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6. A tennis tournament has 5 rounds. After each round, winners go into the next round and losers are knocked out of the tournament. To enter the tournament players must pay an entry fee of \$10 but only the person who wins all 5 rounds receives the prize of \$260

Serena enters this tennis tournament. The random variable S represents the total number of rounds Serena wins. The probability distribution for S is given in the following table.

s	0	1	2	3	4	5
$P(S = s)$	k	$\frac{k}{2}$	$\frac{k}{3}$	$\frac{k}{4}$	$\frac{k}{5}$	$\frac{k}{6}$

(a) Show that $k = \frac{20}{49}$

(2)

(b) Find $E(S)$

(3)

(c) Find Serena's expected profit if she enters the tennis tournament.

(3)

Roger also enters this tennis tournament. Given that Roger is still in the tournament, the probability that he wins the next round is a constant p.
The random variable R represents the total number of rounds that Roger wins.

(d) Explain why $P(R = 2) = p^2(1 - p)$

(2)

(e) Find, in terms of p, the probability distribution for R.

(3)

(f) Find the smallest value of p such that Roger's expected profit is at least as great as Serena's.

(4)

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