EXPERT TUITION

Maths Questions By Topic:

Probability
Mark Scheme

Edexcel GCSE (Higher)

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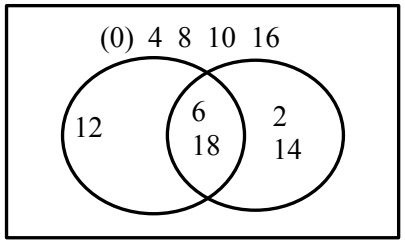
Question	Answer	Mark	Mark scheme	Additional guidance
1	Venn Diagram	C1 C1 C1	for one correct region for two correct regions for all regions correct	 Ignore all entries except the region you are marking for each mark
2	$\frac{180}{336}$	P1 P1 P1 A1	for $\frac{3}{7}$ or $\frac{4}{7}$ or $\frac{5}{7}$ as probability for second counter for one correct product eg $\frac{3}{8}\times\frac{5}{7}\times\frac{4}{6}$ $(=\frac{60}{336})$ **or** $\frac{5}{8}\times\frac{3}{7}\times\frac{4}{6}$ $(=\frac{60}{336})$ **or** $\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}$ $(=\frac{60}{336})$ for a complete process eg $\frac{3}{8}\times\frac{5}{7}\times\frac{4}{6}+\frac{5}{8}\times\frac{3}{7}\times\frac{4}{6}+\frac{5}{8}\times\frac{4}{7}\times\frac{3}{6}$ oe, eg $\frac{15}{28}$ SC B1 for answer of $\frac{225}{512}$ (replacement)	May be seen in a calculation or on a diagram Accept equivalent fractions, decimals (0.53... or 0.54) or percentages (53% or 54%)

Question	Answer	Mark	Mark scheme	Additional guidance
3	0.42	P1	for appropriate multiplication eg 0.3×0.7 (=0.21) **or** 0.3×0.1 (=0.03) **or** 0.3×0.6 (=0.18)	Probabilities could also be given in fraction or percentage form
		P1	(dep) for complete process eg $0.3 \times 0.7 + 0.7 \times 0.3$ **or** $0.3 \times 0.1 + 0.3 \times 0.6 + 0.6 \times 0.3 + 0.1 \times 0.3$	
		A1	oe	Acceptable equivalents are 42% or $\frac{42}{100}$ oe

Question	Answer	Mark	Mark scheme	Additional guidance
4 (a)	0.4, 0.4	P1	for process to find sum of unknown probabilities, eg 1 – 0.2 (= 0.8)	Award mark for any two probabilities given that sum to 0.8, eg given in the table
		A1	oe	Accept any equivalent fraction or 40%
(b)	60	P1	for complete process to find total number of cubes, eg 12 ÷ 0.2 **or** 12 × 5 **or** (“0.4” ÷ 0.2) ×12 + (“0.4” ÷ 0.2) ×12 + 12 **OR** states 0.1 = 6 **or** 0.4 = 24	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
5	12 red, 9 green	P1	for process to find a relationship between r and g eg $\frac{g}{r+g}=\frac{3}{7}$ **or** $\frac{g}{r}=\frac{3}{4}$	
		P1	for process to find a second relationship between r and g eg $\frac{g+3}{r+2+g+3}=\frac{6}{13}$ **or** $\frac{g+3}{r+2}=\frac{6}{7}$	
		P1	(dep P2) for start to process of solving pair of equations, eg eliminates one variable from the equations **or** removes fractions from both equations	
		P1	(dep P3) for complete process to solve equations to find g **or** r	
		A1	cao	
			OR	
		P1	for two of $3x + 3$, $4x + 2$ and $7x + 5$	
		P1	for $\frac{3x+3}{7x+5}=\frac{6}{13}$	
		P1	(dep P2) for removing fractions from the equation, eg $13(3x + 3) = 6(7x + 5)$ **or** $39x + 39 = 42x + 30$	
		P1	(dep P3) for complete process to solve $13(3x + 3) = 6(7x + 5)$	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
6	21	P1	for a relevant probability, eg P(green) = $\frac{x}{2x+3}$ or P(blue) = $\frac{x+3}{2x+3}$	the number of green and blue pens could be $x - 3$ and x or equivalent probabilities must be in an algebraic form in a single variable
		P1	for a relevant product, eg. $"\frac{x}{2x+3}" \times "\frac{x-1}{2x+2}"$ or $"\frac{x+3}{2x+3}" \times "\frac{x+2}{2x+2}"$ **OR** $\left("\frac{x}{x+3}"\right)^2 + \left("\frac{x+3}{2x+3}"\right)^2 = \frac{27}{75}$	This is an exception using replacements. No further credit is available
		P1	forms an appropriate equation, eg. $"\frac{x}{2x+3} \times \frac{x-1}{2x+2}" + "\frac{x+3}{2x+3} \times \frac{x+2}{2x+2}" = \frac{27}{55}$	
		P1	(dep P3) process to reduce equation to $ax^2 + bx + c = 0$ eg. $x^2 - 25x + 84 = 0$	
		P1	process to solve quadratic equation eg. $(x - 21)(x - 4) = 0$	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
7	0.12	P1	for process to start eg $(1 - 0.2) \div (3 + 17)$ (= 0.04) **or** $(3 + 17) \div (1 - 0.2)$ oe (= 25) **or** $(100 - 20) \div (3 + 17)$ (= 4) **or** 3×4 (= 12) and 17×4 (= 68)	Just $1 - 0.2 = 0.8$ is **not** sufficient for P1 May be seen in a ratio
		P1	full process to find the required probability eg $3 \times$ "0.04" **or** $\frac{3}{20} \times (1 - 0.2)$ oe **or** $3 \div$ "25" or $3 \times$ "4" $\div 100$	
		A1	oe	0.12 using incorrect probability notation gets P2

