

CHAPTER 6 / 6B

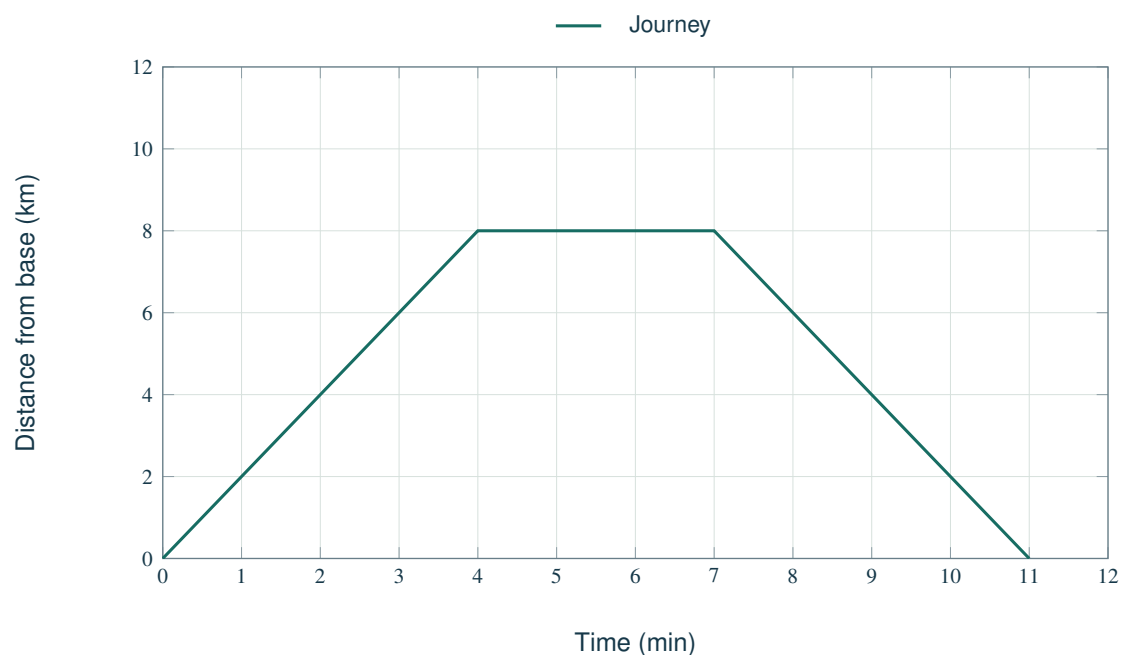
Distance–time graphs

Name: _____ Class: _____ Date: _____

Tell the story of a journey from its graph. All journeys in this worksheet take place along one straight route. Distinguish distance from base from total distance travelled, and use time intervals to compare motion.

What you will learn

- Interpret sloping and horizontal journey segments.
- Calculate travel times, speeds and total distance.
- Construct and compare complete journey plans.

See the mathematics

Learning map: follow an outward trip, a stop and a return along one straight road.

Key ideas

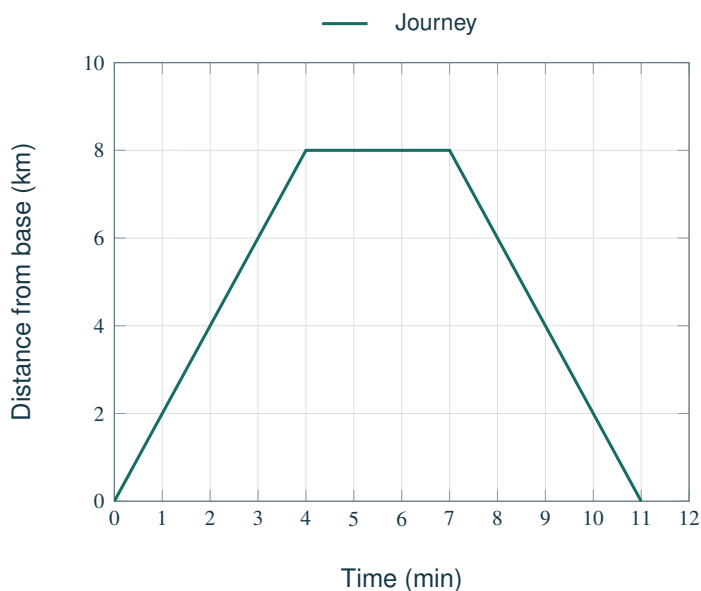
- Read the vertical-axis label: distance from base can decrease on a return trip.
- For motion along one straight route, a flat distance-from-base segment means the traveller is stationary.
- Gradient gives speed magnitude; a downward distance-from-base segment indicates return.
- Total distance is the sum of the magnitudes of each moving segment's distance change.

