The Other Constant-Acceleration Formulae

Specification: AQA 7357: P1, Q1, Q3 · Edexcel 9MA0: 6.1, 7.1, 7.3

INDEPENDENT

You do

A · Choose and use The dashed letter picks the formula.

1 A particle has constant acceleration 3 m s^{-2}. It passes A with velocity 2 m s^{-1}. Find its velocity at B, where AB $= 10$ m.

2 A cyclist travelling at 10 m s^{-1} brakes and stops in 25 m. Assuming constant deceleration, find the deceleration.

3 A car passes a lamp post at 5 m s^{-1}. It accelerates uniformly and passes a sign 72 m further on, 8 s later. Find its acceleration.

4 A particle accelerates uniformly at 1.5 m s^{-2} for 8 s, reaching 20 m s^{-1}. How far does it travel in this time?

5 A train passes one signal at 36 km h^{-1} and a second signal, 300 m further on, at 72 km h^{-1}. Its acceleration is constant. Find the acceleration.

B · Two steps and quadratics Collect a quadratic on one side; reject a negative time.

6 A puck slides across ice in a straight line. Its initial speed is 10 m s^{-1} and it slows down at a constant 0.4 m s^{-2}.
(a) Find the distance it slides before it stops.
(b) Find its speed when it has slid half of this distance.

7 A particle passes O with velocity 6 m s^{-1} and constant acceleration 2 m s^{-2}. Find the time it takes to travel 40 m, and its velocity then.

8 A particle passes O with velocity 7 m s^{-1} and constant acceleration 1.5 m s^{-2}. A point A is 50 m from O in its direction of motion.
(a) Find the time it takes to reach A.
(b) Find its speed at A.

9 A particle has constant acceleration 2 m s^{-2}. It travels 52 m in 4 s.
(a) Find its initial velocity.
(b) Find its final velocity.

C · Reasoning No calculator.

10 Which formula would you use? Do not solve.
(a) You know u, v and s, and want a.
(b) You know u, a and t, and want s.
(c) You know v, a and t, and want s.

11 A particle passes O moving in the positive direction at 4 m s^{-1}. Its acceleration is a constant -2 m s^{-2}.
(a) Show that it never reaches the point 5 m from O in the positive direction.
(b) Find the greatest distance it reaches from O in that direction.

12 True or false? Explain each answer.
(a) $v^2 = u^2 + 2as$ can be used to find the time taken.
(b) A car that slows down from 10 m s^{-1} to 5 m s^{-1} covers the same distance as one that speeds up from 5 m s^{-1} to 10 m s^{-1} with the same size of acceleration.
(c) Both solutions of a quadratic in t always give a sensible time.

D · Derive and simultaneous equations

Number your equations; say what you substitute.

13 Use $v = u + at$ and $s = ut + \frac{1}{2}at^2$ to show that $s = vt - \frac{1}{2}at^2$.

14 A car moves along a straight road with constant acceleration. It passes A, B and C in that order. AB = 60 m and BC = 165 m. Its speed at B is 8 m s^{-1} and at C is 14 m s^{-1}.

(a) Find its acceleration.

(b) Find its speed at A.

(c) Find the time it takes from A to C.

15 A runner moves along a straight path with constant deceleration. She passes P, Q and R. It takes her 4 s to run from P to Q and another 4 s from Q to R. PQ = 24 m and QR = 16 m. Find her deceleration and her speed at P.

E · Exam-style question

Show your method: marks are for working.

16 A particle moves along a straight line with constant acceleration. It passes the points A, B and C in that order, with velocities 5 m s^{-1}, 13 m s^{-1} and 29 m s^{-1}. It takes t_1 seconds to move from A to B and t_2 seconds to move from B to C.

(a) Show that $t_1 : t_2 = 1 : 2$. [3 marks]

The particle takes 24 s to move from A to C.

(b) Find the acceleration of the particle and the distance AB. [3 marks]

(c) Find the distance BC. [2 marks]