Cambridge IGCSE · Mathematics 0580 · Notes

Graphs in practical situations

Read online at **pastopic.com/cambridge/mathematics-0580/notes/graphs-in-practical-situations**

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Read first: **Ratio, proportion and rates**, **Calculators, time and money**

What you need to know

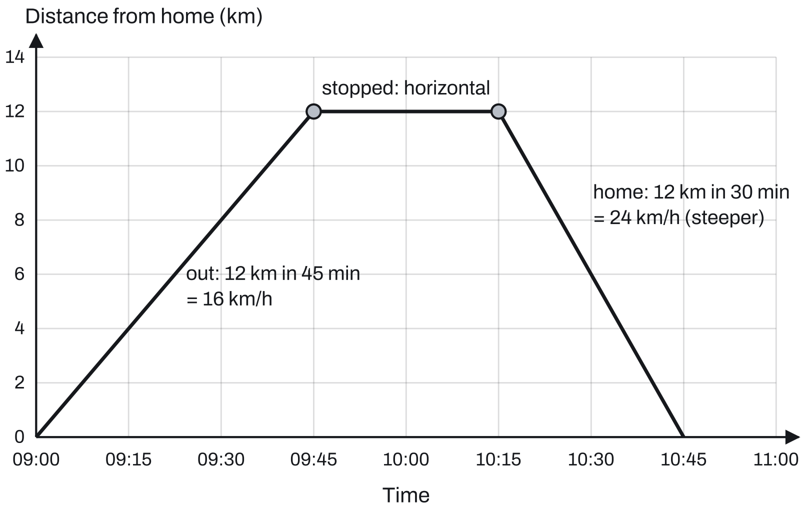
By the end of this topic you should be able to:

1. **Read and interpret graphs of real situations**, especially **travel graphs** (distance–time graphs) and **conversion graphs**. This includes saying what the **gradient** of a straight-line section means: it is a rate of change, such as a speed in km/h.
2. **Draw a graph from given information**, for example a travel graph of a journey described in words, or a conversion graph from one pair of values.
3. **Extended only:** use rates of change for simple motion on **distance–time** and **speed–time** graphs: speed from a distance–time graph, and **acceleration** and **deceleration** from a speed–time graph.
4. **Extended only:** find the **distance travelled** as the **area under a speed–time graph**. The areas are made of straight-line sections only (triangles, rectangles and trapezia).
5. **Extended only:** estimate the gradient of a **curved** graph at a point by drawing a **tangent**, and say what that gradient means (for example the acceleration at that moment).

Understand it

Travel graphs (distance–time graphs)

A travel graph has **time** across the bottom and **distance from a starting place** up the side. Each point says where someone is at that moment. Read the scales carefully: one small square is often 2 minutes, 5 minutes or 0.2 km, not 1.



The shape of the line tells the story:

- **A sloping straight line** means moving at a **constant speed**. Going up means moving away from the start; going down means coming back.
- **A horizontal line** means the distance is not changing: the person has **stopped**. Its length across the page is how long they stopped for.
- **The steeper the line, the faster** the movement.

The **gradient** of a section is $\frac{\text{distance}}{\text{time}}$, which is the **speed**. In the diagram, the ride out covers 12 km in 45 minutes, which is $\frac{3}{4}$ of an hour, so the speed is $12 \div \frac{3}{4} = 16$ km/h. The ride home covers 12 km in 30 minutes: $12 \div \frac{1}{2} = 24$ km/h. That line is steeper because the speed is higher.

Speed, distance and time

$$\text{speed} = \frac{\text{distance}}{\text{time}}, \qquad \text{distance} = \text{speed} \times \text{time}, \qquad \text{time} = \frac{\text{distance}}{\text{speed}}$$

The units must match. For a speed in **km/h**, the time must be in **hours**, so change minutes to hours by dividing by 60:

- 45 minutes $= \frac{45}{60} = 0.75$ hours; 2 hours 24 minutes $= 2 + \frac{24}{60} = 2.4$ hours;
- 2 hours 40 minutes $= 2\frac{2}{3}$ hours $= 2.666\ldots$ hours, **not** 2.4 hours.

