, so it is impossible.

12 A satellite has a circular orbit 800 km above the Earth's surface.

a If the radius of the Earth is 6400 km, find the radius of the orbit of the satellite.

7200 km

b Find the circumference of the satellite's orbit, to the nearest kilometre.

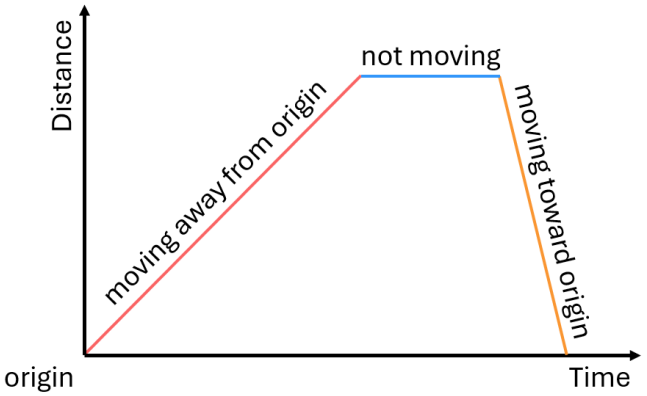
45 239 km

c If the satellite makes one orbit in a day, find the speed of the satellite.

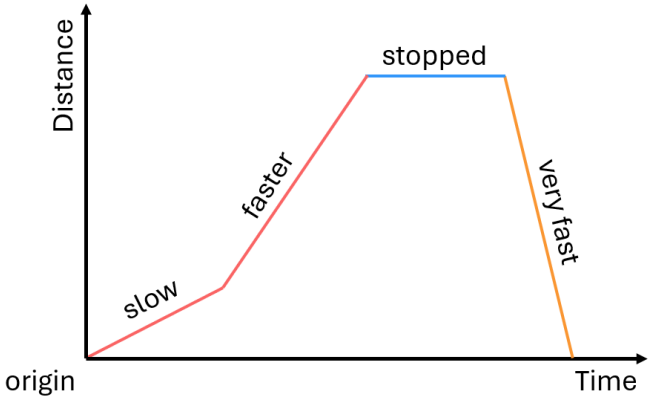
1885 km/h

INTERPRETING DISTANCE-TIME GRAPHS

- A distance-time graph shows a journey.



- The greater the speed, the steeper the line.



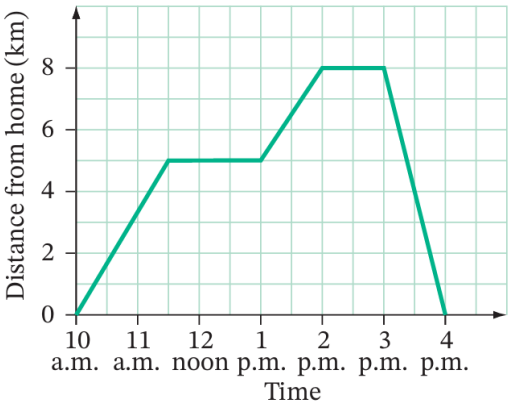
- Distance Time Graphs 1: https://www.geogebra.org/m/ncm9gzch
- Distance Time Graphs 2: https://www.geogebra.org/m/nn4q6ehs
- Distance Time Graphs 3: https://www.geogebra.org/m/akbvuhuc

INTERPRETING DISTANCE-TIME GRAPHS

Example Interpret a distance-time graph.

The distance time graph shows Bella's bushwalk.
She:

- Hiked for a while
- Stopped to each lunch
- Continued her journey
- Stopped at the lookout
- Then quickly returned



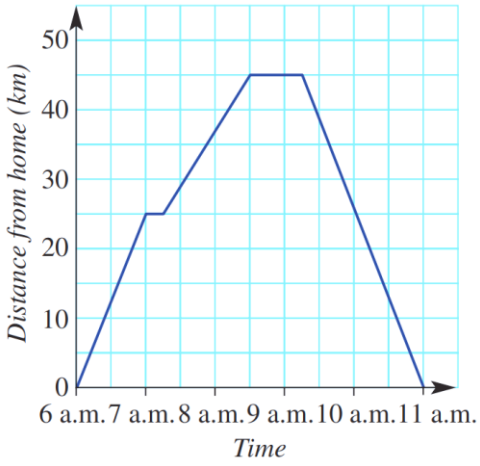
How far did Bella travel from 10 am to 2 pm? 8 km

When was Bella's lunch break? 11:30 am

How long did she spend eating lunch? 1 hour 30 minutes

When did she reach the lookout? 2 pm

The graph shows the journey of a car travelling from home to a worksite and back.
Before reaching the worksite, the car briefly stopped to refuel.



How far is the worksite from home?

