



A particle P is moving along a straight line with constant acceleration. Initially the particle is at O . After 9 s, P is at a point A , where $OA = 18$ m (see diagram) and the velocity of P at A is 8 m s^{-1} in the direction \overrightarrow{OA} .

(i) (a) Show that the initial speed of P is 4 m s^{-1} . [2]

(b) Find the acceleration of P . [2]

B is a point on the line such that $OB = 10$ m, as shown in the diagram.

(ii) Show that P is never at point B . [4]

A second particle Q moves along the same straight line, but has variable acceleration. Initially Q is at O , and the displacement of Q from O at time t seconds is given by

$$x = at^3 + bt^2 + ct,$$

where a , b and c are constants.

It is given that

- the velocity and acceleration of Q at the point O are the same as those of P at O ,
- Q reaches the point A when $t = 6$.

(iii) Find the velocity of Q at A . [5]