Question	Scheme	Marks	AOs
5(a)	$m^2 + 3m + 2 = 0 \Rightarrow m = -2, -1$	M1	1.1b
	$R = Ae^{-t} + Be^{-2t}$	A1	1.1b
	$R = \lambda t + \mu \Rightarrow \frac{dR}{dt} = \lambda \Rightarrow \frac{d^2R}{dt^2} = 0$ $\Rightarrow 0 + 3\lambda + 2(\lambda t + \mu) = 4t \Rightarrow \lambda = 2, \mu = -3$	M1	3.1b
	$R = PI + CF = Ae^{-t} + Be^{-2t} + 2t - 3$	M1 A1	1.1b 1.1b
	$t = 0, R = 20 \Rightarrow 20 = A + B - 3$	M1	3.4
	$\frac{dR}{dt} = -Ae^{-t} - 2Be^{-2t} + 2, t = 0, \frac{dR}{dt} = 5 \Rightarrow -A - 2B + 2 = 5$	M1	3.4
	$R = 49e^{-t} - 26e^{-2t} + 2t - 3$	A1	1.1b
	$t = 10 \Rightarrow R = 17 \Rightarrow 1700$ rabbits	A1	3.2a
		(9)	
(b)	The population will keep increasing ($R \to 2t - 3$) which is unrealistic.	B1	3.5b
		(1)	
			(10 marks)

Notes:

(a)

M1: Forms and solves the auxiliary equation

A1: Correct complementary function

M1: A complete method to find the particular integral. Look for the correct from of the PI $= \lambda t + \mu$, differentiates twice and substituted into the differential equation to find the values of λ *and* μ

M1: Adding CF and PI

A1: Correct general solution for R

M1: Uses the information from the model $t = 0, R = 20$ to find an equation for the constants.

M1: Uses the information from the model $t = 0, \frac{dR}{dt} = 5$ to find another equation for the constants.

A1: Correct particular solution

A1: Correct answer only

(b)

B1: An appropriate limitation