

Year 1 Chapter 11

Variable Acceleration: Integration

Q1.

A particle P moves on the x -axis. At time t seconds the velocity of P is $v \text{ m s}^{-1}$ in the direction of x increasing, where $v = 6t - 2t^2$. When $t = 0$, P is at the origin O . Find the distance of P from O when P comes to instantaneous rest after leaving O .

(Total 5 marks)

Q2.

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 6 marks)

Q3.

A particle P moves on the x -axis. At time t seconds, its acceleration is $(5 - 2t) \text{ m s}^{-2}$, measured in the direction of x increasing. When $t = 0$, its velocity is 6 m s^{-1} measured in the direction of x increasing. Find the time when P is instantaneously at rest in the subsequent motion.

(Total 6 marks)

Q4.

A particle P moves along the x -axis in a straight line so that, at time t seconds, the velocity of P is $v \text{ m s}^{-1}$, where

$$v = \begin{cases} 10t - 2t^2, & 0 \leq t \leq 6, \\ \frac{-432}{t^2}, & t > 6. \end{cases}$$

At $t = 0$, P is at the origin O . Find the displacement of P from O when

(a) $t = 6$,

(3)

(b) $t = 10$.

(5)

(Total 8 marks)

Q5.

At time $t = 0$ a particle P leaves the origin O and moves along the x -axis.

At time t seconds the velocity of P is $v \text{ m s}^{-1}$, where

$$v = 8t - t^2.$$

- (a) Find the maximum value of v .

(4)

- (b) Find the time taken for P to return to O .

(5)

(Total 9 marks)

Q6.

A particle P moves on the x -axis. The acceleration of P at time t seconds is $(4t - 8) \text{ m s}^{-2}$, measured in the direction of x increasing. The velocity of P at time t seconds is $v \text{ m s}^{-1}$. Given that $v = 6$ when $t = 0$, find

- (a) v in terms of t ,

(4)

- (b) the distance between the two points where P is instantaneously at rest.

(7)

(Total 11 marks)