10 A particle P moves along the positive x-axis. At time t seconds ($t \geqslant 0$) the velocity, v m/s, of P is given by $v = t^3 - 4t^2 + 5t + 1$

The acceleration of P at time t seconds is a m/s^2

(a) Find an expression for a in terms of t.

(2)

(b) Find the values of t for which the magnitude of the acceleration of P is instantaneously zero.

(2)

When $t = 0$, the displacement of P from the origin is 3 m.

(c) Find the displacement of P from the origin when $t = 2$

(5)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 9 marks)

11 The curve C has equation $y = px + qx^2$ where p and q are integers.

The curve C has a stationary point at (3, 9).

(a) (i) Show that $p = 6$ and find the value of q.

(ii) Determine the nature of the stationary point at (3, 9).

(7)

The straight line l with equation $y + x - 10 = 0$ intersects C at two points.

(b) Determine the x coordinate of each of these two points of intersection.

(3)

The finite region bounded by the curve C and the straight line l is rotated through 360° about the x-axis.

(c) Use algebraic integration to find the volume of the solid formed. Give your answer in terms of π.

(5)

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 15 marks)

TOTAL FOR PAPER IS 100 MARKS