Going the other way, 0.35 hours $= 0.35 \times 60 = 21$ minutes.

Average speed for a whole journey is

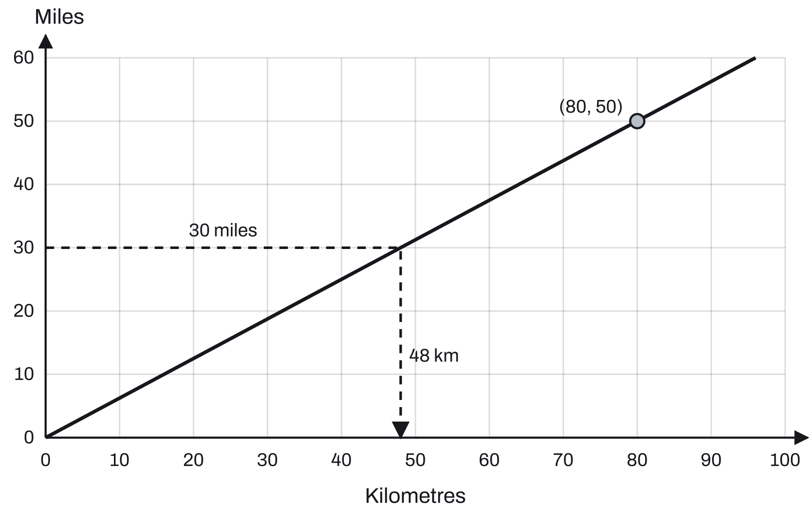
$$\text{average speed} = \frac{\text{total distance}}{\text{total time}},$$

and the total time **includes any stops**. It is **not** the mean of the separate speeds. In the diagram the whole trip is 24 km in 1 hour 45 minutes (1.75 hours), so the average speed is $24 \div 1.75 = 13.7$ km/h (3 s.f.), not $\frac{16+24}{2} = 20$.

To change between **km/h and m/s**: 1 km/h $= \frac{1000}{3600}$ m/s, so divide by 3.6 to go from km/h to m/s, and multiply by 3.6 to go back. For example, 72 km/h $= 20$ m/s.

Conversion graphs

A conversion graph changes one unit or currency into another. When 0 of one is 0 of the other (kilometres and miles, most currencies), the graph is a **straight line through the origin**, so you only need **one** other point to draw it.

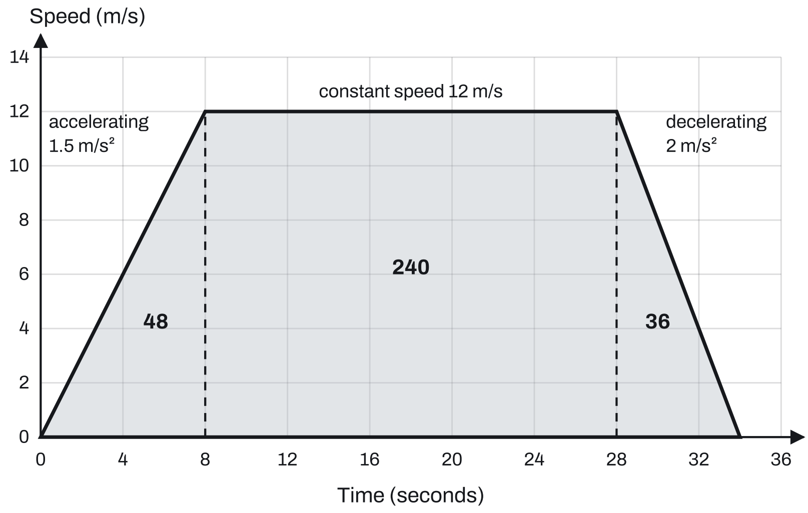


To read it, go **across** from the value you know to the line, then **down** (or up) to the other axis. Here 30 miles is 48 km. For a value off the end of the graph, such as 200 km, use a value you can read and scale it: 80 km $= 50$ miles, so 200 km $= 2.5 \times 50 = 125$ miles.