45 km

When did the car stop to refuel?

7 am

How long was the refuelling stop?

15 minutes

How long did the car stop at the worksite?

45 min

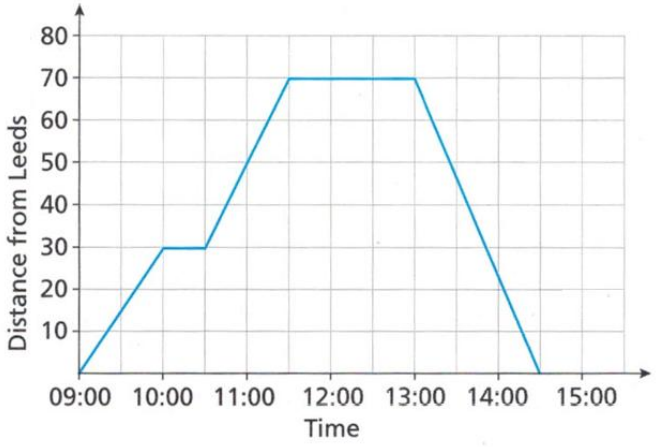
How long did the return journey take?

1 h 45 min

Key ideas

1. Distance – time graphs show a ……
2. The faster the speed, the …… the slope.
3. When the line is horizontal, the object is ……

1 Marta drove from Leeds to Liverpool to deliver a parcel, and then she returned home. The graph shows her journey.



a Marta stopped at a service station on the way to Liverpool. When did she stop and for how long did she stop for?

10:00 for 30 min

b How far is the service station from Leeds?

30 km

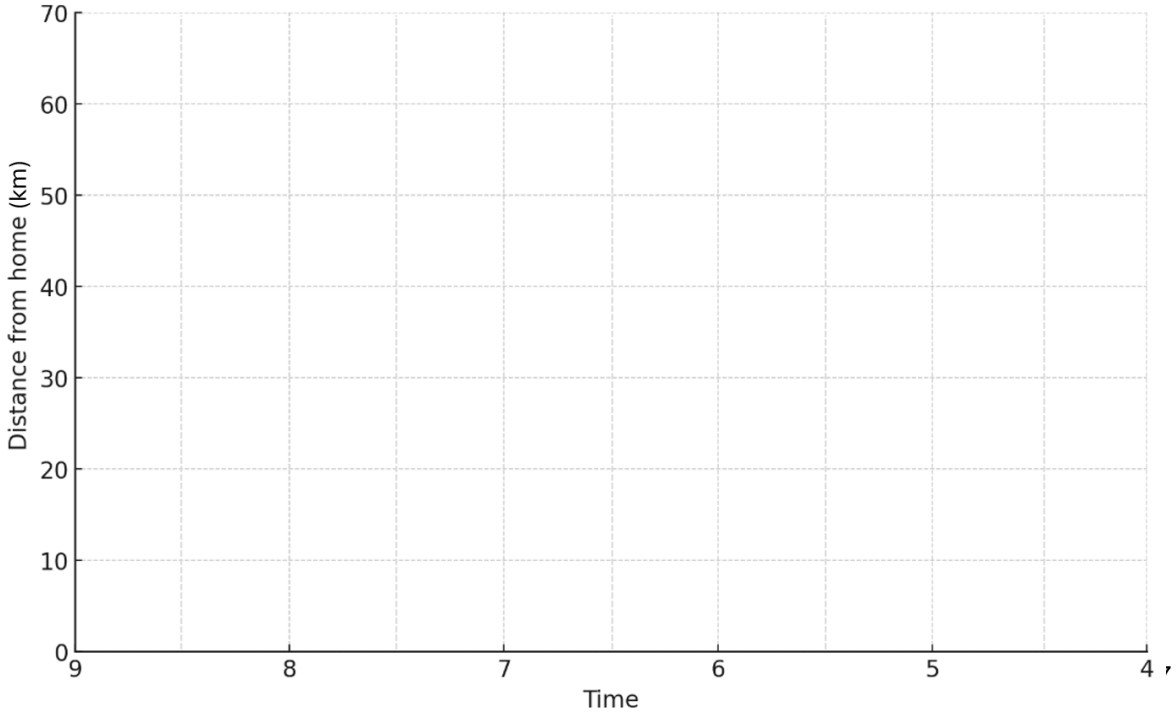
c How far is the service station from Liverpool?