Pages 1–8: student resource. Pages 9–10: worked answers.

Worked examples / connect the calculation to the graph

1. Out, wait and return

A tracker records $(0, 0)$, $(4, 8)$, $(7, 8)$, $(11, 0)$, in minutes and kilometres from base. Find the stop duration and total distance travelled.



1. The horizontal section lasts $7 - 4 = 3$ min.
2. The vehicle travels 8 km outward and 8 km back.

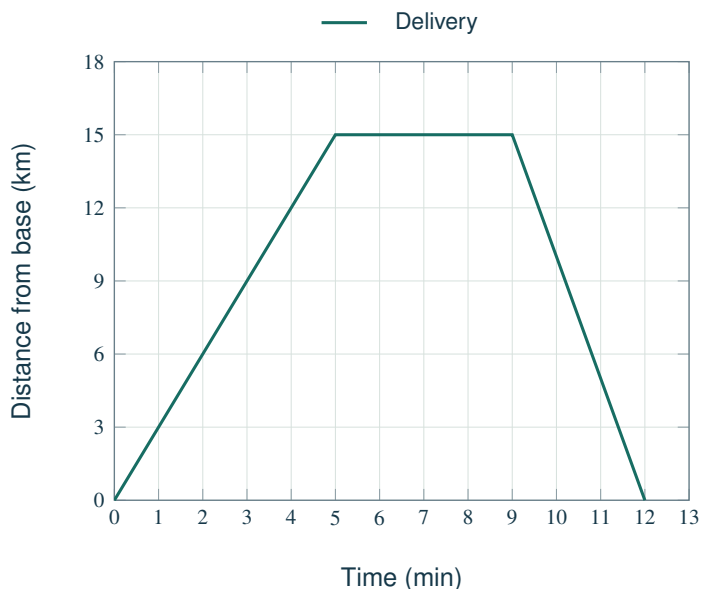
Result

Stop: 3 min. Total distance: 16 km.

Worked example: a stop and return are separate parts of the full trip.

2. A faster return

A vehicle travels 15 km out at 3 km/min, waits 4 minutes and returns at 5 km/min. Find the total time.



1. Outward time = $\frac{15}{3} = 5$ min; return time = $\frac{15}{5} = 3$ min.
2. Add the 4-minute stop: $5 + 4 + 3 = 12$ min.

Result

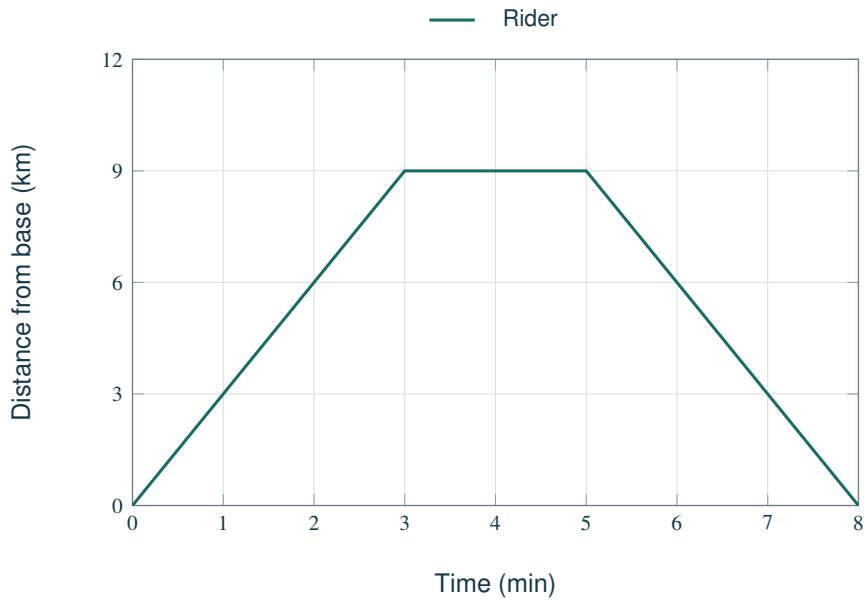
12 minutes.