Some conversion graphs do not go through the origin (for example a taxi fare with a fixed starting charge, or °C and °F), so always use the line itself rather than assuming a simple ratio.

Speed–time graphs (Extended only)

Extended only: a speed–time graph has **time** across and **speed** up the side. Now a horizontal line means **constant speed** (not stopped), and the line touching the time axis means the object is at rest.



The gradient is the acceleration. The speed goes up by 12 m/s in 8 seconds, so the acceleration is $\frac{12}{8} = 1.5$ m/s² (metres per second, every second). A line sloping **down** means the object is slowing: its **deceleration** here is $\frac{12}{6} = 2$ m/s². Give a deceleration as a positive number, because the word "deceleration" already says it is slowing down.

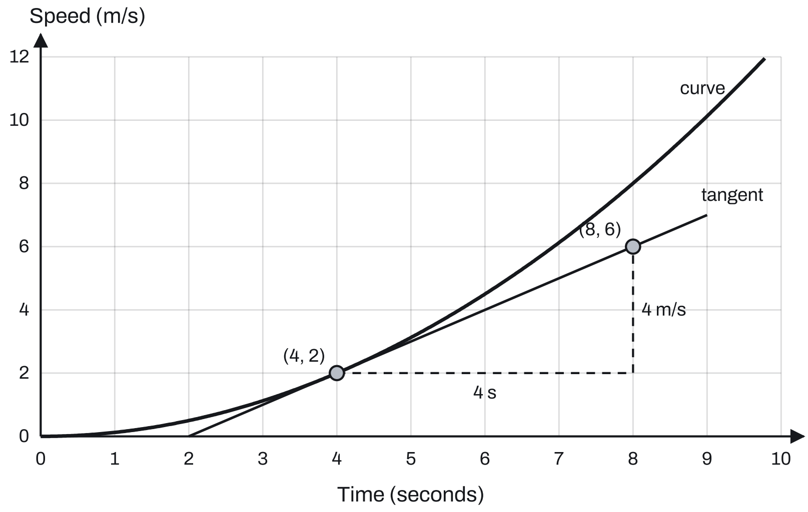
The area under the graph is the distance. For a rectangle this is just speed $\times$ time; the sloping parts give triangles or trapezia. Split the area into shapes:

$$\frac{1}{2} \times 8 \times 12 + 20 \times 12 + \frac{1}{2} \times 6 \times 12 = 48 + 240 + 36 = 324 \text{ m}.$$

The whole shape is also one trapezium with parallel sides 20 and 34 and height 12: $\frac{1}{2}(20 + 34) \times 12 = 324$ m. Always check the units on the axes: speed in km/h with time in **minutes** means changing the minutes to hours before multiplying.

Tangents to a curved graph (Extended only)

Extended only: when the graph is curved, the gradient changes from point to point. To estimate it at one point, draw a **tangent**: a ruled straight line that touches the curve at that point without cutting across it. Then find the gradient of the tangent using two points on it that are far apart.



Here the tangent at 4 seconds goes through $(4, 2)$ and $(8, 6)$, so its gradient is $\frac{6-2}{8-4} = 1$. On a speed–time graph this means the acceleration at 4 seconds is about 1 m/s². On a distance–time graph, the gradient of a tangent is the speed at that moment.

Key facts and formulas

The only formula here that is printed in the exam's list of formulas is the area of a triangle. Learn all the others.