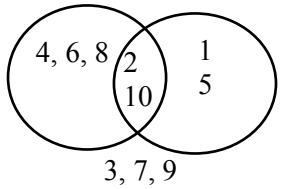
Question	Working	Answer	Mark	Notes
8		$\frac{28}{72}$	P1	for $\frac{6}{8}$ or $\frac{2}{8}$ or $\frac{7}{8}$ or $\frac{1}{8}$ oe seen on diagram or in a calculation
			P1	for $\frac{7}{9} \times \frac{2}{8}$ or $\frac{2}{9} \times \frac{7}{8}$ or $\frac{14}{72}$ oe for $\frac{7}{9} \times \frac{6}{8}$ or $\frac{2}{9} \times \frac{1}{8}$ or $\frac{42}{72}$ or $\frac{2}{72}$ or $\frac{44}{72}$ oe
			P1	for $\frac{7}{9} \times \frac{2}{8} + \frac{2}{9} \times \frac{7}{8}$ for $1 - (\frac{7}{9} \times \frac{6}{8} + \frac{2}{9} \times \frac{1}{8})$ or $1 - ("\frac{42}{72}" + "\frac{2}{72}")$
				or $"\frac{14}{72}" + "\frac{14}{72}"$oe or $1 - "\frac{44}{72}"$ oe
			A1	oe SC B1 for $\frac{14}{81}$ B2 for $\frac{28}{81}$

Question	Working	Answer	Notes
9		25	P1 For process to start to solve. Eg use of x and $4x$ or $x/5x$ and $4x/5x$ P1 process to form equation eg $\frac{x}{5x} \times \frac{x-1}{5x-1} = \frac{6}{155}$ P1 Processes to eliminate fractions and reduce equation to linear form eg. $155x - 155 = 150x - 30$ A1

Question	Working	Answer	Notes
10		0.22	P1 begins process of subtraction of probabilities from 1 A1 oe
11 (a)		Sharif	B1 Sharif with mention of greatest total throws
(b)		No (supported)	P1 starts working with proportions A1 Conclusion: correct for Paul, but not for the rest; or ref to just Paul's results P1 selects Sharif or overall and multiplies P(heads)×P(heads) eg ¾ × ¾
(c)	Tot: H 300 T 100	9 16	A1 oe
12		$\frac{10x-x^2}{45}$	P1 for $\frac{x}{10}$ or $\frac{10-x}{10}$ or $\frac{x-1}{9}$ or $\frac{10-x}{9}$ or $\frac{x}{9}$ or $\frac{9-x}{9}$ seen on diagram or in a calculation P1 for $\frac{x}{10}\times\frac{10-x}{9}$ or $\frac{10-x}{10}\times\frac{x}{9}$ | for $\frac{x}{10}\times\frac{x-1}{9}+\frac{10-x}{10}\times\frac{9-x}{9}$ P1 for $\frac{x}{10}\times\frac{10-x}{9}+\frac{10-x}{10}\times\frac{x}{9}$ | for $1-(\frac{x}{10}\times\frac{x-1}{9}+\frac{10-x}{10}\times\frac{9-x}{9})$ P1 (dep on P3) for beginning to process the algebra A1 $\frac{10x-x^2}{45}$ oe