Worked example: the return trip is faster than the outward trip.

Read a recorded journey

Use the graph to record your thinking. Show calculations and include units where needed.

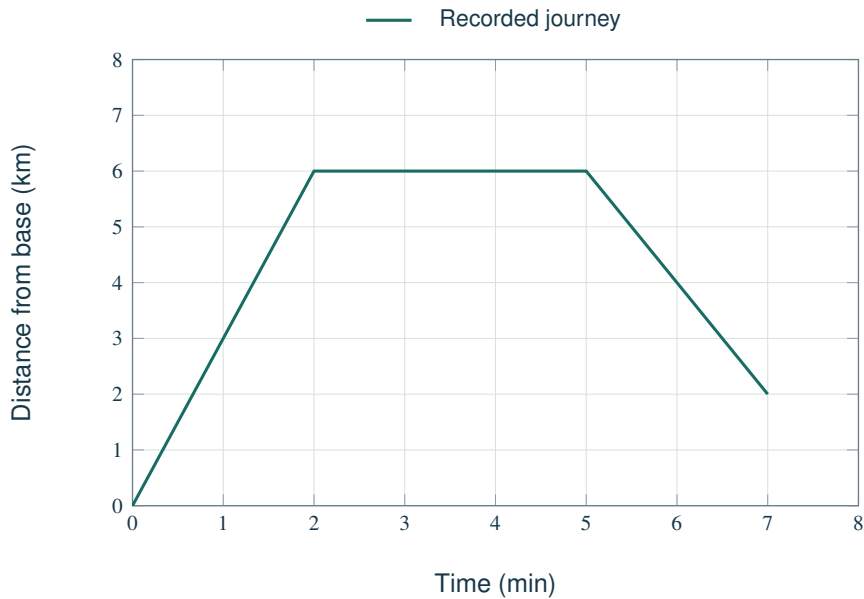
1. Read the journey graph. How far is the rider from base at 2 minutes? When is the rider stationary? When does the rider return to base?



WORKING / DECISION

Read the quantities, scales and labelled line before answering.

2. A journey is recorded as $(0,0)$, $(2,6)$, $(5,6)$, $(7,2)$, with time in minutes and distance from base in kilometres. Find the outward speed and the stop duration.



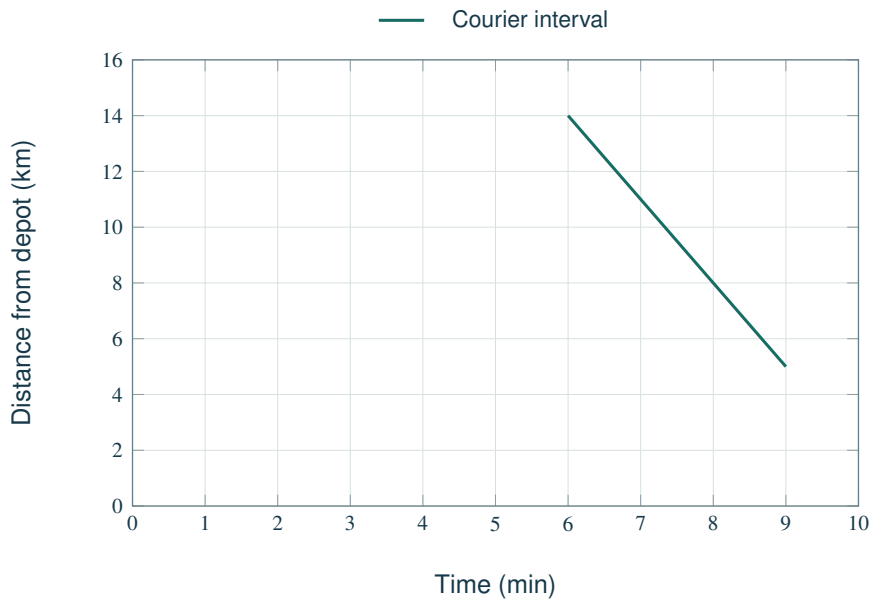
WORKING / DECISION

Use the joined segments to distinguish travel from waiting.

