

C2.9 Graphs in practical situations

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS distance • conversion graph • gradient • axis
• coordinates

Objective

Use graphs in practical situations to solve Core IGCSE Mathematics problems.

You must be able to:

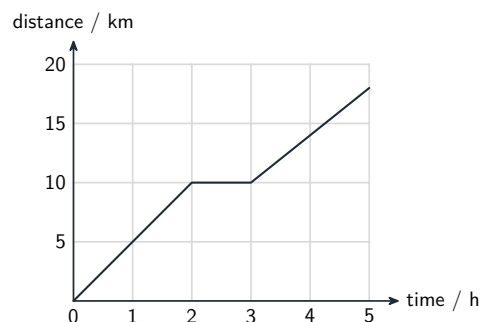
- Read practical graphs with their axis units
- Interpret gradient and stationary sections
- Plot cumulative journey times and find a whole-journey average

1 Key knowledge and worked examples

■ Key knowledge: Graphs in practical situations

Read both axis labels and units before interpreting a graph. On a distance-time graph the gradient is speed; a horizontal section means stopped. Plot time horizontally and distance vertically, joining consecutive data points. On a conversion graph, read one quantity across to the line and then to the other axis. Average speed uses the whole journey time.

■ Worked example: Graphs in practical situations



A journey graph joins $(0, 0)$, $(2, 10)$, $(3, 10)$, $(5, 18)$ with time in hours and distance in km.

- First section: $v = \Delta d / \Delta t = 10/2 = 5$ km/h.

- Between 2 h and 3 h the distance stays 10 km: stopped for 1 h.
- Whole journey: $v_{\text{average}} = 18/5 = 3.6$ km/h.
- A conversion $K = 1.6M$ gives $K = 1.6(5) = 8$ km for 5 miles.
- A new distance-time table starts with $(0, 0)$, includes one point at each journey change, and uses total elapsed time. After 2 h covering 10 km, a 1 h stop ends at $(3, 10)$, not $(1, 10)$.

■ Method check

Journey times on a graph are cumulative. After a rest, add its duration to the time already elapsed; keep the distance unchanged.

2 Practice

2.1 A distance-time line rises from 0 km at 0 h to 24 km at 3 h. Find its speed. [2]

2.2 A graph is horizontal from 09:20 to 09:55. State what happens and for how long. [2]

2.3 A conversion line follows $Y = 7X$. Find Y when $X = 12$ and X when $Y = 56$. [2]

2.4 Draw a distance-time graph through $(0, 0)$, $(1, 6)$, $(2, 6)$, $(4, 14)$, using h and km. [2]

3 Exam-style questions

3.1 Apply the graphs in practical situations methods below. Show working and include units where appropriate.

(a) A walker covers 9 km in 2 h, stops for 30 min, then covers 6 km in 1.5 h. Give the time-distance coordinates for the whole journey. [2]

(b) Find the speed in the final moving section. [2]

(c) Find the average speed for the whole journey. [2]

3.2 A car travels 30 km in 30 min, rests for 15 min, then travels another 45 km in 45 min.

(a) Give the distance-time coordinates, in minutes and km, at the start and each change of activity. Draw the graph. [3]

(b) Find the speed in each moving section and the average speed for the whole journey. Explain the difference. [3]

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

- $v = \Delta d / \Delta t = 24/3 = \mathbf{8}$ km/h.

2.2

- No distance change means **stopped for 35 minutes**.

2.3

- $Y = 7(12) = \mathbf{84}$; $X = 56/7 = \mathbf{8}$.

2.4

- **Plot the four points and join consecutive points by straight lines.** The middle section is horizontal.

3.1

(a)

- With time in hours: $(0, 0)$, $(2, 9)$, $(2.5, 9)$, $(4, 15)$. Join consecutive points.

(b)

- $v = 6/1.5 = \mathbf{4}$ km/h.

(c)

- $v_{\text{average}} = 15/(2 + 0.5 + 1.5) = 15/4 = \mathbf{3.75}$ km/h.

3.2

(a)

- Plot **(0,0)**, **(30,30)**, **(45,30)**, **(90,75)**.
- Label minutes and km on the axes and join consecutive points by straight segments, including the horizontal rest.

(b)

- $v_1 = 30/(30/60) = 60$ and $v_2 = 45/(45/60) = \mathbf{60}$ km/h.
- Whole-journey $v = 75/(90/60) = \mathbf{50}$ km/h.
- The rest lowers the average despite equal moving speeds.