

AS Mathematics Exam Questions by Topic Chapter 19a: Velocity-Time Graphs

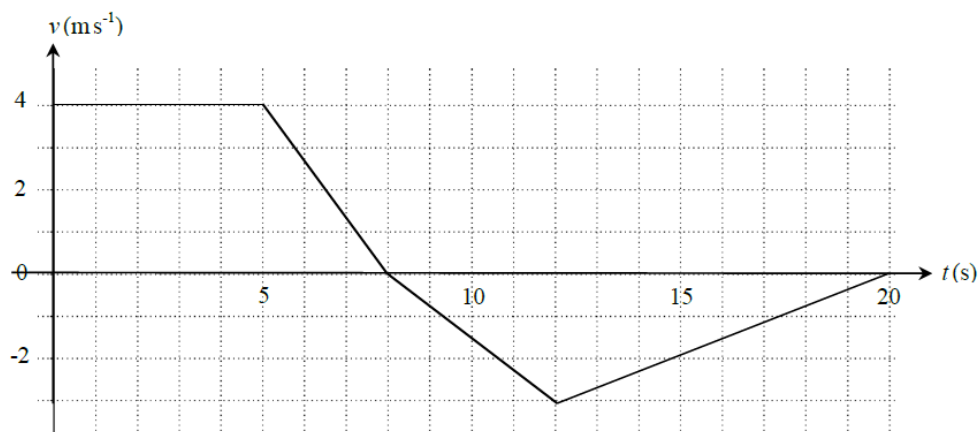
These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: <https://amzn.to/39umfr5> and <https://amzn.to/3hE8kBL>). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

<https://mathsaurus.com/>

OCR A AS Sample Paper 2 Question 9:

- 9 The diagram below shows the velocity-time graph of a car moving along a straight road, where $v \text{ m s}^{-1}$ is the velocity of the car at time t s after it passes through the point A .



- (i) Calculate the acceleration of the car at $t = 6$. [2]
- (ii) Jasmit says “The distance travelled by the car during the first 20 seconds of the car’s motion is more than five times its displacement from A after the first 20 seconds of the car’s motion”. Give evidence to support Jasmit’s statement. [3]

OCR B MEI AS 2018 Paper 1 Question 10:

- 10 Rory runs a distance of 45 m in 12.5 s. He starts from rest and accelerates to a speed of 4 m s^{-1} . He runs the remaining distance at 4 m s^{-1} .

Rory proposes a model in which the acceleration is constant until time T seconds.

- (i) Sketch the velocity-time graph for Rory's run using this model. [2]
- (ii) Calculate T . [2]
- (iii) Find an expression for Rory's displacement at time t s for $0 \leq t \leq T$. [2]
- (iv) Use this model to find the time taken for Rory to run the first 4 m. [1]

Rory proposes a refined model in which the velocity during the acceleration phase is a quadratic function of t . The graph of Rory's quadratic goes through $(0, 0)$ and has its maximum point at $(S, 4)$. In this model the acceleration phase lasts until time S seconds, after which the velocity is constant.

- (v) Sketch a velocity-time graph that represents Rory's run using this refined model. [1]
- (vi) State with a reason whether S is greater than T or less than T . (You are not required to calculate the value of S .) [1]

OCR B MEI AS Sample Paper 1 Question 7:

- 7 A car is usually driven along the whole of a 5 km stretch of road at a constant speed of 25 m s^{-1} . On one occasion, during a period of 50 seconds the speed of the car is as shown by the speed-time graph in Fig. 7; the rest of the 5 km is travelled at 25 m s^{-1} .

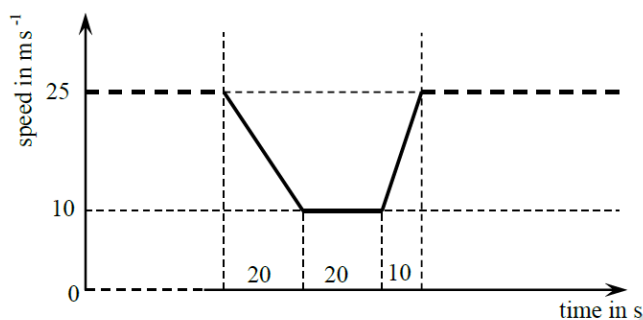
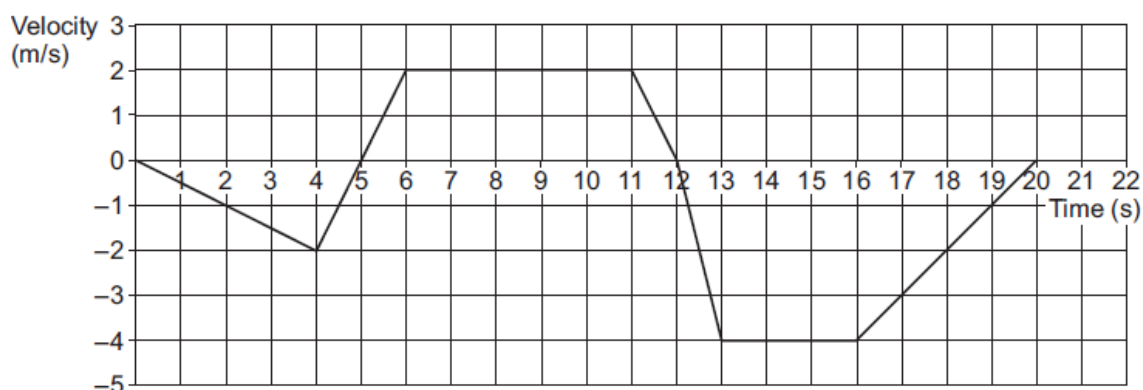


Fig. 7

How much more time than usual did the journey take on this occasion? Show your working clearly. [4]

AQA 2018 Paper 2 Question 12:

- 12 The graph below shows the velocity of an object moving in a straight line over a 20 second journey.