Read a recorded journey

Use the graph to record your thinking. Show calculations and include units where needed.

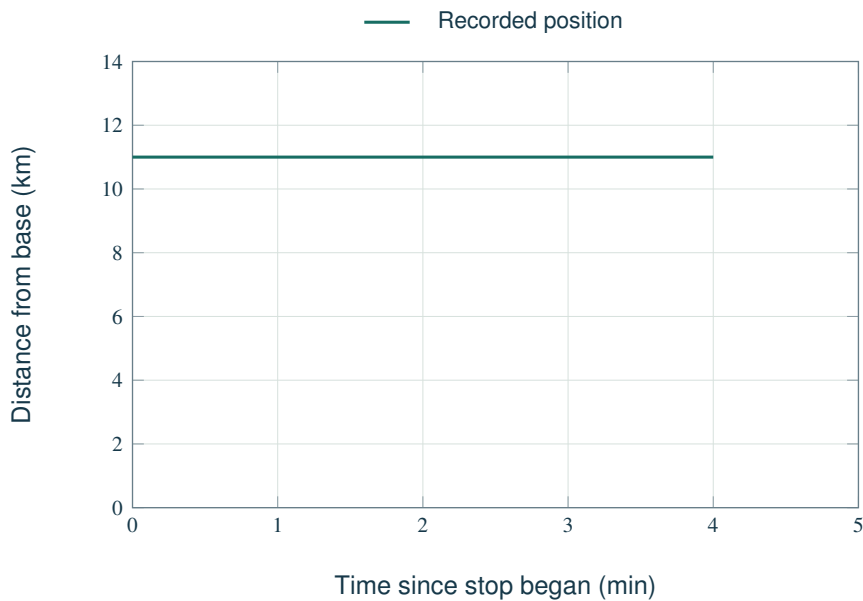
3. A courier's distance from the depot changes from 14 km at 6 minutes to 5 km at 9 minutes. Is the courier heading toward or away from the depot? Find the speed.



WORKING / DECISION

Only the measured interval is shown. Interpret its direction and rate.

4. A graph is flat at a distance of 11 km from base for 4 minutes. A student says the vehicle travels 11 km in those 4 minutes. Explain the error.



WORKING / DECISION

Describe what changes, and what stays fixed, during this interval.

