

Kinematics P2 version 2 [23 marks]

1. [Maximum mark: 6]

19M.2.AHL.TZ2.H_6

A particle moves along a horizontal line such that at time t seconds, $t \geq 0$, its acceleration a is given by $a = 2t - 1$. When $t = 6$, its displacement s from a fixed origin O is 18.25 m. When $t = 15$, its displacement from O is 922.75 m. Find an expression for s in terms of t .

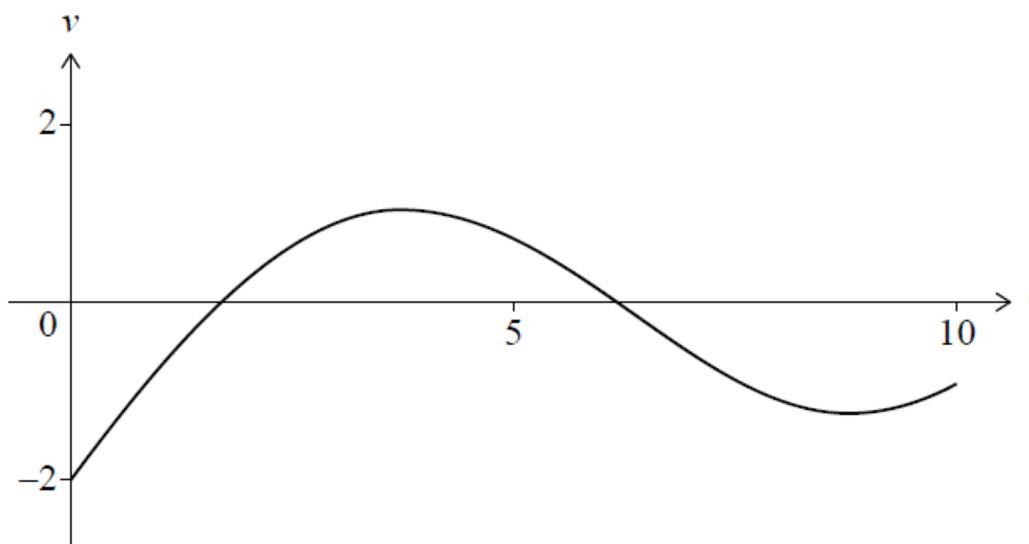
[6]

2. [Maximum mark: 6]

24M.2.AHL.TZ1.4

A particle moves in a straight line such that it passes through a fixed point O at time $t = 0$, where t represents time measured in seconds after passing O . For $0 \leq t \leq 10$ its velocity, v metres per second, is given by $v = 2 \sin(0.5t) + 0.3t - 2$.

The graph of v is shown in the following diagram.



(a) Find the smallest value of t when the particle changes direction.

[2]

The displacement of the particle is measured in metres from O .

- (b) Find the range of values of t for which the velocity is positive. [2]
- (c) Find the displacement of the particle relative to O when $t = 10$. [2]

3. [Maximum mark: 6] 24M.2.AHL.TZ2.4

A particle moves in a straight line such that its velocity, $v \text{ ms}^{-1}$, at time t seconds is given by $v(t) = 1 + e^{-t} - e^{-\sin 2t}$ for $0 \leq t \leq 2$.

- (a) Find the velocity of the particle at $t = 2$. [1]
- (b) Find the maximum velocity of the particle. [2]
- (c) Find the acceleration of the particle at the instant it changes direction. [3]

4. [Maximum mark: 5] 23N.2.AHL.TZ1.4

A particle moves along a straight line. Its displacement, s metres, from a fixed point O after time t seconds is given by $s(t) = 4.3 \sin(\sqrt{3t + 5})$, where $0 \leq t \leq 10$.

The particle first comes to rest after q seconds.

- (a) Find the value of q . [2]
- (b) Find the total distance that the particle travels in the first q seconds. [3]