1 The acceleration of a particle after t seconds is given by $(4t - 8)\ \text{ms}^{-2}$. Given the velocity (v) of the particle is $6\ \text{ms}^{-1}$ when $t = 0$.

(a) Find v in terms of t.

(3)

(b) Find the distance between the two points the particle is instantaneously at rest.

(7)

(Total for question 1 is 10 marks)

2 The velocity of a particle after t seconds is given by $v = (6t - 2)$ m s^{-1}. After 5 seconds the displacement is 75m from O.

(a) Find an expression for the displacement.

(3)

(b) Find the displacement after 10 seconds.

(2)

(Total for question 2 is 5 marks)

3 A particle P moves in a straight line so that, at time t seconds, its acceleration a m s^{-2} is given by

$$a = \begin{cases} 4t - t^2 & 0 \leq t \leq 3 \\ \frac{27}{t^2} & t > 3 \end{cases}$$

At $t = 0$, P is at rest. Find the speed of P when

(a) $t = 3$

(3)

(b) $t = 6$

(5)

(Total for question 3 is 8 marks)

4 A particle P moves in a straight line so that, at time t seconds, its velocity v m s^{-1} is given by

$$v = \begin{cases} 7t - t^2 & 0 \leq t \leq 5 \\ 10 - 2t & t > 5 \end{cases}$$

(a) Find the acceleration of P when $t = 4$

(3)

(b) Find the total distance traveled by P in the first 10 seconds.

(7)

(Total for question 4 is 10 marks)

5 The velocity of a particle after t seconds is given by $v = (6t - 2t^2)$ m s^{-1}.
Find the time at which the acceleration of the particle is zero.

(Total for question 5 is 3 marks)

6 A particle P moves on the x axis. The acceleration of P at time t seconds is $(6t - 24)$ m s^{-2} measured in the positive x direction. Initially the particle is at O with a velocity of 60 m s^{-1}.

(a) Show that the particle will never travel in the negative x direction.

(4)

(b) Find the distance travelled by the particle in the first 10 seconds.

(3)

(Total for question 6 is 7 marks)

7 A particle P moves in a straight line such that at t seconds, $t \geq 0$, its velocity, v ms^{-1} is given by:

$$v = 12 - 2t^2$$

(a) the distance travelled by P in the first second,

(3)

(b) the value of t when P changes direction of motion,

(2)

(c) the value of t at the instant P returns to its starting point.

(3)

(Total for question 7 is 8 marks)

8 A particle P travels along a straight line through a point O so that at time t s after passing through O its displacement from O is x m, where $x = t^3 - 15t^2 + 62t$

(a) the initial velocity of P,

(3)

(b) the value of t for which P has zero acceleration.

(2)

(Total for question 8 is 5 marks)

9 A particle P travels along a straight line through a point O so that at time t s after passing through O its displacement from O is x m, where $x = 2t^3 - 18t^2 + 48t$

(a) the times when P is instantaneously at rest,

(3)

(b) the total distance travelled in the first 5 seconds.

(5)

(Total for question 9 is 8 marks)

10 A particle P moves on the x axis. The acceleration of P at time t seconds, $t \geq 0$, is $(3t + 5)$ m s^{-2} in the positive x direction. When $t = 0$, the velocity of P is 2 m s^{-1} in the positive x direction. When $t = T$, the velocity of P is 6 m s^{-1} in the positive x direction.
Find the value of T.

(Total for question 10 is 6 marks)

11 The displacement of a particle P from the origin after t seconds is given by $s = t^2(t + k)$ m. Given P is at instantaneous rest when $t = 4$.

Find the acceleration of P when $t = 10$.

(Total for question 11 is 8 marks)

12 The velocity of a particle after t seconds is given by $v = (6t - 2t^2)$ m s^{-1}. When $t = 0$ the particle is at the origin O.

Find the distance of the particle from O when the particle comes to instantaneous rest.

(Total for question 12 is 5 marks)

13 A particle P travels along a straight line through a point O so that at time t s after passing through O its displacement from O is x m, where

$$x = \frac{1}{12}t^2(9t^2 - 16t + 6)$$

(a) Find the times when P is instantaneously at rest.

(5)

(b) Find the total distance travelled by P in the interval $0 \leq t \leq 2$

(3)

(Total for question 13 is 8 marks)

14 A particle P travels along a straight line through a point O so that at time t s after passing through O its displacement from O is x m, where $x = t^2(4t^2 - 4t + 1)$

(a) Show that P will never move along the negative x-axis.

(2)

(b) Find the times when P is instantaneously at rest.

(5)

(c) Find the total distance travelled by P in the interval $0 \leq t \leq 5$

(3)

(Total for question 14 is 10 marks)

15 A particle P travels along a straight line such that at time t seconds, $t \geq 0$, after leaving the point O on the line, the velocity of P, v ms^{-1}, is modelled as

$$v = 16 + 6t - t^2$$

(a) the magnitude of the acceleration of P when P is at instantaneous rest,

(5)

(b) Find the total distance travelled by P in the interval $0 \leq t \leq 5$

(3)

(Total for question 15 is 8 marks)

16 A particle P travels along a straight line such that at time t seconds, $t \geq 0$, after leaving the point O on the line, the velocity of P, v ms^{-1}, is modelled as

$$v = 3t + 5 - 2t^2$$

(a) Find the value of t at the point when P stops accelerating.

(4)

(b) Find the distance of P from O at the instant when P changes its direction of motion.

(5)

(Total for question 16 is 9 marks)