Rectilinear AP ?s

1979 AB4/BC1

A particle moves along a line so that at any time t its position is given by $x(t) = 2\pi t + \cos 2\pi t$.

(a) Find the velocity at time t.

(b) Find the acceleration at time t.

(c) What are all values of t, $0 \le t \le 3$, for which the particle is at rest?

1981 AB6/BC4

A particle moves along the x-axis so that at time t its position is given by $x(t) = \sin\left(\pi t^2\right)$ for $-1 \le t \le 1$.

(a) Find the velocity at time t.

(b) Find the acceleration at time t.

(c) For what values of t does the particle change direction?

(d) Find all values of t for which the particle is moving to the left.

1983 AB2

A particle moves along the x-axis so that at time t its position is given by $x(t) = t^3 - 6t^2 + 9t + 11$.

(a) What is the velocity of the particle at $t = 0$?

(b) During what time intervals is the particle moving to the left?

1969 AB2/BC2

A particle moves along the x-axis in such a way that its position at time t is given by $x = 3t^4 - 16t^3 + 24t^2$ for $-5 \le t \le 5$.

(a) Determine the velocity and acceleration of the particle at time t.

(b) At what values of t is the particle at rest?

(c) At what values of t does the particle change direction?

(d) What is the velocity when the acceleration is first zero?

1975 AB2

A particle moves along the x-axis in such a way that its position at time t for $t \ge 0$ is given by $x = \frac{1}{3}t^3 - 3t^2 + 8t$.

(a) Show that at time $t = 0$, the particle is moving to the right.

(b) Find all values of t for which the particle is moving to the left.

(c) What is the position of the particle at time $t = 3$?

ANSWERS

1979 AB4/BC1

a. $v(t) = 2\pi - 2\pi\sin(2\pi t)$

b. $a(t) = -4\pi^2\cos(2\pi t)$

c. $t = \frac{1}{4}, \frac{5}{4}, \frac{9}{4}$. At these times the particle is at rest because $v(t) = 0$

1981 AB6/BC4

a. $v(t) = 2\pi t\cos(\pi t^2)$

b. $a(t) = 2\pi\cos(\pi t^2) - 4\pi^2 t^2\sin(\pi t^2)$

c. $t = 0, \pm\frac{\sqrt{2}}{2}$. The particle changes directions at these times because $v(t)$ changes signs.

d. $\left(-\frac{\sqrt{2}}{2}, 0\right) \cup \left(\frac{\sqrt{2}}{2}, 1\right)$. The particle moves to the left on these intervals because $v(t) < 0$.

1983 AB2

a. $v(0) = 9$

b. $(1,3)$ The particle moves to the left on these intervals because $v(t) < 0$.

1969 AB2/BC2

a. $v(t) = 12t^3 - 48t^2 + 48t$, $a(t) = 36t^2 - 96t + 48$

b. $t = 0, 2$. At these times the particle is at rest because $v(t) = 0$.

c. $t = 0$. The particle changes directions at these times because $v(t)$ changes signs.

d. $a(t) = 0$ when $t = \frac{2}{3}, 2$. So, $v\left(\frac{2}{3}\right) = \frac{128}{9}$

1975 AB2

a. $v(0) = 8 > 0$, Therefore the particle is moving right at t = 0.

b. The particle moves left on the time interval (2, 4) because $v(t) < 0$.

c. $x(3) = 6$.