70 – 30 = 40 km

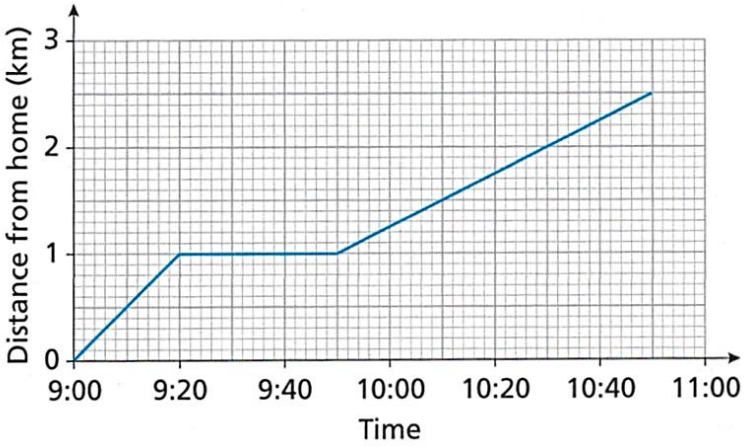
2 Seb went on a day trip to the beach. Here is a description of his journey:

- He left home at 9 a.m.
- He arrived at the beach, 60km away,at 10:30 a.m.
- He stayed at the beach for 3 hours.
- He drove straight home, arriving back at 3:30 p.m.

Represent this information on the graph.



3 This graph shows Emily's journey to the gym.



a After walking 1km, Emily stopped to pick up her friend Ed, but he wasn't ready. How long did she have to wait for Ed?

30 min

b How long did it take Emily and Ed to walk the rest of the way to the gym?

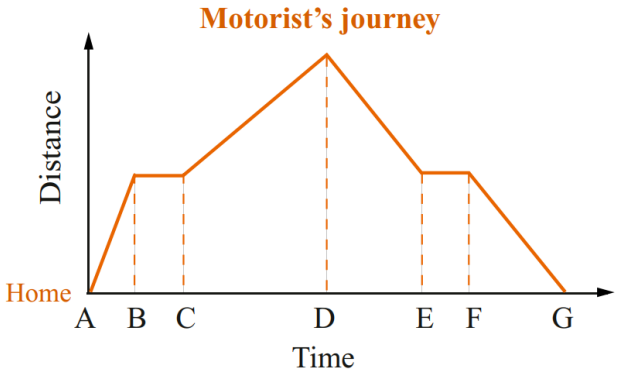
60 min

c Did Emily walk faster when she was on her own or when she was with Ed?

Explain your answer.

On her own. The graph is steeper when Emily was on her own.

4 The graph shows the journey of a motorist.



State the time intervals that represent these situations.

a The motorist was stationary (stopped).

BC and EF

b The motorist was travelling the fastest.

AB

c The motorist was travelling the slowest.

CD

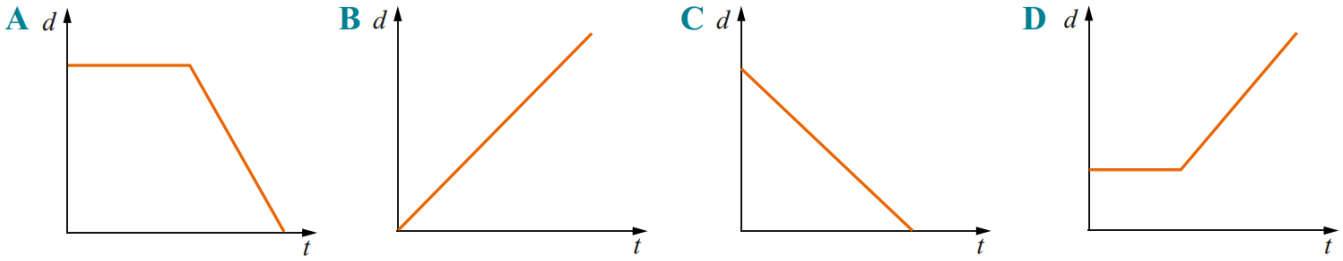
d The motorist's distance from home was increasing.

AB, CD

e The motorist's distance from home was decreasing.

DE, FG

5 Match each of these descriptions to one of the graphs below.



a I left home and travelled at a constant speed for the entire journey.

B

b I returned home travelling at a constant speed.

C

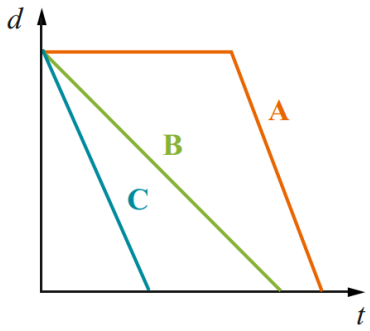
c I waited for my friend to arrive, then we travelled home at a constant speed.

A

d I waited for my friend to arrive, then we completed the journey at a constant speed

D

6 Match each of these descriptions to one of the graphs shown.



a Ashya left school and walked home.

