Ques	Solution	Mark	Notes
1(a)	$E(X) = 3, \mathrm{Var}(X) = 2.1$ si	B1	
	$E(Y) = 2E(X) + 1$	M1	
	$= 7$	A1	
	$\mathrm{Var}(Y) = 4\mathrm{Var}(X)$	M1	
	$= 8.4$	A1	
(b)	$P(Y = 7) = P(X = 3)$	M1	Award M1 just for this line Award M0A0 for no working
	$= \binom{10}{3} \times 0.3^3 \times 0.7^7$	A1	Accept 0.6496 – 0.3828
	$= 0.267$	A1	or 0.6172 – 0.3504
2(a)	$P(A \cap B) = P(A) + P(B) - P(A \cup B)$ oe	M1	Award B1 for a valid verification
	$P(A \cap B) = 0.4 + 0.5 - 2P(A \cap B)$	A1	
	$P(A \cap B) = 0.3$		
(b)	$P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$	M1	Accept the use of a Venn diagram in (b) and (c)
	$= \dfrac{0.3}{0.5} = 0.6$	A1	
(c)	$P(B \mid A') = \dfrac{P(B \cap A')}{P(A')} \quad (= \dfrac{P(B) - P(B \cap A)}{1 - P(A)})$	M1	
	$= \dfrac{0.5 - 0.3}{1 - 0.4}$	A1	
	$= \dfrac{1}{3}$ (0.33)	A1	
3(a)	P(A chooses G) = 0.3	B1	
(b)	P(B chooses Y) = $\dfrac{8}{10} \times \dfrac{2}{9} + \dfrac{2}{10} \times \dfrac{1}{9}$	M1A1	
	$= 0.2$	A1	Accept 0.2 without working
(c)	P(Diff colours) = $\dfrac{3}{10} \times \dfrac{7}{9} + \dfrac{5}{10} \times \dfrac{5}{9} + \dfrac{2}{10} \times \dfrac{8}{9}$	M1A1	Accept $\dfrac{{}^5C_1 \times {}^3C_1 + {}^5C_1 \times {}^2C_1 + {}^3C_1 \times {}^2C_1}{{}^{10}C_2}$
	$= \dfrac{31}{45}$	A1	
4(a)(i)	$P(X = 9) = \dfrac{e^{-10} \times 10^9}{9!}$	M1	Accept 0.4579 – 0.3328 or 0.6672 – 0.5421
	$= 0.1251$	A1	Award M0 if no working seen
(ii)	$P(X < 12) = 0.6968$	M1A1	Award M1A0 if in adjacent row or column
(b)	Looking at the appropriate section of the table,	M1	
	$n = 19$	A1	Award M1A0 for 18 or 20

5(a)(i)	P(male and bike) = 0.6×0.75 $= 0.45$	**M1A1**	
(ii)	P(owns a bike) $= 0.6 \times 0.75 + 0.4 \times 0.3$ $= 0.57$	**M1A1** **A1**	
(b)	P(female|bike) = $\dfrac{0.12}{0.57}$ = 0.211 (4/19) cao	**B1B1** **B1**	B1 num, B1 denom FT denominator from (a)
6(a) **(i)**	Let X = no. of defective cups so X is B(50,0.05) $P(X=2) = \binom{50}{2} \times 0.05^2 \times 0.95^{48}$ $= 0.261$	**B1** **M1** **A1**	si Accept 0.5405 – 0.2794 or 0.7206 – 0.4595 M0A0 if no working
(ii)	P($3 \le X \le 8$) = 0.9992 – 0.5405 or 0.4595 – 0.0008 = 0.4587	**B1B1** **B1**	Award no marks if no working seen
(b)	Let Y = no. of defective plates so Y is B(250,0.015) $\approx$ Po(3.75) si P($Y = 4$) = $\dfrac{e^{-3.75} \times 3.75^4}{4!}$ = 0.194	**B1** **M1** **A1**	 M0A0 if no working
7(a)	$k\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{6}\right)=1$ $k \times \frac{15}{12} = 1$ $k = \frac{4}{5}$	**M1** **A1**	Or equivalent Accept verification
(b)	$E(X) = \frac{4}{5}\left(\frac{2}{2}+\frac{3}{3}+\frac{4}{4}+\frac{6}{6}\right)$ = 3.2	**M1** **A1**	
(c)	The possible pairs are (3,4), (4,3), (2,6),(6,2) Prob = $\frac{4}{5}\times\frac{1}{3}\times\frac{4}{5}\times\frac{1}{4}\times 2+\frac{4}{5}\times\frac{1}{2}\times\frac{4}{5}\times\frac{1}{6}\times 2$ = 0.213 (16/75)	**B1** **M1A1** **A1**	B1 for (3,4),(2,6) M1A0A0 if factor 2 missing

8(a)	P(1st hit with 3rd throw) $= 0.7 \times 0.7 \times 0.3$ $= 0.147$	**M1** **A1**	
(b)(i)	P(F wins 1st throw) = P(G misses) × P(F hits) $= 0.8 \times 0.3 = 0.24$	**M1** **A1**	
(ii)	P(F wins with 2nd throw) = P(G miss) × P(F miss) × P(G miss) × P(F hits) $= 0.8 \times 0.7 \times 0.8 \times 0.3 = 0.1344$	**M1** **A1**	
(iii)	P(F wins) $= 0.24 + 0.24 \times 0.56 + 0.24 \times 0.56^2 + \ldots$ $= \frac{0.24}{1-0.56}$ $= 0.545 \left(\frac{6}{11}\right)$	**M1** **B1** **A1**	Award this M1 for realising that the probability is the sum of an infinite geometric series
9(a)	$E\left(\frac{1}{X}\right) = \frac{4}{9}\int_1^2 \frac{1}{x}(4x - x^3)\mathrm{d}x$ $= \frac{4}{9}\left[4x - \frac{x^3}{3}\right]_1^2$ $= 0.741 \quad (20/27)$	**M1A1** **A1** **A1**	M1 for the integral of $\frac{1}{x}f(x)$ A1 for completely correct although limits may be left until 2nd line Award M0 if no working
(b)(i)	$F(x) = \frac{4}{9}\int_1^x (4u - u^3)\mathrm{d}u$ $= \frac{4}{9}\left[2u^2 - \frac{u^4}{4}\right]_1^x$ $= \frac{8x^2}{9} - \frac{x^4}{9} - \frac{7}{9}$	**M1** **A1** **A1**	Allow x as dummy variable Limits may be left until next line but must then be applied
(ii)	$P(1.25 \le X \le 1.75) = F(1.75) - F(1.25)$ $= 0.5625 \quad (9/16)$	**M1** **A1**	FT from (b)(i) if possible
(iii)	The median m satisfies $\frac{8m^2 - m^4 - 7}{9} = 0.5$ $m^4 - 8m^2 + 11.5 = 0$ $m^2 = \left(\frac{8 \pm \sqrt{64-46}}{2}\right) = 1.88$ $m = 1.37$	**M1** **A1** **A1** **A1**	FT from (b)(i) if possible Condone the absence of ±