



8.7D Velocity Time Graphs: Fluency and Exam Drill

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 45 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A vehicle travels at a constant velocity of 5 m/s for 6 seconds. Work out the distance travelled in that time.

(Total for Question 1 is 1 mark)

- 2** A vehicle has a constant velocity of -3 m/s for 4 seconds (negative means travelling in the opposite direction). What is the displacement of the vehicle over the 4 seconds?

(Total for Question 2 is 1 mark)

- 3** A velocity-time graph shows velocity increasing uniformly from 0 m/s at $t = 0$ s to 20 m/s at $t = 10$ s. Work out the acceleration.

(Total for Question 3 is 2 marks)

- 4** A vehicle slows from 15 m/s to 5 m/s in 5 seconds. Calculate its acceleration.

(Total for Question 4 is 2 marks)

- 5 A vehicle's velocity-time graph is as follows: from $t = 0$ to 4 s the velocity increases uniformly from 0 m/s to 8 m/s; from $t = 4$ s to 10 s the velocity is constant at 8 m/s. Work out the total distance travelled in the first 10 seconds.

(Total for Question 5 is 3 marks)

- 6 Consider a vehicle with velocity described by: from $t = 0$ s to 3 s velocity increases uniformly from 0 to 6 m/s; from $t = 3$ s to 8 s velocity is constant at 6 m/s; from $t = 8$ s to 10 s velocity decreases uniformly from 6 to 0 m/s.

State (a) the time interval when the vehicle is speeding up, (b) the interval when the vehicle moves at constant speed, and (c) the interval when the vehicle is slowing down.

(a) State the time interval when the vehicle is speeding up. (1)

(b) State the time interval when the vehicle moves at constant speed. (1)

(c) State the time interval when the vehicle is slowing down. (1)

(Total for Question 6 is 3 marks)

- 7 A vehicle has velocity given by: $0 \leq t < 5$ s: $v = 4$ m/s; $5 \leq t \leq 9$ s: $v = -2$ m/s. (Negative means the opposite direction.)

(a) Find the displacement of the vehicle from $t = 0$ to $t = 9$ s.

(b) Find the total distance travelled from $t = 0$ to $t = 9$ s.

(a) Find the displacement from $t = 0$ to $t = 9$ s. (2)

(b) Find the total distance travelled from $t = 0$ to $t = 9$ s. (2)

(Total for Question 7 is 4 marks)

- 8** Show that a vehicle with velocity described by: $0 \leq t \leq 10$ s velocity increases uniformly from 0 to 10 m/s; $10 \leq t \leq 20$ s velocity is constant at 10 m/s; travels 150 m in the first 20 seconds.

(Total for Question 8 is 3 marks)

- 9** At $t = 2$ s the velocity of a vehicle is 4 m/s. At $t = 8$ s the velocity is 10 m/s. Calculate the average acceleration between $t = 2$ s and $t = 8$ s.

(Total for Question 9 is 2 marks)

- 10** A velocity-time graph has three consecutive sections: section 1 has a negative gradient, section 2 has gradient 0, section 3 has a positive gradient. Describe the motion in each section.

(Total for Question 10 is 3 marks)

- 11** A car starts from rest and accelerates uniformly at 2 m/s^2 for 6 seconds. It then brakes uniformly at -3 m/s^2 until it stops. Work out the total distance the car travels from the start until it stops.

(Total for Question 11 is 4 marks)

- 12** Stretch question. A vehicle has the following velocity-time profile: $0 \leq t < 4$ s: $v = 3$ m/s (constant); $4 \leq t < 10$ s: velocity increases uniformly from 3 m/s to 15 m/s; $10 \leq t \leq 12$ s: velocity decreases uniformly from 15 m/s to 3 m/s. Work out the total distance travelled from $t = 0$ to $t = 12$ s.

(Total for Question 12 is 4 marks)

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Question 1

- **B1** 30 m cao
- **Answer: 30 m**

Question 2

- **B1** -12 m cao
- **Answer: -12 m**

Question 3

- **M1** use $a = \text{change in velocity} / \text{time}$, $(20 - 0) / 10$ or equivalent
- **A1** 2 m/s^2 cao
- **Answer: 2 m/s^2**

Question 4

- **M1** use $a = (v_2 - v_1) / t = (5 - 15) / 5$ oe
- **A1** -2 m/s^2 cao
- **Answer: -2 m/s^2**

Question 5

- **M1** area of triangle $0.5 * 4 * 8 = 16$ or equivalent method for first 4 s
- **M1** area of rectangle $6 * 8 = 48$ for next 6 s
- **A1** 64 m cao
- **Answer: 64 m**

Question 6

- (a) **B1** 0 to 3 s oe
- (a) **Answer: 0 to 3 s**
- (b) **B1** 3 to 8 s oe
- (b) **Answer: 3 to 8 s**
- (c) **B1** 8 to 10 s oe
- (c) **Answer: 8 to 10 s**

Question 7

- (a) **M1** compute $4*5 + (-2)*4 = 20 - 8$ oe
- (a) **A1** 12 m cao
- (a) **Answer: 12 m**
- (b) **M1** compute total distance $= 4*5 + |-2 * 4| = 20 + 8$ oe
- (b) **A1** 28 m cao
- (b) **Answer: 28 m**

Question 8

- **M1** area of triangle $0.5 * 10 * 10 = 50$ oe
- **M1** area of rectangle $10 * 10 = 100$ oe
- **A1** 150 m cao cso
- **Answer: 150 m**

Question 9

- **M1** use $a = (10 - 4) / (8 - 2) = 6 / 6$ oe
- **A1** 1 m/s^2 cao
- **Answer: 1 m/s^2**

Question 10

- **B1** section 1: vehicle is slowing down or decelerating
- **B1** section 2: vehicle is at constant velocity or moving at steady speed
- **B1** section 3: vehicle is speeding up or accelerating
- **Answer: Section 1: slowing down. Section 2: constant speed. Section 3: speeding up.**

Question 11

- **M1** distance during acceleration = $0.5 * 2 * 6^2 = 36$ or equivalent
- **M1** speed at end of acceleration $v = 0 + 2 * 6 = 12$ m/s, then braking time = $12 / 3 = 4$ s
- **M1** distance during braking = $12 * 4 - 0.5 * 3 * 4^2 = 24$ or equivalent
- **A1** 60 m
- **Answer: 60 m**

Question 12

- **M1** area 0-4 s = $3 * 4 = 12$
- **M1** area 4-10 s = average velocity $(3+15)/2 * 6 = 9 * 6 = 54$
- **M1** area 10-12 s = average velocity $(15+3)/2 * 2 = 9 * 2 = 18$
- **A1** 84 m
- **Answer: 84 m**