Formula	Status
$\text{speed} = \dfrac{\text{distance}}{\text{time}}$, so $\text{distance} = \text{speed} \times \text{time}$ and $\text{time} = \dfrac{\text{distance}}{\text{speed}}$	Learn it
$\text{average speed} = \dfrac{\text{total distance}}{\text{total time}}$ (stops included)	Learn it
Minutes to hours: divide by 60; hours to minutes: multiply by 60	Learn it
km/h to m/s: divide by 3.6; m/s to km/h: multiply by 3.6	Learn it
Gradient $= \dfrac{\text{change up}}{\text{change across}}$	Learn it
Distance–time graph: gradient $=$ speed; horizontal line $=$ stopped	Learn it
Extended only: speed–time graph: gradient $=$ acceleration (downward slope: deceleration); horizontal line $=$ constant speed	Learn it
Extended only: distance travelled $=$ area under a speed–time graph	Learn it
Area of a triangle $= \frac{1}{2} \times \text{base} \times \text{height}$	Given
Area of a rectangle $= \text{base} \times \text{height}$; area of a trapezium $= \frac{1}{2}(a+b)h$	Learn it

How to do it

In the questions we have tagged for this topic (29 questions, 2021–2025, from all four papers), the types came up this often. 19 of the 29 questions mix types, so the counts add up to more than 29.

Question type	Questions
Distance from the area under a speed–time graph (Extended)	13
Read and interpret a travel graph	9

Question type	Questions
Speed and average speed from a travel graph	9
Acceleration and deceleration from a speed–time graph (Extended)	9
Draw or complete a travel graph	8
Conversion graphs	2
Draw or complete a speed–time graph (Extended)	2
Gradient of a tangent to a curved graph (Extended)	1

1. Distance from the area under a speed–time graph (13 questions)

Extended only.

1. **Check the units** on both axes. If the speed is in km/h and the time in minutes, change the times to hours (divide by 60) before working out any area. If the speed is in m/s and the time in seconds, the distance comes out in metres.
2. **Split the area** under the graph into triangles, rectangles and trapezia, using the times where the graph changes direction.
3. **Work out each area** and add them. A triangle is $\frac{1}{2}\times$ base $\times$ height; a trapezium is $\frac{1}{2}(a+b)h$, with a and b the two parallel sides.

For example, speed rising steadily from 4 m/s to 10 m/s over 6 seconds gives a trapezium: $\frac{1}{2}(4+10)\times 6 = 42$ m. With km/h and minutes: speed rising from 50 to 70 km/h over 6 minutes covers $\frac{1}{2}(50+70)\times\frac{6}{60} = 6$ km.

Variations you will meet:

- **The graph doesn't start at 0.** The first shape is then a trapezium, not a triangle.
- **Average speed from a speed–time graph**: find the total distance (the area), then divide by the total time.
- **Working backwards**: "the total distance is 2300 m; find V". Write the area with V in it, set it equal to the distance and solve (Example 3).
- **After the graph ends**: "it then continues at 6 m/s until it has gone 150 m". Take the graph's distance from 150, then time $=$ distance $\div$ speed for the rest, and add it to the time so far.
- **Two vehicles** on one graph: find each area separately, then compare them as the question asks.
- **Large units**: "after t minutes it has gone 30 km" means changing km to m (or m/s to km/h) so every quantity matches.

2. Read and interpret a travel graph (9 questions)

1. **Read the scales.** Work out what one small square is worth on each axis before you read anything.
2. **Times and distances**: go up or across from the point you want to the axis. A start time is where the line leaves the time axis; an arrival time is where it reaches the destination's distance.

3. **"Explain what is happening"** for a horizontal line: say that the person (or vehicle) has **stopped**, because the **distance from the start is not changing**. Give how long, if asked.
4. **"When is it fastest?"** Choose the **steepest** section, give its start and end times, and say that the line is steepest there (or work out each speed to show it).

Variations you will meet:

- **How long was the stop?** Read both ends of the horizontal line and subtract, in minutes.
- **Two people on one graph**: they **pass each other** (or meet) where their lines **cross**. Read the time and the distance there. If one line goes up and the other comes down, they are travelling towards each other.
- **Named places on the distance axis** (a station part-way, for example): a place's distance is where its label is.
- **A section with a timetable**: plot each arrival and departure time at the right distance and join them with ruled lines.