B

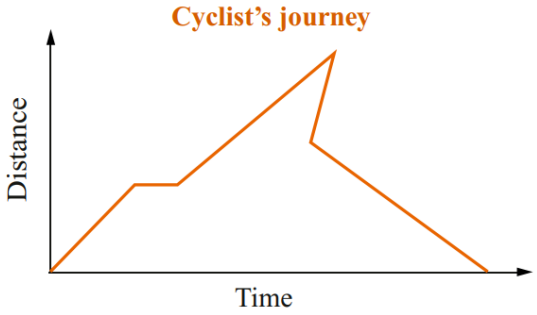
b Her brother Rob left at the same time and rode his bike home.

C

c Their sister Jane talked to a friend for a short time and then caught the bus home from school.

A

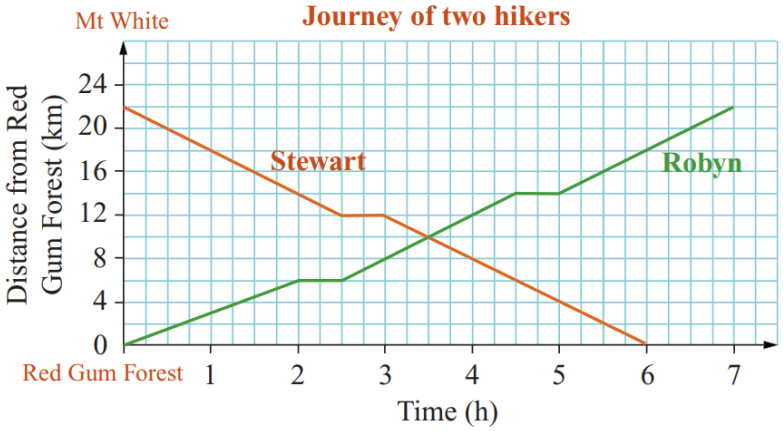
7 Pete drew the distance–time graph shown to represent a trip made by a cyclist.



Explain why Pete's graph is not possible.

There is an interval where the cyclist is going back in time.

8 The graph shows the journeys of two hikers, Robyn and Stewart.
Robyn starts at Red Gum Forest and walks to Mount White.
Stewart starts at Mount White and walks to Red Gum Forest along the same track.



a Who completed the hike in the least time?

Stewart

b When did Robyn and Stewart pass each other?

After 3.5 hours

c At this time, how far was each hiker from their destination?

Stewart: 10 km, Robyn: 12 km

d How far apart were they after 3 hours?

4 km

e How far did Robyn still have to travel when Stewart arrived at Red Gum Forest?

4 km

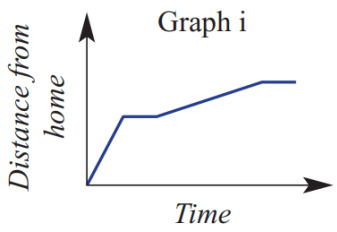
9 Match the distance time graphs to the description of the journey.

Journey A: A man walks slowly away from home, stops for a short time, then continues walking away from home at a fast pace and finally stops again.

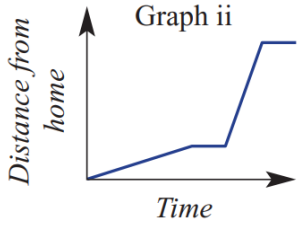
Journey B: A girl walks slowly away from home and then stops for a short time. She then turns around and walks at a fast pace back to her home.

Journey C: A boy walks quickly away from home, briefly stops, then continues slowly walking away from home and finally stops again.

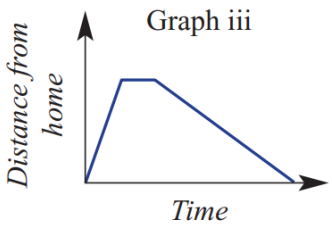
Journey D: A woman walks quickly away from home and then stops briefly. She then turns around and slowly walks back home.



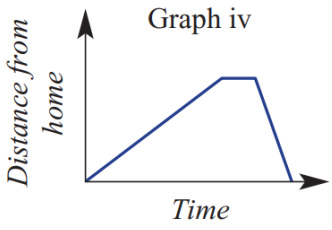
C



A



D



B

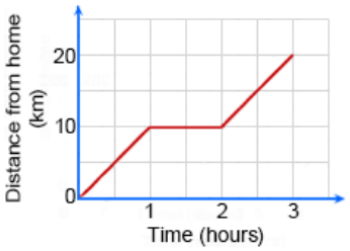
10 Match the distance time graphs to the description of the journey.

Journey A: Susan takes 1 hour to cycle 10 km towards home.
She then cycles 5 km away from home in 1 hour and
then rests for 1 hour.

