Unit Review

Specification: AQA 7357: P1, Q1, Q2, Q3, R3, OT3 · Edexcel 9MA0: 6.1, 7.1, 7.2, 7.3, 8.3, OT3

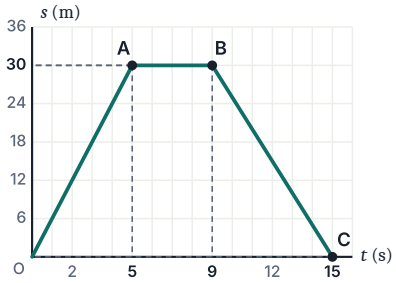
INDEPENDENT

Mixed practice

A · Fluency One step each. Which tool?

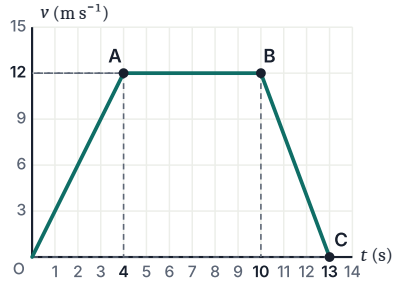
1 A car slows down uniformly from 72 km h^{-1} to 18 km h^{-1} in 6 s. Find its deceleration.

2 The graph shows the displacement of a cyclist from O.
(a) Find her velocity from B to C.
(b) Find her average speed for the whole journey.



3 A stone is dropped from rest from a bridge and hits the water 1.5 s later. Find
(a) the height of the bridge above the water
(b) the speed with which the stone hits the water.

4 The graph shows the velocity of a particle.
(a) Find its acceleration from O to A.
(b) Find its deceleration from B to C.
(c) Find the total distance travelled.



5 A particle moving with constant acceleration 1.5 m s^{-2} passes a point P with speed 4 m s^{-1}. Find its distance from P when its speed is 10 m s^{-1}.

6 A particle moves with constant acceleration from A to B, a distance of 54 m, in 6 s. Its speed at B is 12 m s^{-1}. Find
(a) its speed at A
(b) its acceleration.

B · Multi-step Sketch first. Several tools in one question.

7 A train starts from rest at station A. It accelerates uniformly for 40 s to a speed of 20 m s^{-1}, travels at this speed for T seconds, then decelerates uniformly for 30 s, coming to rest at station B. The distance AB is 3.5 km.
(a) Sketch a velocity–time graph of the journey.
(b) Find T.
(c) Find the deceleration.

8 A ball is projected vertically upwards with speed 8.4 m s^{-1} from a balcony 18.9 m above the ground. Find
(a) the greatest height of the ball above the ground
(b) the time it takes to reach the ground
(c) its speed as it hits the ground.

9 A particle moves with constant acceleration along a straight line through points A, B and C, in that order. $AB = 24$ m and $BC = 66$ m. It takes 2 s to go from A to B and 3 s to go from B to C.
(a) Find its acceleration and its speed at A.
(b) Find its speed at C.

10 Ball A is dropped from rest from the top of a tower 44.8 m high. At the same instant ball B is projected vertically upwards with speed 22.4 m s^{-1} from the foot of the tower, directly below A.
(a) Find when the balls meet.
(b) Find their height above the ground then.
(c) Is B moving up or down when they meet?

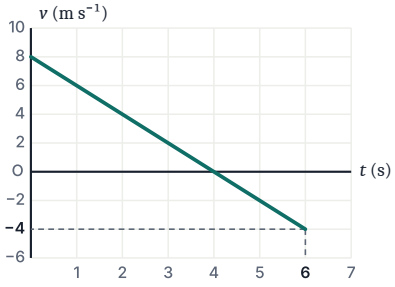
11 A particle P passes O with velocity 14 m s^{-1} in the positive direction. It has constant acceleration -2 m s^{-2}.
(a) Find the times at which P is 40 m from O on the positive side.
(b) Find the total distance travelled by P in the first 10 s.

C · Reasoning No calculator.

12 A particle passes O with velocity 8 m s^{-1} and has constant acceleration -2 m s^{-2}.
(a) When does it turn round?
(b) Find its displacement from O after 6 s.
(c) Find the distance it travels in the 6 s, and explain why it is not the same as the displacement.

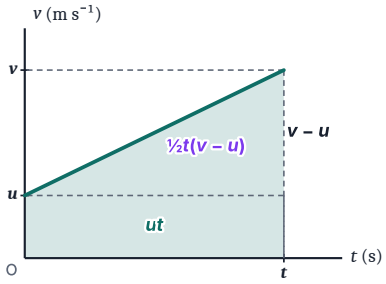
13 A ball is thrown vertically upwards with speed 9.8 m s^{-1}. Ali takes up as positive; Beth takes down as positive.
(a) Write down the acceleration each of them uses.
(b) Ali writes $a = -9.8$ on the way up and $a = +9.8$ on the way down. Explain the mistake.
(c) Using Beth's direction, find the ball's velocity after 3 s. Which way is it moving?

14 The graph shows the velocity of a particle that starts at O.
(a) When does it turn round?
(b) How far from O does it get?
(c) Find its displacement and the distance travelled after 6 s.
(d) At $t = 5$, is it speeding up or slowing down?



D · Derive and "show that" Work from the graph or from the formulae you know.

15 The graph shows a particle accelerating uniformly from u to v in time t.
(a) Use the graph to show that $s = ut + \frac{1}{2}at^2$.
(b) Using $v = u + at$ and $s = \frac{1}{2}(u + v)t$, show that $v^2 = u^2 + 2as$.



16 A cyclist starts from rest and accelerates uniformly at 0.5 m s^{-2} for T seconds. She then rides at the speed she has reached for 30 s. She travels 400 m altogether.
(a) Show that $T^2 + 60T - 1600 = 0$.
(b) Find T and her greatest speed.

E · Exam-style questions Show your method: marks are for working.

17 *AQA-style*. A car passes a point A with speed 8 m s^{-1}. It accelerates uniformly at 0.75 m s^{-2} for 16 s, then travels at constant speed for 20 s. It then decelerates uniformly, coming to rest at a point B 14 s later.
(a) Show that the greatest speed of the car is 20 m s^{-1}. [2 marks]
(b) Sketch a velocity–time graph for the motion from A to B. [2 marks]
(c) Find the distance AB. [3 marks]
(d) Find the deceleration of the car. [1 mark]

18 *Edexcel-style*. A ball is projected vertically upwards with speed 19.6 m s^{-1} from a point A which is 24.5 m above the ground. The ball is modelled as a particle moving freely under gravity. Find
(a) the greatest height of the ball above the ground, (2)
(b) the total time for which the ball is at least 39.2 m above the ground, (3)
(c) the time taken for the ball to reach the ground. (3)