Reconstruct and compare

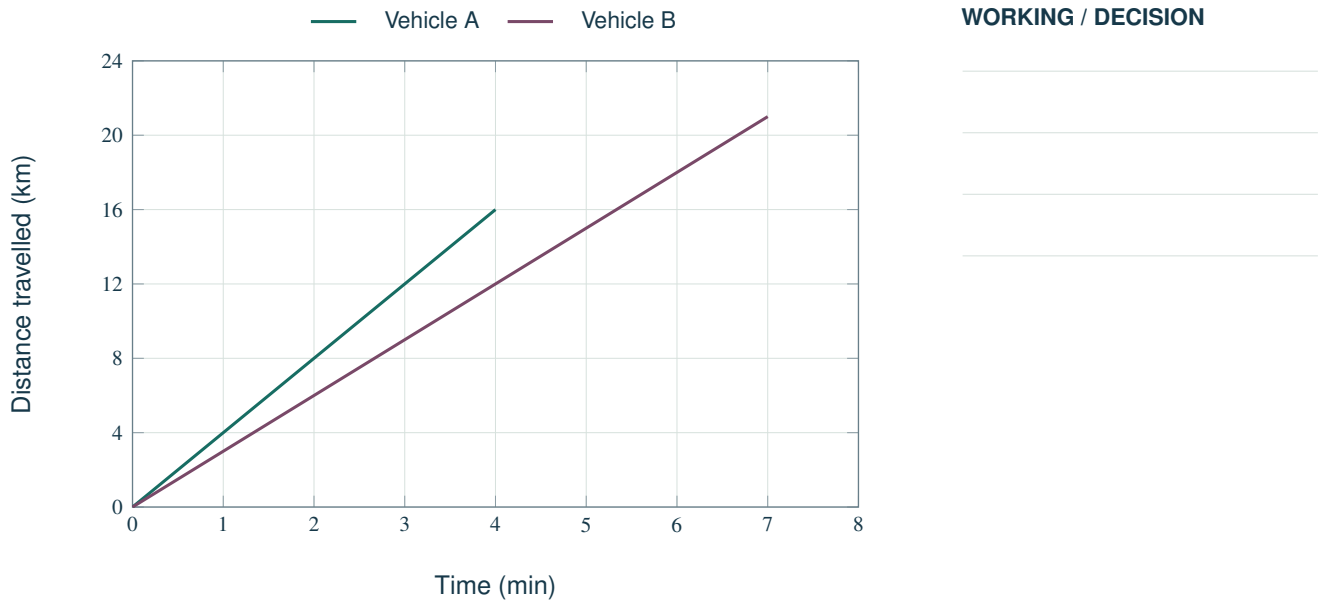
Use the graph to record your thinking. Show calculations and include units where needed.

5. A route goes from base to 10 km away, returns to the 4 km mark, then goes outward to the 7 km mark. Find total distance travelled and final distance from base.



Checkpoints show travel order only. Equal horizontal spacing does not imply equal travel time.

6. Vehicle A travels 16 km in 4 min. Vehicle B travels 21 km in 7 min. Which has the steeper distance–time graph when the scales are identical?

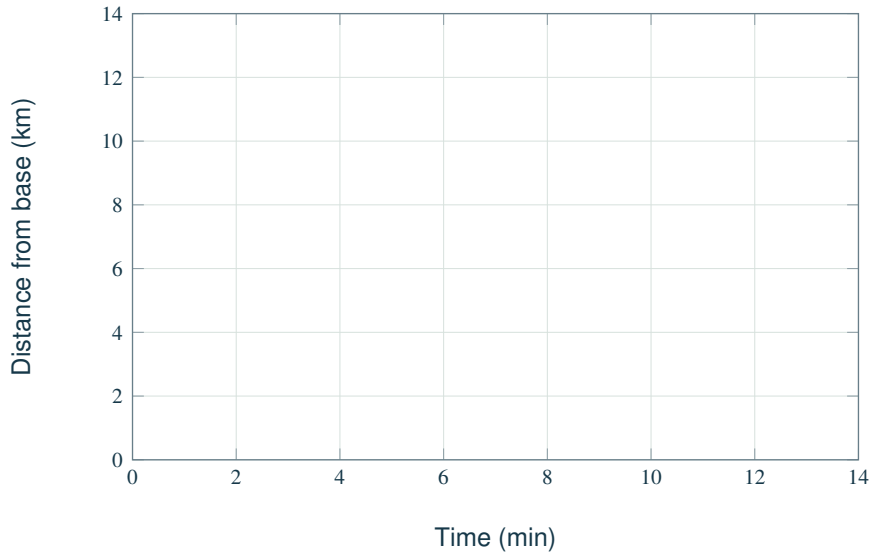


Compare the vehicles on the same time and distance scales.

Reconstruct and compare

Use the graph to record your thinking. Show calculations and include units where needed.