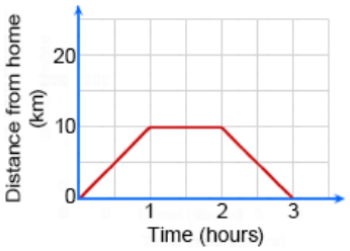
Journey B: Susan takes 1 hour to cycle 10 km towards home.
She stops to rest for an hour and
then cycles another 10 km home in 1 hour.

Journey C: Susan takes 1 hour to cycle 10 km away from home.
She stops to rest for an hour and
then cycles back home in 1 hour.

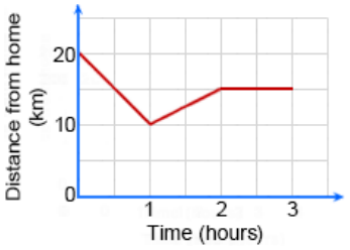
Journey D: Susan takes 1 hour to cycle 10 km away from home.
She stops to rest for an hour and
then cycles 10 km further in 1 hour.



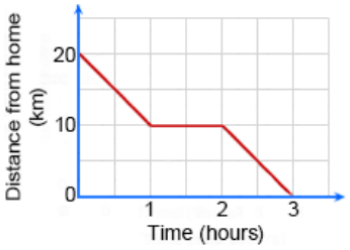
D



C



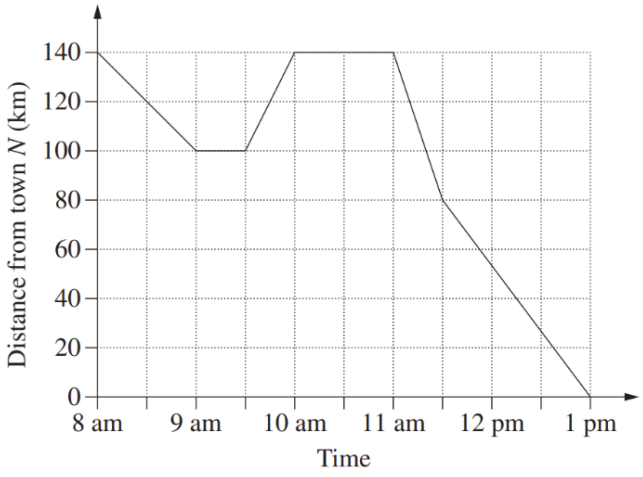
A



B

11 2022 HSC Standard 1

The travel graph displays Jamie's trip which began at town M at 8 am and finished at town N.



a How far apart are the two towns?

140 km

b At what time during the day did Jamie arrive back at town M?

10 am

c What was the total distance that Jamie travelled?

40 + 40 + 120 = 200 km

d Between which times in the day was Jamie travelling at the fastest speed?
Justify your answer, without calculations.

11:00 to 11:30. This is the steepest segment.

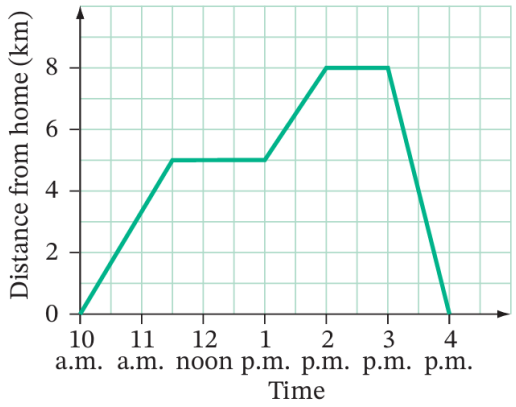
12 Mr Ding's parents wanted him to go to a good school, so he had to travel a long distance. Draw a distance-time graph of his journey from home to school using this information:

1. Mr Ding leaves home at 7:10 am.
2. He walks 20 minutes to Burwood station, a distance of 2 km.
3. He takes the 7:30 am train to Parramatta.
   The train journey takes 20 minutes and covers a distance of 15 km.
4. He waits for 10 minutes at Parramatta for the bus.
5. The bus arrives at school at 8:35 am and travels a distance of 8 km.

CALCULATING SPEED IN DISTANCE-TIME GRAPHS

Example Calculate speed from a distance-time graph.

The distance time graph shows the journey of Bella's bushwalk along a hiking trail.



What was her speed during the first leg of her journey between 10 am and 11:30 am?

