12 A cake is cooling so that, t minutes after it is removed from an oven, its temperature is $\theta\,°C$. When the cake is removed from the oven, its temperature is $160\,°C$. After 10 minutes its temperature has fallen to $125\,°C$.

(a) In a simple model, the rate of decrease of the temperature of the cake is assumed to be constant.

    (i) Write down a differential equation for this model. [1]

    (ii) Solve this differential equation to find θ in terms of t. [2]

    (iii) State **one** limitation of this model. [1]

(b) In a revised model, the rate of decrease of the temperature of the cake is proportional to the difference between the temperature of the cake and the temperature of the room. The temperature of the room is a constant $20\,°C$.

    (i) Write down a differential equation for this revised model. [1]

    (ii) Solve this differential equation to find θ in terms of t. [6]

(c) The cake can be decorated when its temperature is $25\,°C$. Find the difference in time between when the two models would predict that the cake can be decorated, giving your answer correct to the nearest minute. [2]