Question	Scheme	Marks	AOs
5(a)	$(t+4)\frac{\mathrm{d}v}{\mathrm{d}t}+5v=10(t+4)\Rightarrow\frac{\mathrm{d}v}{\mathrm{d}t}+\frac{5v}{(t+4)}=10$	M1	1.1b
	$\mathrm{IF}=\mathrm{e}^{\int\frac{5}{t+4}\mathrm{d}t}=(t+4)^5\Rightarrow v(t+4)^5=\int 10(t+4)^5\mathrm{d}t$	M1	3.1b
	$v(t+4)^5=\frac{5}{3}(t+4)^6+c$	A1	1.1b
	$t=0,\ v=0\Rightarrow c=-\frac{20480}{3}$	M1	3.4
	$t=3\Rightarrow v=\frac{5}{3}\times 7-\frac{20480}{3\times 7^5}$	M1	3.4
	$v=11.3\left(\mathrm{ms}^{-1}\right)$	A1	1.1b
		(6)	
(b)	For large values of t, the velocity increases	B1	1.1b
		(1)	
(c)	E.g. • The raindrop may hit an obstacle as it falls • The raindrop is unlikely to be at rest initially • The raindrop may be affected by the wind as it falls • The raindrop will eventually hit the ground	B1	3.5b
		(1)	
			(8 marks)

Notes

(a)

M1: Divides through by $(t + 4)$

M1: Uses the model to find the integrating factor and attempts the solution of the differential equation

A1: Correct solution

M1: Interprets the initial conditions to find the constant of integration

M1: Uses their solution to the problem to find the velocity after 3 seconds

A1: Correct value

(b)

B1: Makes a sensible comment regarding the motion of the raindrop e.g. as t increases so does v

(c)

B1: States a limitation of the model – see scheme for examples