Question	Working	Answer	Notes
13 a	$\frac{1}{6}\times\frac{1}{5}\times 30\times 5=5$ $(\frac{5}{6}\times\frac{1}{5}+\frac{1}{6}\times\frac{4}{5}+\frac{1}{6}\times\frac{1}{5})\times 30\times 2$ $30-5-20$	5	P1 for identifying correct process to find probabilities for winnng scores. May include use of tree diagram or sample space P1 for correct process to find prize money P1 for completing correct process to find profit A1
b		Explanation	C1 for appropriate comment to interpret result eg probability so only likelihood not certainty, other than 30 may play, £5 is small difference.
14		Events independent	C1 Statement that events are independent

Question	Answer	Mark	Mark scheme	Additional guidance
15	0.748	P1	for a process to find a correct probability product for 2 consecutive days, eg. 0.7 × 0.8 (rain M + T) **or** 0.7 × 0.2 (rain M + no rain T) **or** 0.3 × 0.6 (no rain M + rain on T) **or** 0.3 × 0.4 (no rain M + T)	Throughout accept probabilities given as fractions or percentages Could be for Tuesday and Wednesday also
		P1	for process to find a correct triple probability product for it raining on Wednesday, eg. 0.7 × 0.8 × 0.8 (rain M + T + W) (= 0.448 **or** $\frac{56}{125}$ oe) **or** 0.7 × 0.2 × 0.6 (rain M + no rain T + rain W) (= 0.084 **or** $\frac{21}{250}$ oe) **or** 0.3 × 0.6 × 0.8 (no rain M + rain T + rain W) (= 0.144 **or** $\frac{18}{125}$ oe) **or** 0.3 × 0.4 × 0.6 (no rain M + no rain T + rain W) (= 0.072 **or** $\frac{9}{125}$ oe)	
		P1	for complete process, eg. "0.448" + "0.084" + "0.144" + "0.072"	
		A1	oe eg, $\frac{187}{250}$	NB: correct answer without supportive working gets 0 marks

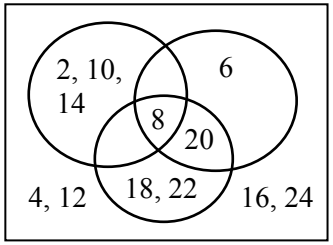
Question	Answer	Mark	Mark scheme	Additional guidance
16 (a)	Venn diagram	M1	for correct numbers in at least one region	Ignore all entries except the region you are marking for each method mark
		M1	for correct numbers in at least two regions	
		A1	for all regions correct	
(b)	$\frac{2}{10}$	M1	for $\frac{a}{10}$ where $0 < a < 10$ and a is an integer **or** $\frac{2}{b}$ where $b > 2$ and b is an integer **or** ft diagram	Need not be written in correct form at this stage eg could be a ratio 2 : 10 Repeated digits in the diagram should be counted as 2 elements
		A1	$\frac{2}{10}$ oe **or** ft diagram	Accept any equivalent fraction, decimal form 0.2 or percentage form 20%

Question	Answer	Mark	Mark scheme	Additional guidance
17 (a)	Shown	M1	for $\frac{n}{n+8}$ **or** starts to work with ratios, eg 3:7	
		M1	forms equation and clears fractions, eg $10n = 7n + 56$ or $10n + 3(n + 8) = 10(n + 8)$ **or** equates $\frac{3}{10} = \frac{8}{x}$ or $\frac{3}{10} = \frac{8}{n+8}$ **or** continues to work with ratios, eg 3:7 = 24:56	
		C1	gives the total sweets eg $\frac{80}{3}$ oe **or** number of red sweets $n = \frac{56}{3}$ oe **or** gives number of red as $\frac{56}{3}$ **OR** award 3 marks for a complete written argument, eg, P(y) = $\frac{3}{10}$ and there are 8 yellows. This cannot work as 3 is not a factor of 8 (and $\frac{3}{10}$ is in its simplest form)	Does not have to restate the $\frac{7}{10}$; giving a different probability will suffice

