Qu No.	Scheme	Marks
6. (a)	[Sum of probs = 1 gives] $k\left[1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}\right]$ {=1} <u>or</u> $\frac{147k}{60}=1$	M1
	$k=\underline{\underline{\frac{20}{49}}}$	A1 cso
		(2)
(b)	$\mathrm{E}(S)=\frac{1}{147}\left(60\times\frac{1}{2}+120\times\frac{1}{3}+180\times\frac{1}{4}+240\times\frac{1}{5}+300\times\frac{1}{6}\right)$ <u>or</u> $3.55k$	M1A1
	$=\underline{\underline{\frac{71}{49}}}$	A1
		(3)
(c)	Expected profit = $260\mathrm{P}(S=5)-10$ **<u>or</u>** $-10\times\mathrm{P}(\mathrm{S}\neq 5)+250\times\mathrm{P}(\mathrm{S}=5)$	M1M1
	$=\left[260\times\frac{10}{147}-10\right]=7.68707\ldots$ = awrt (\$)**<u>7.69</u>**	A1
		(3)
(d)	p^2 because Roger must win 1st and 2nd round (accept "wins 2 rounds")	B1
	$(1-p)$ because Roger loses in 3rd round match	B1
		(2)
(e)	$[r]$: 0, 1, 2, 3, 4, 5	B1
	$[\mathrm{P}(R=r)]$: $1-p$, $p(1-p)$, $[p^2(1-p)]$, $p^3(1-p)$, $p^4(1-p)$, p^5	M1A1
		(3)
(f)	E (profit) = $260\times p^5-10$	M1 A1
	$\left[\mathrm{E(profit)}\geqslant 7.69\right]\Rightarrow p^5\geqslant\frac{17.69}{260}$ so $p\geqslant 0.58418..$	M1; A1
		(4)
		[17]

	Notes
(a)	M1 for clear attempt to find sum of probs. (Condone $\frac{147k}{60}=1$)
	A1cso for the correct answer with M1 clearly scored and no incorrect working seen.
Verify	Need to see all 6 probs added and = 1 for M1 and a comment (e.g. therefore k = ...) for A1
(b)	M1 for an attempt at E(S) – at least 4 correct products (allow use of k or k = 0.408 or better)
	1st A1 for a fully correct expression (allow $3.55k$)
	2nd A1 for $\frac{71}{49}$ (accept 1.45 or better [calc:1.44897…]) (Ans only 3/3)
(c)	1st M1 for $260\times\mathrm{P}(S=5)$ <u>or</u> $250\times\mathrm{P}(S=5)$ | Probabilities can be in terms of k or ft their values
	2nd M1 for $N\times\mathrm{P}(S=5)-10$ <u>or</u> $N\times\mathrm{P}(S=5)-10\times\mathrm{P}(S\neq 5)$ ($N\in\mathbb{N}$)
	A1 for awrt (\$)7.69
(d)	1st B1 for an explanation of the p^2 term (e.g. use of tree diagram) | WWL alone scores 1st B1 <u>but</u> WWL <u>and</u> $pp(1-p)$ will get B1B1
	2nd B1 for an explanation that must lose the 3rd round match
(e)	B1 for correct set of values for R (in a table or a list)
	M1 for at least 3 correct values [apart from P(R = 2)] for R and correct probabilities
	A1 for a fully correct probability distribution
(f)	1st M1 for $260\times\mathrm{P}(R=5)$ (ft their P(R = 5) implied by 2nd M1 | 1st A1 for $260\times p^5-10$ **<u>or</u>** $p^5\geqslant\frac{10}{147}$
	2nd M1 for forming a correct ft of $\mathrm{P}(R=5)\geqslant\mathrm{P}(S=5)$ (accept > or allow =) [ft their (c)]
	2nd A1 for awrt 0.58 <u>or</u> 0.59 [If equals sign is used we need to see awrt 0.59 for the A1]
ALT	$260p^5-10\geqslant 260\times\frac{10}{147}-10$ (M1A1) $\Rightarrow p^5\geqslant\frac{10}{147}$ (M1) etc (A1)

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom

WST01_01
January 2020