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

$$= \frac{5 \text{ km}}{1.5 \text{ h}}$$

$$= 3.33 \frac{\text{km}}{\text{h}}$$

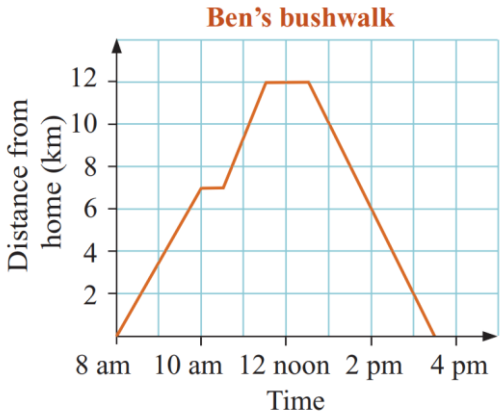
What was her speed during the second leg from 1 pm to 2 pm?

$$\text{speed} = \frac{3 \text{ km}}{1 \text{ h}}$$

$$= 3 \frac{\text{km}}{\text{h}}$$

The distance time graph shows the journey of Ben's bushwalk

What was Ben's speed during:



a the first leg of his journey?

3.5 km/h

b during the second leg of his journey?

5 km/h

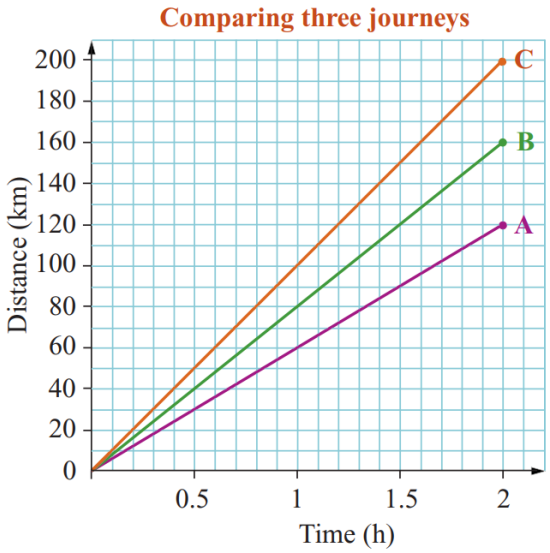
c during the return trip?

4 km/h

d What was Ben's average speed for the entire journey, including the stops?

3.2 km/h

1 Three motorists set out from the same starting point at the same time. The graph shows the distance of each motorist from the starting point for the first 2 hours of their trip.



a Which line is the steepest?

C

a Calculate the speed of each motorist

C: $\frac{\text{distance}}{\text{time}} = \frac{200}{2} =$ ..... km/h

100 km/h

B: .....

80 km/h

A: .....

60 km/h

b The steeper a line is on a distance–time graph,
the ..... the speed of the vehicle.

faster

c Another motorist starts at the same point and travels at 50 km/h for 2 hours.

i Draw the straight-line graph of this journey on the axis above.

The line should start from (0,0) and end at (2,100)

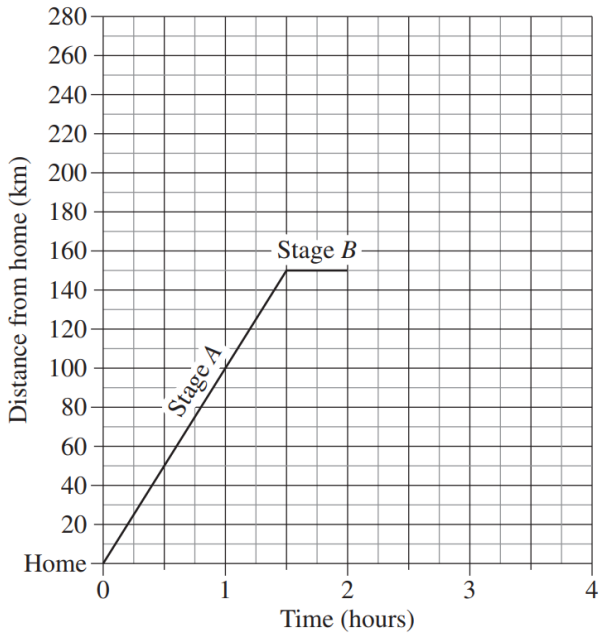
ii Describe the steepness of this line compared to the others, how does this relate to the speed?

It is the least steep as it is the slowest speed.

2 **2023 HSC Standard 1**

The graph shows the first two stages of a car journey from home to a holiday house.

a At what speed, in kilometres per hour, did the car travel during stage A of the journey?



150 km/h in 1h 30 min = 100 km/h

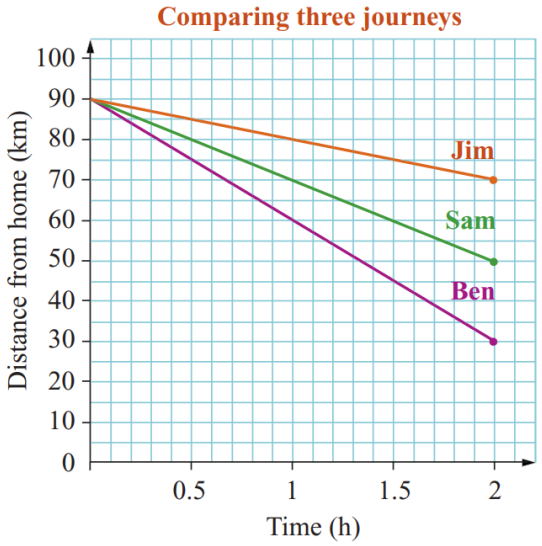
b For how long did the car stop during stage B of the journey?