Question	Answer	Mark	Mark scheme	Additional guidance
17 (b)	28	P1	for $\frac{n}{n+8}$ and $\frac{n-1}{n+7}$ oe	
		P1	forms an appropriate equation, eg $\frac{n}{n+8}\times\frac{n-1}{n+7}=\frac{3}{5}$	
		P1	for correctly forming a quadratic ready for solving, eg $an^2 + bn + c$ (= 0), $2n^2 - 50n - 168$ (= 0), $n^2 - 25n - 84$ (= 0) oe	Note we do not need to see "= 0"; just the LHS is sufficient.
		P1	process to solve quadratic equation, ft a 3 term quadratic factorising eg $(n + 3)(n - 28)$ (=0) oe **or** completing the square **or** correct use of formula eg $\frac{--25\pm\sqrt{25^2-4\times-84}}{2}$, $\frac{--50\pm\sqrt{50^2-4\times2\times-168}}{2\times2}$	
		A1	cao	Award 0 marks for a correct answer with no supportive working.

Question	Answer	Mark	Mark scheme	Additional guidance
18	$\frac{52}{72}$	P1	for $\frac{4}{9}\times\frac{3}{8}\left(\frac{12}{72}\right)$ **or** $\frac{4}{9}\times\frac{5}{8}$ **or** $\frac{5}{9}\times\frac{4}{8}\left(\frac{20}{72}\right)$	
		P1	for $1-\left(\frac{5}{9}\times\frac{4}{8}\right)$ **or** $\frac{4}{9}\times\frac{3}{8}+\frac{4}{9}\times\frac{5}{8}+\frac{5}{9}\times\frac{4}{8}$ oe	
		A1	for $\frac{52}{72}$, $\frac{13}{18}$ oe SC B1 for answer of $\frac{56}{81}$ (replacement)	Accept equivalent fractions, decimals (0.72…) or percentages (72.22…..%)

Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	Diagram completed 0.85 0.15, 0.85, 0.15, 0.85	M1 A1	for 1 – 0.15 (=0.85) fully correct diagram	
(b)	0.2775	M1 M1 A1	for one correct product eg 0.15 × 0.15 (= 0.0225) or 0.15 × 0.85 (= 0.1275) or 0.85 × 0.85 (= 0.7225) for a complete method eg “0.0225” + 2×”0.1275” **OR** 1 – “0.7225” oe oe, eg $\frac{111}{400}$	ft their diagram provided probabilities are less than 1 ft their diagram provided probabilities are less than 1

Question	Answer	Mark	Mark scheme	Additional guidance
20 (a)	Venn diagram	C4	fully correct Venn diagram	
		(C3	7 of the 8 regions correct **or** for a diagram with only one number incorrectly placed)	
		(C2	5 or 6 of the 8 regions correct)	
		(C1	3 or 4 of the 8 regions correct)	
(b)	$\frac{1}{12}$	M1	ft for identification of 1 or 12 eg from the diagram	Need not be written as a fraction or probability at this stage. eg could be a ratio 1:12
		A1	ft oe	Acceptable equivalents are (eg, could ft) any fraction equivalent to $\frac{1}{12}$, 0.08(33..) or 8(.33..)%
21 (a)	0.455	M1	for $0.65 \times (1 - 0.65)$ or 0.65×0.35 (=0.2275 or $\frac{91}{400}$) or 2×0.2275 oe	Could be shown on a tree diagram but must show an intention to multiply
		A1	oe	Acceptable equivalents are 45.5% or $\frac{91}{200}$ oe
(b)	42	M1	for a start of the process eg $78 \div 0.65$ (= 120) or 78×0.35 (=27.3)	$\frac{78 \times 0.35}{0.65}$, $\frac{78}{0.65} - 78$
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
22	$\frac{3}{22}$	P1	for a process to find a first value eg male/Britain = 32 – 11 (=21) **or** Italy/total = 60 – (32+12) (=16) **or** female/total = 60 – 38 (=22)	<table><tr><td></td><td>Br</td><td>Sp</td><td>It</td><td>Tot</td></tr><tr><td>M</td><td>**21**</td><td>**9**</td><td>8</td><td>38</td></tr><tr><td>F</td><td>11</td><td>**3**</td><td>**8**</td><td>**22**</td></tr><tr><td>Tot</td><td>32</td><td>12</td><td>**16**</td><td>60</td></tr></table>
		P1	for process to find a secondary value, eg male/Spain = 38 – (“21” + 8) (=9) **or** female/Italy = “16” – 8 (=8)	May be seen in a frequency tree Values attributed to a category or from method seen
		P1	complete process to find female/Spain, eg 12 – “9” **or** “22” – (11 + “8”) (=3)	
		A1	oe accept 0.136 to 0.14 SC B3 for $\frac{3}{60}$	
23 (a)	0.55, 0.67, 0.33, 0.35, 0.65	B1	for 0.55 in correct position	Can be seen as fractions or percentages
		B1	for the branches for the second game correct	
(b)	0.341	M1	for one correct product, eg 0.45 × “0.33” (=0.1485) **or** “0.55” × “0.35” (=0.1925) **or** 0.45 × “0.67” (=0.3015) **or** “0.55” × “0.65” (=0.3575)	Follow through acceptable for method marks from their tree in part (a) providing probabilities are less than 1. Accept fractional equivalents
		M1	for correct method eg (0.45 × “0.33”) + (“0.55” × “0.35”) **or** 1 – (0.45 × “0.67”) – (“0.55” × “0.65”)	
		A1	answer in range 0.34 – 0.341 oe	