3. Speed and average speed from a travel graph (9 questions)

1. **Read the distance** travelled (total distance for a whole journey, **both ways** if it goes there and back).
2. **Read the time** taken, from the first time to the last, including any stops. Convert it to hours if the answer is in km/h: 32 minutes $= \frac{32}{60}$ hours.
3. **Divide**: speed $=$ distance $\div$ time.

For example, 8 km in 32 minutes is $8 \div \frac{32}{60} = 15$ km/h.

Variations you will meet:

- **Speed for one section**: use just that line's distance and time (its gradient).
- **Average speed for the whole journey**: total distance $\div$ total time, stops included. Don't average the speeds.
- **A time given as a clock time**, such as "arrives at 16:22": subtract to get hours and minutes, then change to hours.
- **Keep the fraction**: 2 hours 40 minutes is $\frac{8}{3}$ hours. Type it into your calculator as a fraction, or as $160 \div 60$, rather than rounding it first.

4. Acceleration and deceleration from a speed–time graph (9 questions)

Extended only.

1. Pick the straight section you need.
2. **Acceleration** $= \dfrac{\text{change in speed}}{\text{time taken}}$, the gradient. Units: m/s² when the speed is in m/s and the time in seconds.
3. For a section sloping down, give the **deceleration** as a positive number.

Variations you will meet:

- **A horizontal section** has acceleration 0 (constant speed).
- **Find a speed from an acceleration**: speed after t seconds from rest $=$ acceleration $\times\ t$. For example, 2 m/s² for 7 seconds from rest gives 14 m/s.
- **Find a time from a deceleration**: time to stop $=$ speed $\div$ deceleration. From 18 m/s at 1.5 m/s², that is $18 \div 1.5 = 12$ seconds.
- **"Which section cannot be correct?"** A section that goes **back in time** (the line slopes backwards) or shows a negative speed is impossible.
- **Units that need converting**, such as a deceleration in km/h²: change it to m/s² (or change everything else to km and hours) before comparing.

5. Draw or complete a travel graph (8 questions)

1. **Plot the known points**: the start (time, distance) and anywhere the question gives a time and place.
2. **For each moving part**, find the time it takes: time $=$ distance $\div$ speed. Change the answer to minutes ($\times 60$) and add it to the start time to get the end point.
3. **A stop** is a horizontal line for the length of the stop.
4. **Join the points with ruled straight lines**, ending exactly at the right point (for example back at 0 km when the person gets home).

For example, from home at 15:00, 10 km at 12 km/h takes $\frac{10}{12}$ hours $= 50$ minutes, so the first line goes from (15:00, 0) to (15:50, 10).

Variations you will meet:

- **Working backwards from an arrival time**: "she cycles 18 km to a meeting at 24 km/h and arrives at 11:15". The ride takes $\frac{18}{24}$ hours $= 45$ minutes, so it started at 10:30.
- **A second person** who leaves later or from the other end: start their line at the right time **and** the right distance (for someone starting at the far end, that is the top of the graph).
- **A return at an unknown speed**, "arrives home at 17:25": just join the last point to (17:25, 0).
- **Speeds in other units**: a speed of 45 km/h for 54 km takes $\frac{54}{45} = 1.2$ hours $= 1$ hour 12 minutes.

6. Conversion graphs (2 questions)

1. **To draw one** for a straight-line conversion through 0: plot the given pair (such as 80 km $= 50$ miles) and the origin, and join them with a ruled line across the grid.
2. **To read it**: across from the known value to the line, then down to the other axis. Check that the answer makes sense (there are more kilometres than miles in a distance).
3. **For values off the grid**: read an easy value and multiply. If 20 is on the graph and you need 100, read 20 and multiply by 5.

7. Draw or complete a speed–time graph (2 questions)

Extended only.

