| Question | Scheme | Marks | AOs |
|---|---|---|---|
| 11(a) | $\frac{dx}{dt} = -kx^2$ | M1 | 3.3 |
| | $\frac{dx}{dt} = -kx^2 \Rightarrow \int \frac{dx}{x^2} = \int -k\,dt \Rightarrow \ldots$ | M1 | 2.1 |
| | $\frac{1}{x} = kt + c$ | A1 | 1.1b |
| | $x = 3.5,\ t = 0\ \ x = 2,\ t = 1 \Rightarrow c = \ldots,\ k = \ldots$ | M1 | 3.1a |
| | $\frac{1}{x} = \frac{3}{14}t + \frac{2}{7}$ or $t = \frac{1}{kx} + c$ | A1 | 1.1b |
| | $x = \frac{14}{3t+4}$* | A1* | 2.1 |
| | | **(6)** | |
| **(b)** | $0.5 = \frac{14}{3T+4} \Rightarrow 1.5T + 2 = 14 \Rightarrow T = \ldots$ | M1 | 3.4 |
| | $T = 8$ | A1 | 1.1b |
| | | **(2)** | |
| | | | **(8 marks)** |

**Notes**

(a)

M1: Translates the description of the model into mathematics. Allow $\frac{dx}{dt} = kx^2$

M1: Separates the variables and attempts to integrate.

A1: Correct equation with or without the "+ $c$"

M1: Uses both conditions in order to find both constants.

A1: Correct equation in any form.

A1*: Fully correct proof.

(b)

M1: Uses $x = 0.5$ in the model and rearranges to find $T$

A1: Obtains the correct value for $T$ (or states 8 weeks)