Question Number	Scheme	Marks
2(a)	$\dfrac{1}{(r+1)!}-\dfrac{1}{(r+2)!}=\dfrac{(r+2)!-(r+1)!}{(r+1)!(r+2)!}=\left\{\dfrac{(r+1)!\big((r+2)-1\big)}{(r+1)!(r+2)!}\right\}$ OR $\dfrac{1}{(r+1)!}-\dfrac{1}{(r+2)!}=\dfrac{r+2-1}{(r+2)!}$	M1
	$\dfrac{\cancel{(r+1)!}(r+1)}{\cancel{(r+1)!}(r+2)!}=\dfrac{r+1}{(r+2)!}$	A1*
		(2)
(b)	$r=1:\quad \left(\dfrac{1}{2!}-\cancel{\dfrac{1}{3!}}\right).$ $r=2:\quad \left(\cancel{\dfrac{1}{3!}}-\cancel{\dfrac{1}{4!}}\right)$ $\vdots \qquad \vdots$ $\vdots \qquad \vdots$ $r=n-1:\quad \left(\cancel{\dfrac{1}{n!}}-\cancel{\dfrac{1}{(n+1)!}}\right)$ $r=n:\quad \left(\cancel{\dfrac{1}{(n+1)!}}-\dfrac{1}{(n+2)!}\right)$	M1
	$\left[\sum_{r=1}^{n}\dfrac{r+1}{(r+2)!}=\right]\ \dfrac{1}{2}-\dfrac{1}{(n+2)!}=\dfrac{(n+2)!-2}{2(n+2)!}$	A1A1
		(3)
(c)	$\left[\sum_{r=4}^{10}\dfrac{3r+3}{(r+2)!}=\right]3\big[\mathrm{f}(10)-\mathrm{f}(3)\big]=3\left[\left(\dfrac{1}{2}-\dfrac{1}{12!}\right)-\left(\dfrac{1}{2}-\dfrac{1}{5!}\right)\right]$ $=3\left[\dfrac{(12)!-2}{2(12)!}-\dfrac{(5)!-2}{2(5)!}\right]$	M1
	$=3\left[\dfrac{1}{5!}-\dfrac{1}{12!}\right]=0.024999\ldots=0.0250$	A1
		(2)
		Total 7

Notes

(a)

M1: Indicates intention to combine over a common denominator, with only sign errors condoned on the numerator. This mark may be awarded by sight of two separate correct terms with a common denominator. May work in reverse from right hand side to left. This mark can be scored with two separate fractions with the same denominator

A1*: Fully correct proof. Must see evidence of cancellation (which can be implied by a correct factorised form) or one line of correct intermediate working before the stated printed result.

(b)

M1: Correct process of differences evidenced in their work, e.g. attempts first two and last or first and last two etc. There should be enough evidence of at least one pair of cancelling terms. Ignore any attempts at $r = 0$ if they start earlier than $r = 1$.

A1: Correct non-cancelling terms. Accept 2 or 2! Sight of the correct non-cancelling terms is M1A1

A1: Correct simplified expression obtained. Accept 2 or 2! Note that A0A1 is not possible.

(c)

M1: Attempts $3\left[\mathrm{f}(10)-\mathrm{f}(3)\right]$ using **their answer to (b)**. Must be indication of subtraction and the 3 must be included. The '$-\frac{1}{2}$' s may be omitted and allow a slip in signs/brackets. They may use (a) again to obtain $\mathrm{f}(3)$ but their answer to (b) must be used for $\mathrm{f}(10)$. Allow from attempts starting at $r = 0$ in their summations. $\mathrm{f}(10)-\mathrm{f}(4)$ is M0 and subtraction of decimals is M0 unless supported by evidence of using (b)

A1: Correct answer only. Note: 0.025 or 1/40 is A0