1. Work out each missing time from what you are told: time to reach a speed $=$ speed $\div$ acceleration; time at a constant speed $=$ distance $\div$ speed; time to stop $=$ speed $\div$ deceleration.
2. Add the times to find where each section ends.
3. Draw ruled lines: sloping up while accelerating, horizontal at a constant speed, sloping down to **exactly** 0 at the stopping time.

For example, a car at 16 m/s travels 240 m at that speed ($240 \div 16 = 15$ seconds), then decelerates at 2 m/s² ($16 \div 2 = 8$ seconds to stop). If the constant speed starts at 12 s, that section ends at 27 s and the car stops at 35 s, which is not the end of the grid.

8. Gradient of a tangent to a curved graph (1 question)

Extended only.

1. Place your ruler so it **touches** the curve at the given time, on the correct side, and does not cut through it. Draw it long.
2. Choose two points on your tangent that are **far apart** and easy to read.
3. Gradient $= \dfrac{\text{change in speed}}{\text{change in time}}$. On a speed–time graph that is the acceleration at that time; on a distance–time graph it is the speed.

Your answer only has to be in a range, because it depends on how you drew the tangent, but a line that misses the point, cuts the curve or has a gap gives a gradient outside the range.

Worked examples

The bold codes show where marks are earned, as in Cambridge mark schemes. The number is how many marks.

- **M1** method mark: for a correct method, even if the numbers slip.
- **A1** accuracy mark: for a correct answer; it needs the M mark before it.
- **B1** mark for a correct result on its own, with no method needed.

Example 1

Leo leaves home at 13:00 and cycles 18 km to a park at a constant speed of 12 km/h. He stays at the park for 40 minutes. He then cycles home at a constant speed of 15 km/h.

(a) Find the time Leo arrives at the park. **[2]**

(b) Find the time Leo arrives home. **[2]**

(c) Describe how Leo's travel graph would look. **[2]**

(d) Calculate Leo's average speed for the whole journey. **[3]**

(a) Time $= 18 \div 12 = 1.5$ hours $= 1$ hour 30 minutes. **M1**

He arrives at 14:30. **A1**

(b) He leaves the park at 14:30 $+40$ min $=$ 15:10. Time home $= 18 \div 15 = 1.2$ hours $= 72$ minutes. **M1**

He arrives home at 15:10 $+$ 1 h 12 min $=$ 16:22. **A1**

(c) A ruled line from (13:00, 0) to (14:30, 18); a horizontal line from (14:30, 18) to (15:10, 18); a ruled line from (15:10, 18) down to (16:22, 0), steeper than the first. **B1** for the horizontal stop, **B1** for both sloping lines ending at the right points.

(d) Total distance $= 18 + 18 = 36$ km. Total time from 13:00 to 16:22 is 3 hours 22 minutes $= 3 + \frac{22}{60} = \frac{101}{30}$ hours. **M1** for the total time in hours, stop included.

$$\text{average speed} = 36 \div \frac{101}{30} = 10.69\ldots = 10.7\ \text{km/h}\ (3\ \text{s.f.})$$

M1 for total distance ÷ total time, **A1**

Example 2

A bus leaves town P at 08:00 and travels 60 km to town Q at a constant speed of 40 km/h. A car leaves Q at 08:30 and travels along the same road to P at a constant speed of 60 km/h.

(a) Find the time each vehicle arrives. **[2]**

(b) Find the time when the bus and the car pass each other, and how far from P they are. **[3]**

(a) Bus: $60 \div 40 = 1.5$ hours, so it reaches Q at 09:30. Car: $60 \div 60 = 1$ hour, so it reaches P at 09:30. **B1 B1**

(b) On a travel graph (distance from P up the side), the bus's line goes from (08:00, 0) to (09:30, 60) and the car's from (08:30, 60) to (09:30, 0). They pass where the lines cross. Reading the graph gives the answer; here it is also worked out exactly.

