

1994 BC 3

A particle moves along the graph of  $y = \cos x$  so that the  $x$ -coordinate of acceleration is always 2. At time  $t=0$ , the particle is at the point  $(\pi, -1)$  and the velocity vector of the particle is  $(0, 0)$ .

- (a) Find the  $x$ - and  $y$ -coordinates of the position of the particle in terms of  $t$ .
- (b) Find the speed of the particle when its position is  $(4, \cos 4)$ .

**1990 AB1**

A particle, initially at rest, moves along the  $x$ -axis so that its acceleration at any time  $t \geq 0$  is given by  $a(t) = 12t^2 - 4$ . The position of the particle when  $t = 1$  is  $x(1) = 3$ .

- (a) Find the values of  $t$  for which the particle is at rest.
- (b) Write an expression for the position  $x(t)$  of the particle at any time  $t \geq 0$ .
- (c) Find the total distance traveled by the particle from  $t = 0$  to  $t = 2$ .

**1989 AB3**

A particle moves along the  $x$ -axis in such a way that its acceleration at time  $t$  for  $t \geq 0$  is given by  $a(t) = 4 \cos(2t)$ . At time  $t = 0$ , the velocity of the particle is  $v(0) = 1$  and its position is  $x(0) = 0$ .

- (a) Write an equation for the velocity  $v(t)$  of the particle.
- (b) Write an equation for the position  $x(t)$  of the particle.
- (c) For what values of  $t$ ,  $0 \leq t \leq \pi$ , is the particle at rest?

**1997 AB1**

A particle moves along the  $x$ -axis so that its velocity at any time  $t \geq 0$  is given by  $v(t) = 3t^2 - 2t - 1$ . The position  $x(t)$  is 5 for  $t = 2$ .

- (a) Write a polynomial expression for the position of the particle at any time  $t \geq 0$ .
- (b) For what values of  $t$ ,  $0 \leq t \leq 3$ , is the particle's instantaneous velocity the same as its average velocity on the closed interval  $[0, 3]$ ?
- (c) Find the total distance traveled by the particle from time  $t = 0$  until time  $t = 3$ .