Question 11 **(11 marks)**

The 100 m sprint is a race run on a straight section of track. During a race the velocity, v, measured in metres per second, of an athlete is given by

$$v(t) = -10e^{-0.8t} - 0.05e^{0.2t} + 10.05$$

where t is the time, in seconds, measured from the moment the athlete starts to move from the start line.

(a) Determine the acceleration of the athlete three seconds after moving from the start line. (2 marks)

(b) Using calculus, determine the maximum velocity of the athlete during the race, and the time, t, at which it is achieved. (4 marks)

(c) The displacement, x, of the athlete is 0 m at the start of the race. Determine an expression for the displacement of the athlete during the race. (3 marks)

(d) Determine the time, t, at which the athlete finishes the 100 m race. (2 marks)