Let x be the number of hours after 08:00. The bus is $40x$ km from P. The car starts at 60 km and comes back at 60 km/h from $x = 0.5$, so it is $60 - 60(x - 0.5)$ km from P. **M1**

$$40x = 60 - 60(x - 0.5) \;\Rightarrow\; 100x = 90 \;\Rightarrow\; x = 0.9\ \text{hours} = 54\ \text{minutes}.$$

They pass at 08:54, **A1**, $40 \times 0.9 = 36$ km from P. **A1**

Example 3

Extended only. A train starts from rest and accelerates at a constant rate for 40 seconds until it reaches a speed of V m/s. It travels at V m/s for 80 seconds, then decelerates at a constant rate and stops 30 seconds later. The train travels 2300 m altogether.

(a) Find V. **[3]**

(b) Find the acceleration and the deceleration of the train. **[2]**

(c) Find the average speed of the train for the whole journey, in km/h. **[2]**

(a) The area under the speed–time graph is the distance. **M1** for a correct area expression:

$$\frac{1}{2} \times 40 \times V + 80 \times V + \frac{1}{2} \times 30 \times V = 20V + 80V + 15V = 115V.$$

$115V = 2300$, **M1**, so $V = 20$. **A1**

(b) Acceleration $= \frac{20}{40} = 0.5$ m/s². Deceleration $= \frac{20}{30} = 0.667$ m/s² (3 s.f.). **B1 B1**

(c) Average speed $= \frac{2300}{150} = 15.33\ldots$ m/s. **M1**

In km/h: $15.33\ldots \times 3.6 = 55.2$ km/h. **A1**

Example 4

Extended only. A car's speed increases steadily from 36 km/h to 72 km/h in 5 minutes. It then travels at 72 km/h for 10 minutes.

(a) Calculate the total distance travelled in these 15 minutes. **[3]**

(b) Calculate the average speed for the 15 minutes, in km/h. **[1]**

(c) Find the acceleration in the first 5 minutes, in m/s². **[2]**

(a) The speed is in km/h, so the times must be in hours: 5 minutes $= \frac{5}{60}$ h and 10 minutes $= \frac{10}{60}$ h.

Trapezium: $\frac{1}{2}(36 + 72) \times \frac{5}{60} = 4.5$ km. **M1**

Rectangle: $72 \times \frac{10}{60} = 12$ km. **M1**

Total $= 16.5$ km. **A1**

(b) $16.5 \div \frac{15}{60} = 66$ km/h. **B1**

(c) 36 km/h $= 36 \div 3.6 = 10$ m/s and 72 km/h $= 20$ m/s. **M1** for changing the speeds to m/s and the time to 300 seconds.

Acceleration $= \frac{20-10}{300} = 0.0333$ m/s² (3 s.f.). **A1**

Common mistakes

- **Writing minutes as a decimal of an hour wrongly.** 2 hours 40 minutes is 2.67 hours, not 2.4; 50 minutes is 0.833 hours, not 0.5. Examiners mention this in almost every session. Divide the minutes by 60.
- **Averaging the speeds.** The average speed for 25 km/h then 15 km/h is not 20 km/h. Use total distance $\div$ total time.

- **Leaving out the stop** from the total time, or using a clock time (such as 09:36) as if it were the time taken.
- **Forgetting the return half** of a there-and-back journey when finding the total distance.
- **Reading the scale wrongly**, for example taking one small square as 1 minute when it is 2 or 5. Check the scale first, every time.
- **Freehand or broken lines** on a drawn graph. Use a ruler, and make each line start and end exactly at the right points: a return journey must reach 0 km at the arrival time, and a speed–time graph must reach the axis at the stopping time, not the edge of the grid.
- **Extended only: forgetting the $\frac{1}{2}$** in a triangle's area, or finding the whole area as a rectangle (speed $\times$ total time) when part of the graph slopes.
- **Extended only: mixing units** under a speed–time graph: km/h with minutes gives an answer 60 times too big. Change minutes to hours first.
- **Extended only: using area when the gradient is needed**, or the other way round. Gradient $=$ acceleration; area $=$ distance. Some candidates also find the length of the sloping line with Pythagoras, which means nothing here.
- **Extended only: finding the area under a distance–time graph.** That area has no meaning; on a distance–time graph, read the distance straight off the axis.
- **Extended only: a poor tangent**: one that cuts the curve, misses the given point, or is drawn at the wrong time gives a gradient outside the accepted range.

