

Year 1 Chapter 10 - More Variable Acceleration

- 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 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 $v = (6t - 2) \text{ m s}^{-1}$.
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 $a \text{ m s}^{-2}$ 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 $v \text{ m s}^{-1}$ 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 $v = (6t - 2t^2) \text{ m s}^{-1}$.

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 $(6t - 24) \text{ m s}^{-2}$ 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. (3)
- (b) Find the distance travelled by the particle in the first 10 seconds. (3)

(Total for question 6 is 6 marks)

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

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

Find:

- (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 $x = t^3 - 15t^2 + 62t$

Find

- (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 $x = 2t^3 - 18t^2 + 48t$

Find

- (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 $(3t + 5) \text{ m s}^{-2}$ 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 $s = t^2(t + k) \text{ m}$
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 $v = (6t - 2t^2) \text{ m s}^{-1}$.
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)