7 A car C is moving horizontally in a straight line with velocity $v\,\mathrm{m\,s^{-1}}$ at time t seconds, where $v > 0$ and $t \geqslant 0$. The acceleration, $a\,\mathrm{m\,s^{-2}}$, of C is modelled by the equation

$$a = v\left(\frac{8t}{7+4t^2} - \frac{1}{2}\right).$$

(a) In this question you must show detailed reasoning.

Find the times when the acceleration of C is zero. **[3]**

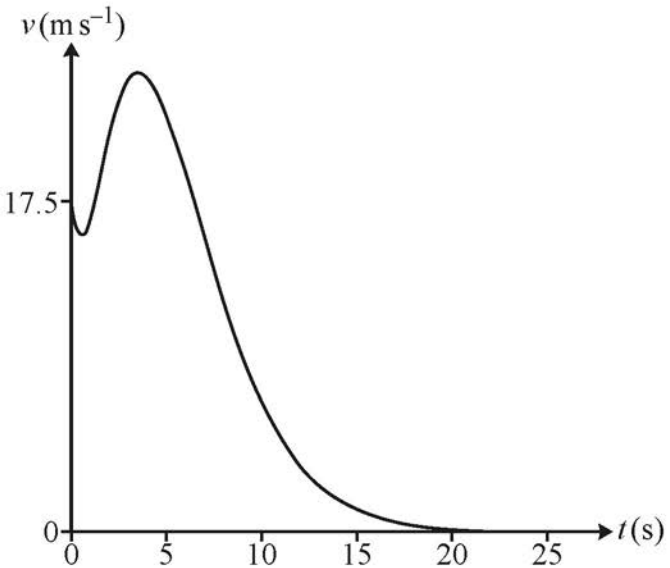
At $t = 0$ the velocity of C is $17.5\,\mathrm{m\,s^{-1}}$ and at $t = T$ the velocity of C is $5\,\mathrm{m\,s^{-1}}$.

(b) By setting up and solving a differential equation, show that T satisfies the equation

$$T = 2\ln\left(\frac{7+4T^2}{2}\right).$$ **[6]**

(c) Use an iterative formula, based on the equation in part **(b)**, to find the value of T, giving your answer correct to **4** significant figures. Use an initial value of 11.25 and show the result of each step of the iteration process. **[2]**

(d) The diagram below shows the velocity-time graph for the motion of C.



Find the time taken for C to decelerate from travelling at its maximum speed until it is travelling at $5\,\mathrm{m\,s^{-1}}$. **[1]**