How to get the marks

- **Show the calculation**, such as $12 \div \frac{45}{60}$ or $\frac{1}{2} \times 6 \times 18 + 10 \times 18$. Method marks are given for a correct division or a correct area even if the final answer slips.
- **Times in hours** for km/h. Write the conversion ($\frac{40}{60}$ h) so the examiner can see it.
- **Drawing a graph**: ruled straight lines, starting and ending at the exact points. Each correct line usually earns its own mark, and a later line can still score if it follows correctly from your earlier wrong one, so keep going.
- **"Explain"** a horizontal travel-graph line with a reason: "he stopped, because the distance does not change" (or "the line is horizontal").
- **"Between which times"** needs both times read from the graph, in the same form as the axis (for example 09:45 and 10:15).
- **Units**: km/h, m/s, m/s², m or km, as the question asks. If it says "in kilometres per hour", convert at the end.
- **Accuracy**: give non-exact answers to 3 significant figures (such as 13.7, not 14), unless the question asks for something else. Keep full values in your calculator until the end.
- **Extended only: "deceleration"** is given as a positive number.
- **Extended only: a tangent estimate** earns its marks for a ruled tangent at the right point, then the gradient from two far-apart points on it.

Quick check

1. Maria leaves at 13:25 and arrives at 14:10, having travelled 9 km. Find her average speed in km/h.
2. A conversion graph is a straight line through $(0, 0)$ and $(20, 44)$, showing that 20 kg $= 44$ lb. How many kilograms are 33 lb? How many pounds are 150 kg?
3. **Extended only.** A cyclist's speed increases steadily from 4 m/s to 16 m/s in 6 seconds. She then decelerates steadily and stops 8 seconds later. Find the acceleration, the deceleration and the total distance travelled.
4. **Extended only.** A car starts from rest and accelerates at 2.5 m/s² for 8 seconds. It then travels at a constant speed until it has gone 400 m altogether. Find the total time taken.
5. A train leaves at 08:40 and arrives at 11:55, a distance of 260 km. Find its average speed.

Answers

1. 45 minutes $= 0.75$ hours. Speed $= 9 \div 0.75 = 12$ km/h.
2. 1 lb $= \frac{20}{44}$ kg, so 33 lb $= 33 \times \frac{20}{44} = 15$ kg (or read it from the graph). 150 kg $= 150 \times \frac{44}{20} = 330$ lb.
3. Acceleration $= \frac{16-4}{6} = 2$ m/s². Deceleration $= \frac{16}{8} = 2$ m/s². Distance $= \frac{1}{2}(4+16) \times 6 + \frac{1}{2} \times 8 \times 16 = 60 + 64 = 124$ m.
4. Speed after 8 s $= 2.5 \times 8 = 20$ m/s. Distance so far $= \frac{1}{2} \times 8 \times 20 = 80$ m. The other 320 m at 20 m/s takes $320 \div 20 = 16$ s. Total time $= 8 + 16 = 24$ seconds.
5. 08:40 to 11:55 is 3 hours 15 minutes $= 3.25$ hours. Speed $= 260 \div 3.25 = 80$ km/h.

Past questions to try

- **0580/31/M/J/23 Q8**: two people on one travel graph; speed, a stop and completing both journeys.
- **0580/33/O/N/22 Q4**: the fastest section, drawing a second journey and where two people pass.
- **0580/22/O/N/21 Q11**: completing a speed–time graph from accelerations and a distance.
- **0580/42/F/M/25 Q16**: a tangent to a curved speed–time graph, and average speed from an area.