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P9 Motion – Aiming for Grade 6

Aims

Use the following questions to test your knowledge of motion equations and graphs. The formulae for speed and acceleration have to be learnt. If you get any questions wrong make sure you find out why, and how to solve them in the future.

Learning outcomes

After completing this activity, you should be able to:

- calculate speed, distance or time using the formula for speed
- calculate acceleration, time or change in velocity using the formula for acceleration
- describe motion shown on distance–time and velocity–time graphs
- calculate speed from a distance–time graph
- calculate distance travelled and acceleration from a velocity–time graph.

Task A Speed calculations

- 1 A car travels 60 miles in 2 hours. Calculate its average speed. (2)

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- 2 A plane travels 2400 km in 3 hours. Calculate its average speed. (2)

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- 3 Calculate how far away a thunderstorm is, if you hear the thunder 4 seconds after you see the lightning. (Speed of sound in air = 330 m/s) (2)

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- 4 In 1983, the world land speed record was captured by Thrust 2, which travelled 1 km at a record 283 m/s. How long did it take to complete this distance? (2)

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Task B Calculating acceleration

- 1 A cheetah can accelerate from 0 to 24 m/s in 3 seconds. Calculate its acceleration. (2)

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- 2 A cyclist accelerates from 5 m/s to 15 m/s in 10 seconds. Calculate their acceleration. (2)

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- 3 A car decelerates at 6 m/s^2 . Calculate how long it takes to stop if it is driving at 30m/s when the driver sees an obstacle in the road and brakes. (3)

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- 4 A swimmer has an acceleration of 2 m/s^2 . They are swimming at 0.5 m/s and accelerate for 0.5 seconds. Calculate their new speed. (3)

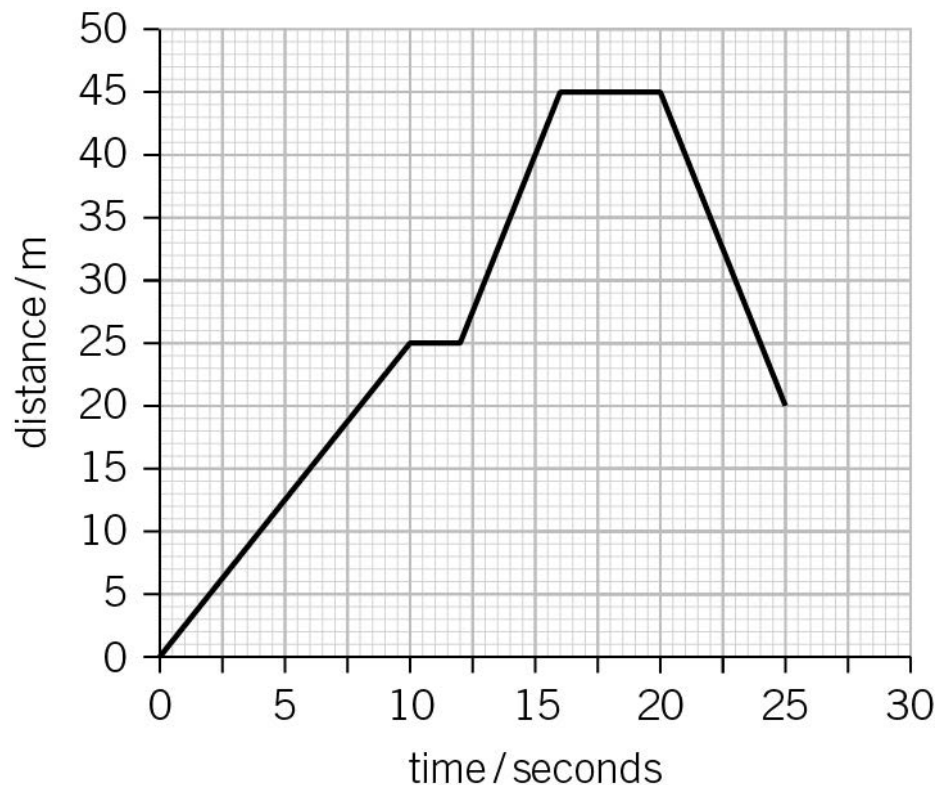
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Task C Distance–time graphs

Study the graph below and answer the following questions.



- 1 Write a story to match the motion shown in the distance–time graph. (5)

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- 2 Calculate the speed in the first 10 seconds. (2)

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- 3 Calculate the speed for the last 5 seconds. (2)

Task D Velocity–time graphs

The table below shows how the speed of a car varies with time.

Time (s)	0	10	20	30	40	50	60	70	80	90	100	110
Velocity (m/s)	10	15	20	25	28	30	30	30	30	0	2	2

- 1 Plot a velocity–time graph for the data (4)
- 2 Study the graph carefully and suggest when
- a the car was on a clear stretch of road (1)

- b the car had to make an emergency stop (1)

- c the car was in a traffic jam. (1)

- 3 Use the graph to calculate the acceleration in the first 20 seconds. (3)

- 4 Use the graph to calculate the acceleration between 80 and 90 seconds. (3)

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- 5 Use the graph to calculate the distance travelled by the car in the first 20 seconds. (4)

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