# Quadratics in t, Turning Round, Two Particles

Specification: AQA 7357: Q1, Q3, B3 · Edexcel 9MA0: 7.1, 7.3, 2.3

## HOMEWORK Consolidation

**1** A particle passes O with velocity $13$ m s$^{-1}$ and constant acceleration $-2$ m s$^{-2}$. Find the times when it is $40$ m from O, on the positive side.

AQA Q3, B3 · Edexcel 7.3, 2.3

**2** A particle passes O with velocity $9$ m s$^{-1}$ and constant acceleration $-3$ m s$^{-2}$.
(a) Find the time when it returns to O.
(b) Find the total distance it travels in this time.

AQA Q1, Q3 · Edexcel 7.1, 7.3

**3** A particle passes O with velocity $4$ m s$^{-1}$ and constant acceleration $3$ m s$^{-2}$. Find the time it takes to travel $30$ m.

AQA Q3, B3 · Edexcel 7.3, 2.3

**4** A particle passes O with velocity $14$ m s$^{-1}$ and constant acceleration $-2$ m s$^{-2}$.
(a) Find, to 3 s.f., the times when it is $44$ m from O, on the positive side.
(b) For how long is it more than $44$ m from O on the positive side?

AQA Q3, B3 · Edexcel 7.3, 2.3

**5** A particle passes O with velocity $12$ m s$^{-1}$ and constant acceleration $-3$ m s$^{-2}$.
(a) Show that it never reaches the point $25$ m from O in the positive direction.
(b) Find its greatest distance from O in that direction.

AQA Q3, B3 · Edexcel 7.3, 2.3

**6** A particle passes O moving in the positive direction with speed $5$ m s$^{-1}$. Its acceleration is a constant $2$ m s$^{-2}$ in the negative direction.
(a) Find the time when it is $6$ m from O on the negative side.
(b) Find the total distance it has travelled by then.

AQA Q1, Q3 · Edexcel 7.1, 7.3

**7** A particle passes O with velocity $9$ m s$^{-1}$ and constant acceleration $-2$ m s$^{-2}$. The point A is $20$ m from O in its direction of motion.
(a) Find the times when it is at A.
(b) Find its velocity at each of these times.

AQA Q3, B3 · Edexcel 7.3, 2.3

**8** At $t = 0$ a particle P passes a point A with speed $6$ m s$^{-1}$ and acceleration $0.5$ m s$^{-2}$. Two seconds later a particle Q passes A, moving in the same direction along the same line with speed $10$ m s$^{-1}$ and acceleration $4$ m s$^{-2}$. Find when Q catches P, and how far from A they are.

AQA Q3 · Edexcel 7.3

**9** The points A and B are $80$ m apart. At $t = 0$ a particle P passes A moving towards B with speed $6$ m s$^{-1}$ and acceleration $2$ m s$^{-2}$ towards B. At the same instant a particle Q passes B moving towards A with speed $5$ m s$^{-1}$ and acceleration $2.5$ m s$^{-2}$ towards A. Find when and where they meet.

AQA Q3 · Edexcel 7.3

**10** A particle passes O with velocity $u$ m s$^{-1}$ ($u > 0$). Its acceleration is a constant $-k$ m s$^{-2}$ ($k > 0$). Given that $u^2 > 2kd$, show that the time it spends more than $d$ metres from O on the positive side is $\frac{2}{k}\sqrt{(u^2 - 2kd)}$ seconds.

AQA Q3, B3 · Edexcel 7.3, 2.3 (show that)

**11** *AQA-style*. A particle P starts from rest at a point A and moves along a straight line with constant acceleration $2.5$ m s$^{-2}$. Two seconds later a particle Q passes A, moving in the same direction along the line with speed $7$ m s$^{-1}$ and constant acceleration $3$ m s$^{-2}$. Time $t$ seconds is measured from when P starts.
(a) Show that Q overtakes P when $t^2 + 4t - 32 = 0$. [3 marks]
(b) Find the distance from A where Q overtakes P. [2 marks]
(c) Find the speed of each particle at that instant. [2 marks]

AQA Q3 · Edexcel 7.3 · AQA-style

**12** *Edexcel-style*. A particle P moves on the $x$-axis with constant deceleration $3$ m s$^{-2}$. At time $t = 0$, P passes through the origin O, moving in the positive direction with speed $15$ m s$^{-1}$. The point A lies on the positive $x$-axis and OA = $33$ m. Find
(a) the difference between the times when P passes through A, (4)
(b) the total distance travelled by P in the interval between these times. (2)

AQA Q3, B3 · Edexcel 7.3, 2.3 · Edexcel-style