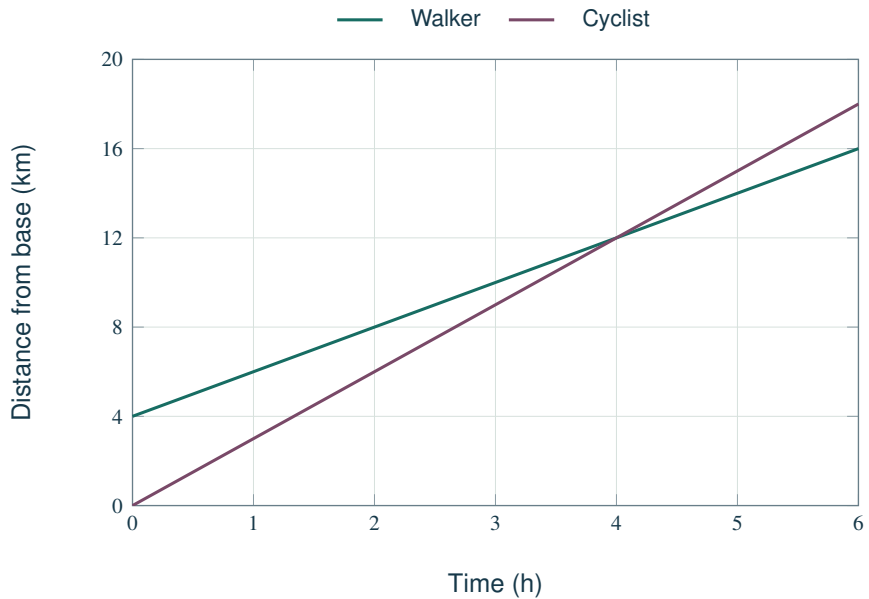
7. Sketch a distance-from-base graph for a 12 km outward trip in 4 min, a 3 min stop, and a return to base in 6 min. Give the coordinates of each change of activity.



Use these labelled axes to construct and check the requested graph.

WORKING / DECISION

8. The graph shows a walker and a cyclist on the same straight path, with time measured in hours. Find their meeting time and distance from base. Which starts ahead?



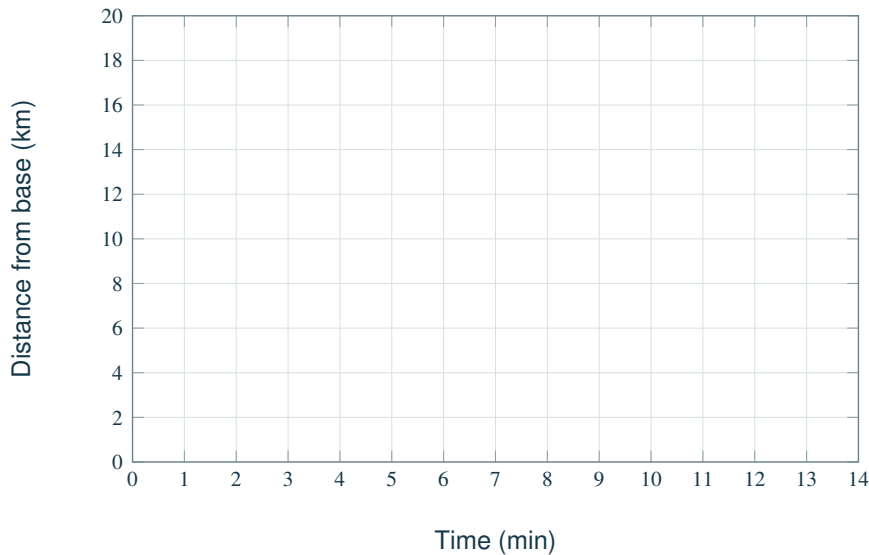
Read the quantities, scales and labelled line before answering.

WORKING / DECISION

Plan the whole journey

Use the graph to record your thinking. Show calculations and include units where needed.

