Specimen Question 1

A particle P is moving along the x-axis in such a way that its displacement $t$ seconds after it leaves the origin O is given by the equation:

$$x = t^3 - 6t^2 + 9t.$$  

Find

(a) expressions for the velocity and acceleration after $t$ seconds,
(b) the times at which the particle is instantaneously at rest and its positions at those times,
(c) the velocity when $t = 2$, explaining the significance of the sign,
(d) the time at which the acceleration is zero, explaining the meaning of this.

Specimen Question 2

A particle P moves along the x-axis in such a way that, $t$ seconds after it leaves the origin O, its displacement $x = 3t^2 - t$.

(i) Find the time when the particle returns to O again.
(ii) Write down an expression for the speed of the particle after $t$ seconds, and hence find its speed at the time when it returns to O.
(iii) Find the two times when the particle is instantaneously at rest, and its distance from O at these times.
(iv) Write down an expression for the acceleration of the particle after $t$ seconds. Hence find the time at which the acceleration is zero, and the speed of the particle at that time. What is the significance of this speed?
Kinematics (Motion of a Particle) 9-1 IGCSE Questions

Specimen Question 3

3. The one-dimensional displacement, \( s \) metres of a particle, after \( t \) seconds, is given by the function \( s = t(t - 4)^2 \)

a) Find the function representing the velocity of the particle at time \( t \). (4 marks)

b) At what times is the particle at rest? (5 marks)

c) When does the particle have zero acceleration? (3 marks)

d) Where is the particle at this time and what is it doing? (6 marks)

Jan 2014 3HR Paper

15 A particle moves along a straight line. The fixed point \( O \) lies on this line. The displacement of the particle from \( O \) at time \( t \) seconds is \( s \) metres, where

\[
s = t^3 - 6t + 3
\]

(a) Find an expression for the velocity, \( v \) m/s, of the particle at time \( t \) seconds.

(b) Find the acceleration of the particle at time 5 seconds.
Kinematics (Motion of a Particle) 9-1 IGCSE Questions

May 2008, 4H Paper,

19. A particle moves in a straight line through a fixed point $O$.
   The displacement of the particle from $O$ at time $t$ seconds is $s$ metres, where
   \[ s = t^2 - 6t + 10 \]
   (a) Find \( \frac{ds}{dt} \)

   (b) Find the velocity of the particle when $t = 5$

   (c) Find the acceleration of the particle.

May 2006 4H Paper

18. A particle moves along a line.
   For $t \geq 1$, the distance of the particle from $O$ at time $t$ seconds is $x$ metres, where
   \[ x = \frac{20}{t} \]

   Find an expression for the acceleration of the particle.
13. A body is moving in a straight line which passes through a fixed point \( O \).
The displacement, \( s \) metres, of the body from \( O \) at time \( t \) seconds is given by
\[
s = t^3 + 4t^2 - 5t
\]
(a) Find an expression for the velocity, \( v \) m/s, at time \( t \) seconds.

(b) Find the acceleration after 2 seconds.

14. A particle is moving along a straight line.
The fixed point \( O \) lies on this line.
The displacement of the particle from \( O \) at time \( t \) seconds is \( s \) metres where
\[
s = 2t^3 - 12t^2 + 7t
\]
(a) Find an expression for the velocity, \( v \) m/s, of the particle at time \( t \) seconds.

(b) Find the time at which the acceleration of the particle is instantaneously zero.
Kinematics (Motion of a Particle) 9-1 IGCSE Questions

Nov 2009 4H Paper

19. A particle moves in a straight line through a fixed point $O$. The displacement, $s$ metres, of the particle from $O$ at time $t$ seconds is given by

$$s = t^3 - 5t^2 + 8$$

(a) Find an expression for the velocity, $v$ m/s, of the particle after $t$ seconds.

(b) Find the time at which the acceleration of the particle is 20 m/s$^2$.

May 2013, 3HR Paper

19 A particle is moving in a straight line which passes through a fixed point $O$. The displacement, $s$ metres, of the particle from $O$ at time $t$ seconds is given by

$$s = 10 + 9t^2 - t^3$$

(a) Find an expression for the velocity, $v$ m/s, of the particle at time $t$ seconds.

(b) Find the time at which the acceleration of the particle is zero.