30 min

c After stage B, the car continues to travel towards the holiday house at a constant speed of 50 km/h for 2 hours.
Graph this part of the journey on the grid.

Straight line connecting (2,150) to (4,250)

3 Three cyclists, Jim, Sam and Ben, set out from the same starting point to travel home.
The graph shows the distance from home of each cyclist for the first 2 hours of their journey.



a How far from home did the cyclists start?

90 km

b How far was Jim from home after 1 hour?

80 km

c When was Sam 80 km from home?

After 30 min

d How long did it take Ben to travel 45 km?

1 h 30 min

e Which line is the steepest?

Ben's journey

f Calculate the speed of each cyclist

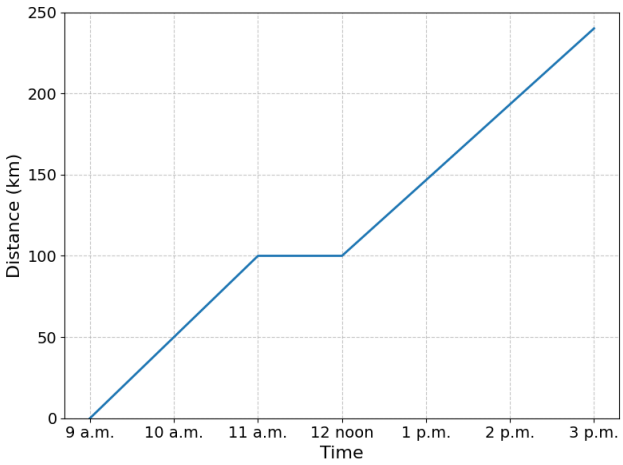
Jim: Sam: Ben:

Jim: 10 km/h, Sam: 20 km/h, Ben: 30 km/h

g Another cyclist starts at the same point and travels at 15 km/h for 2 hours.
Describe the line for this cyclist.

Steeper than Jim but less steep than Sam.

4 Faith travelled 240 km to visit her father.



a Faith made one stop on the journey.
For how long did she stop?

1 h

b Find Faith's average speed between 9 a.m. and 3 p.m, including her stop.

240 ÷ 6 = 40 km/h

c What was Faith's speed between 9 a.m. and 11 a.m.?

50 km/h

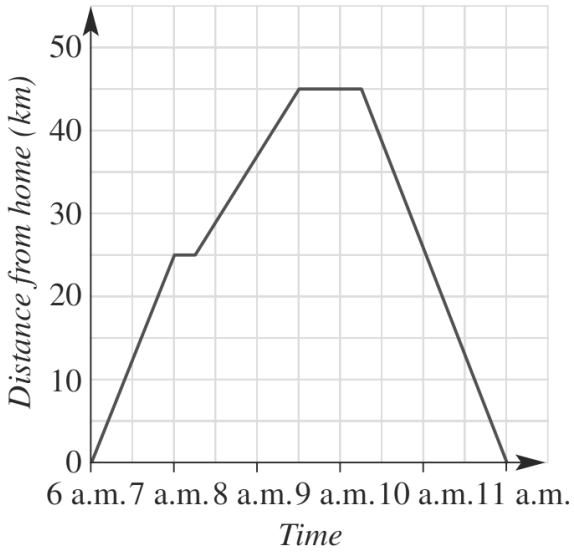
d What was Faith's speed between 12 noon and 3 p.m.?

46.$\dot{6}$ km/h

e Find Faith's average speed for the time she was actually driving, not including her stop.

240 ÷ 5 = 48 km/h

5 This graph shows the journey of a car to a worksite and back.
Before reaching the worksite, the car made a small stop at a petrol station.



a Label the line segments as:
A: Before petrol station
B: After petrol station but before worksite
C: Return from worksite

b What was the car's speed during stage A?

25 km/h

c What was the car's speed during stage B?

16 km/h

d What was the car's speed during stage C?