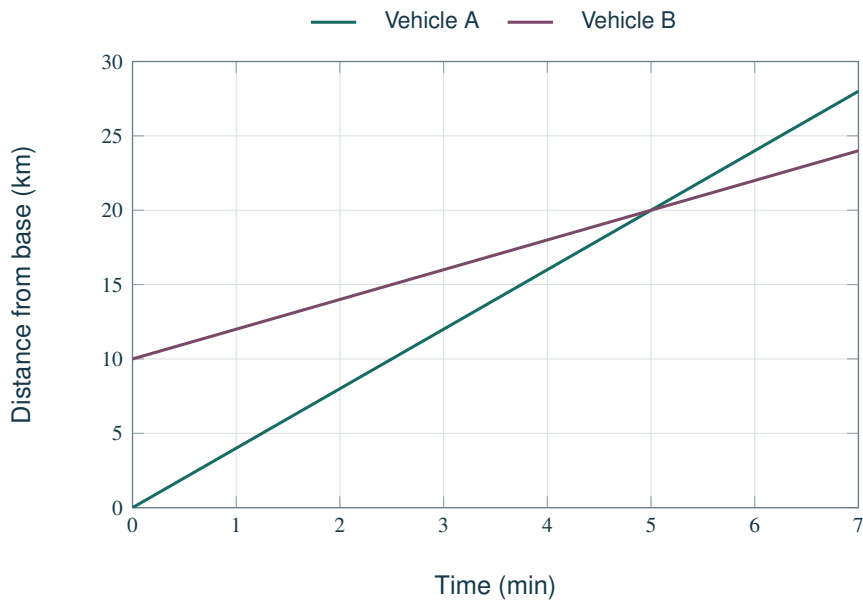
9. A van travels 18 km out at 3 km/min, stops for 2 min and returns at 6 km/min. Will it finish within 12 minutes? Show the complete time.



WORKING / DECISION

Draw the complete outward journey, stop and return before checking the deadline.

10. Two vehicles follow $dA = 4t$ and $dB = 2t + 10$, with time in minutes and distance from base in kilometres. Find when and where A catches B.



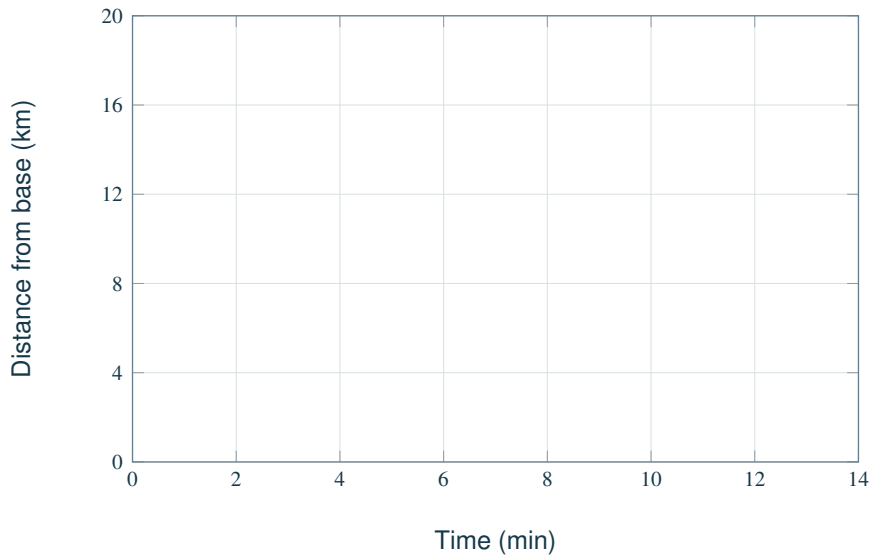
WORKING / DECISION

A handover needs the same position at the same time.

Plan the whole journey

Use the graph to record your thinking. Show calculations and include units where needed.

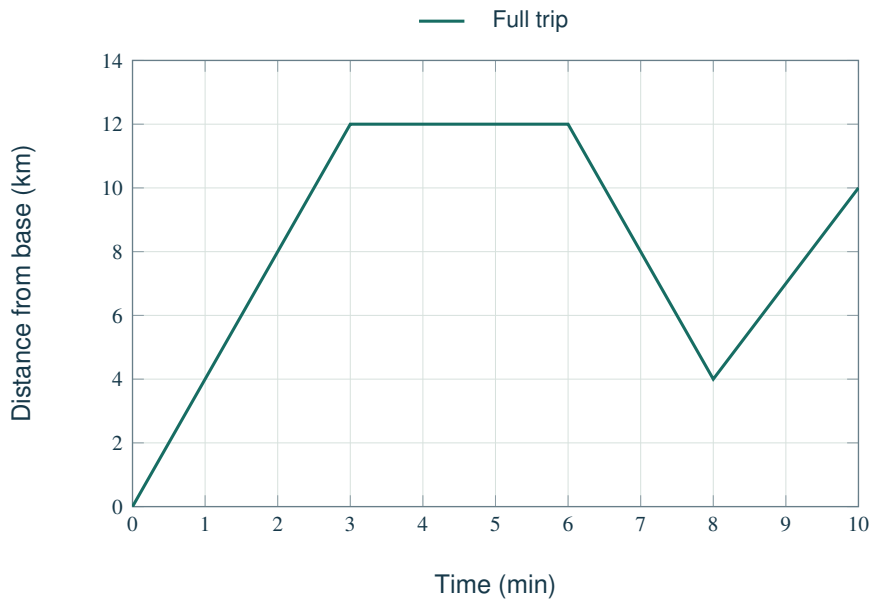
11. A 16 km delivery requires a 4-minute stop and a return to base. Van P costs \$80 and travels 4 km/min. Van Q costs \$115 and travels 8 km/min. The deadline is 12 minutes and the budget is \$100. Choose a van.