- 12 (a) Find the maximum magnitude of the acceleration of the object. [1 mark]
- 12 (b) The object is at its starting position at times 0, t_1 and t_2 seconds.
Find t_1 and t_2 [4 marks]
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Edexcel AS 2018 Paper 2 Question 7:

7. A train travels along a straight horizontal track between two stations, A and B .

In a model of the motion, the train starts from rest at A and moves with constant acceleration 0.3 m s^{-2} for 80 s.

The train then moves at constant velocity before it moves with a constant deceleration of 0.5 m s^{-2} , coming to rest at B .

- (a) For this model of the motion of the train between A and B ,
- state the value of the constant velocity of the train,
 - state the time for which the train is decelerating,
 - sketch a velocity-time graph. (3)

The total distance between the two stations is 4800 m.

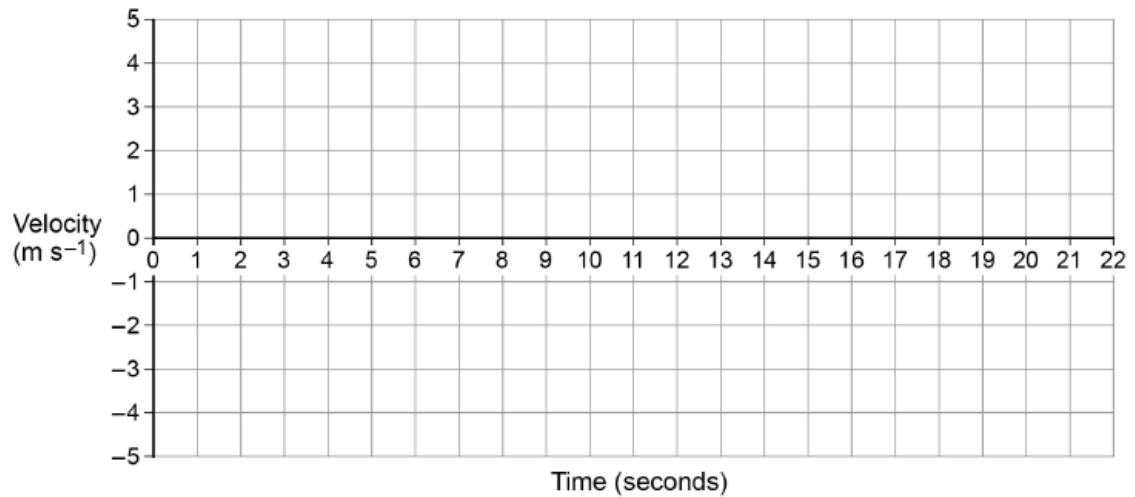
- (b) Using the model, find the total time taken by the train to travel from A to B . (3)
- (c) Suggest one improvement that could be made to the model of the motion of the train from A to B in order to make the model more realistic. (1)

AQA AS 2018 Paper 1 Question 13:

- 13 A vehicle, which begins at rest at point P , is travelling in a straight line.
- For the first 4 seconds the vehicle moves with a constant acceleration of 0.75 m s^{-2}
- For the next 5 seconds the vehicle moves with a constant acceleration of -1.2 m s^{-2}
- The vehicle then immediately stops accelerating, and travels a further 33m at constant speed.

- 13 (a) Draw a velocity–time graph for this journey on the grid below.

[3 marks]

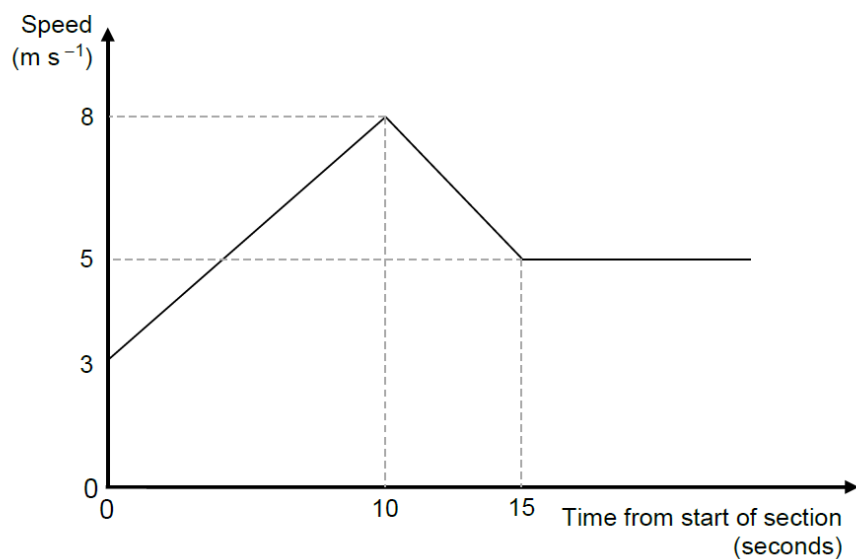


- 13 (b) Find the distance of the car from P after 20 seconds.

[3 marks]

AQA AS Sample Paper 1 Question 15:

- 15 The graph shows how the speed of a cyclist varies during a timed section of length 120 metres along a straight track.



- 15 (a) Find the acceleration of the cyclist during the first 10 seconds.

[1 mark]

- 15 (b) After the first 15 seconds, the cyclist travels at a constant speed of 5 m s^{-1} for a further T seconds to complete the 120-metre section.

Calculate the value of T .

[4 marks]