25.71 km/h

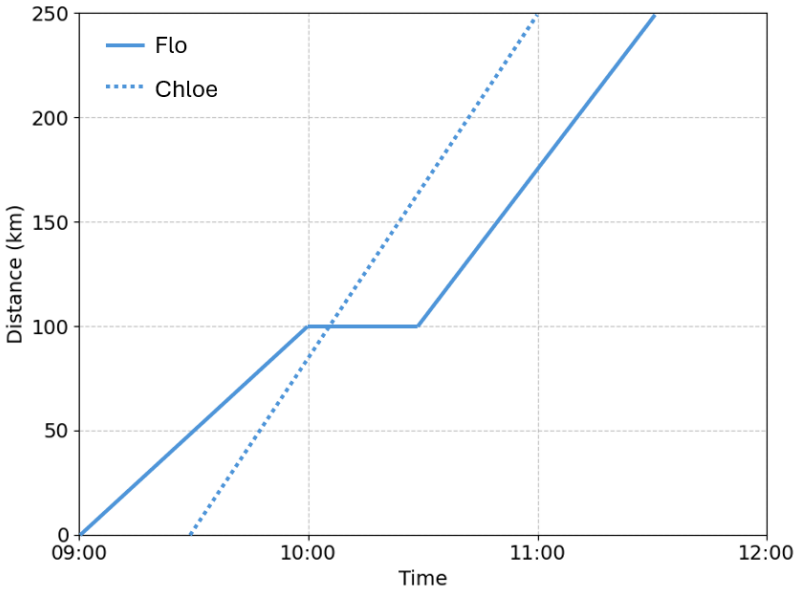
e What distance did the car travel in total?

90 km

f What was the car's average speed for the whole journey, not including the stops?

90 ÷ 4 = 22.5 km/h

6 The graph shows Flo and Chloe's journeys as they drove from home.



a Explain how the graph shows that Chloe cycled at a constant speed for the whole journey.

Her line is a straight line with constant steepness.

b Calculate Chloe's speed, round to one decimal place.

250 ÷ 1.5 = 166.$\dot{6}$ km/h

c Flo stopped to fix a puncture.
For how long did she stop?

30 min

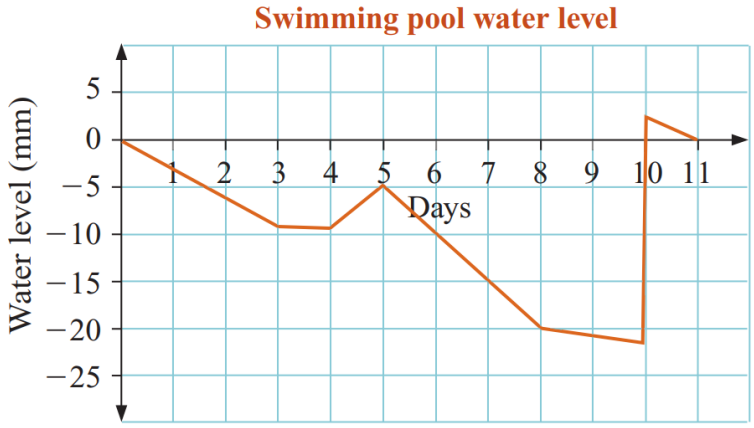
d Find Flo's speed for the remainder of the journey after she fixed the puncture.

150 km/h

e Find Flo's average speed for the whole journey, not including when she was stopped.

250 ÷ 2 = 125 km/h

7 Jade is investigating the rate at which water evaporates from their swimming pool.
One evening she fills the pool and marks a line at the recommended maximum level.
Each day at the same time she measures the distance from that mark to the current water level.
Her results are shown in the graph.



a What was the water level on day 3?

–9 mm

b What was the rate of evaporation in mm per day for the first 3 days?

–3 mm/day

c It rained a little on one day and then more on the next. Which days were these?

Day 3 and day 4.

d Which 3 days were the hottest? (The evaporation is greatest when its hot)

Days 5 6 7

e Jade filled the pool with the hose one evening but forgot to turn it off. When was this?

End of day 9

CHECK YOUR UNDERSTANDING

Check your understanding

1 An object travels 200 km in 3 hours.
What is its average speed in kilometres per hour?

a $66.\dot{6}$ **b** 600 **c** 0.015 **d** 40

2 An object travels 4 hours at an average speed of 45 km/h.
How far has it travelled in kilometres?

a 11.25 **b** 180 **c** $0.0\dot{8}$ **d** 49

3 An object travels 275 kilometres at an average speed of 56 km/h.
How long did it take, in hours?

a 218 **b** 4.91 **c** 15400 **d** 0.20

4 12 minutes is the same as …… hours.

a 0.12 **b** 0.2 **c** 0.25 **d** 0.6

5 1.4 hours is the same as …… minutes.

a 100 **b** 24 **c** 140 **d** 84

6 An object travels 100 km in 22 minutes.
What is the average speed in kilometres per hour?

a $4.\overline{54}$ **b** $0.0\overline{75}$ **c** 132 000 **d** $0.\overline{27}$