WORKING / DECISION

Sketch the plan for each candidate, including the delivery stop. Use the hire costs from the question.

12. A trip has points (0, 0), (3, 12), (6, 12), (8, 4), (10, 10), in minutes and kilometres from base. Find the total distance, total stationary time and greatest speed.



WORKING / DECISION

The axes show distance from base, not an odometer reading.

6B / Worked answers

Teacher appendix. Equivalent exact forms are accepted. Use the reasoning to check student work.

1. 6 km; from 3 to 5 min; returns at 8 min.

- The first segment rises 3 km per minute, so at 2 min the rider is 6 km out.
 - The graph is horizontal between 3 and 5 min, then reaches zero at 8 min.
-

2. 3 km/min; 3-minute stop.

- Outward speed = $\frac{6}{2} = 3$ km/min.
 - The stop lasts from minute 2 to minute 5, or 3 min.
-

3. Toward the depot; 3 km/min.

- Distance from depot decreases by 9 km.
 - Speed magnitude = $\frac{9}{9-6} = 3$ km/min.
-

4. It remains 11 km from base and travels no distance during the flat section.

- The vertical value describes position relative to base.
 - A flat section has zero change in distance from base, so the vehicle is stationary.
-

5. 19 km travelled; 7 km from base.

- Add 10 km out, $10 - 4 = 6$ km back and $7 - 4 = 3$ km out.
 - $10 + 6 + 3 = 19$ km; the final position is 7 km.
-

6. Vehicle A.

- A's speed is $\frac{16}{4} = 4$ km/min.
 - B's speed is $\frac{21}{7} = 3$ km/min, so A's graph is steeper.
-

6B / Worked answers

Teacher appendix. Equivalent exact forms are accepted. Use the reasoning to check student work.

7. (0, 0), (4, 12), (7, 12), (13, 0), joined in order.

- After driving 4 min the vehicle is 12 km away.
 - The stop ends at 7 min; the 6 min return ends at 13 min.
-

8. Meet at 4 hours and 12 km; walker starts 4 km ahead.

- The lines intersect at (4, 12): 4 hours after the cyclist starts, 12 km from base.
 - At time zero the walker is at 4 km while the cyclist is at 0 km.
-

9. Yes; it takes 11 minutes.

- Outward time is $\frac{18}{3} = 6$ min; return time is $\frac{18}{6} = 3$ min.
 - Total = $6 + 2 + 3 = 11$ min.
-

10. 5 minutes; 20 km from base.

- Set $4t = 2t + 10$, so $t = 5$.
 - Substitute into either expression: $d = 20$ km.
-

11. Van P; 12-minute journey costing \$80.

- P takes $\frac{32}{4} + 4 = 12$ min and is within budget.
 - Q takes $\frac{32}{8} + 4 = 8$ min but exceeds the \$100 budget.
-

12. 26 km; 3 min stationary; greatest speed 4 km/min.

- Total distance = $12 + 8 + 6 = 26$ km; the stop lasts $6 - 3 = 3$ min.
 - Moving speeds are $\frac{12}{3} = 4$, $\frac{8}{2} = 4$ and $\frac{6}{2} = 3$ km/min.
-