Question	Working	Answer	Mark	Notes
24 (a)		$\frac{1}{55}$	M1	for $\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10}$
			A1	for $\frac{1}{55}$ oe
(b)		Conclusion (supported)	C1	starts correct argument, eg by calculating a relevant probability, eg $\frac{5}{15} \times \frac{4}{14} \times \frac{3}{13}$
			C1	statement of "more likely" from eg comparison of probabilities, ft answer to (a) eg $\frac{1}{55}$ (= 0.018…) and $\frac{2}{91}$ (= 0.021…or 0.022)

Question	Working	Answer	Mark	Notes
25		98	P1 P1 A1 P1 P1 A1	for process to find P(1), eg. 1 – 0.17 – 0.18 – 0.09 – 0.15 – 0.1 (= 0.31) or for a process to find P(1 or 3), eg. 1 – 0.17 – 0.09 – 0.15 – 0.1 (= 0.49) for process to find the number of 3s eg. 0.18 × 200 (=36) or process to find the number of 1s, e.g. P(1) × 200 (= 62), or process to find the number of (1 or 3)s, eg [P(1) + 0.18] × 200 or for process to find any expected frequency using any probability × 200 eg. 0.17 × 200 cao OR for process to find P(2 or 4 or 5 or 6), eg. 0.17 + 0.09 + 0.15 + 0.1 (= 0.51) for process to find the number of (2 or 4 or 5 or 6)s, eg. "0.51" × 200 (= 102) cao
26 (a)		comment	C1	for comment e.g. incorrect denominator for the 2nd student or probabilities for 2nd student do not add up to 1
(b)		No (supported)	C1	for "no" with supporting evidence, e.g. probabilities should be multiplied together or 0.4 × 0.25

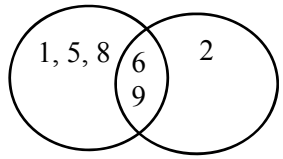
Question	Working	Answer	Notes
27 (a)		0.4,0.6	B1 correctly placing probs for light A eg 0.4, 0.6
		0.3,0.7,0.8,0.2	B1 correctly placing probs for light B eg 0.3, 0.7, 0.8, 0.2
(b)		B with correct	P1 (ft) eg 0.4×0.3 or 0.6×0.8 or $1-(0.28+0.12)$
		probabilities	P1 both sets of correct probability calculations
			C1 Correct interpretation of results with correct comparable results

Question	Working	Answer	Notes
28 (a)		0.49	M1 for 0.7 × 0.7 A1 for 0.49 oe
(b)		0.51	M1 for a correct process, eg. 1 – "0.49" or 0.7 × 0.3 + 0.3× 0.7 + 0.3 × 0.3 A1 for 0.51 oe

Question	Working	Answer	Notes
29 (a)(i)		10, 12, 14, 15, 16, 18	B1 cao
(ii)		12, 18	B1 cao
(b)		$\frac{7}{10}$	M1 for 7 or indicating correct region or for 10, 14, 16, 11, 13, 17, 19 listed
			A1 for $\frac{7}{10}$ oe

Question	Answer	Mark	Mark scheme	Additional guidance
30 (a)	0.5, 0.3	P1	for $1 - 0.05 - 0.15$ (= 0.8)	Award this mark for any two probabilities that sum to 0.8
		A1	oe	
(b)	120	M1	$18 \div 0.15$ oe **or** $6 + 18 + a + b$ where $a + b = 96$	
		A1	cao	
31	$1 - \left(\frac{1}{2}\right)^n - \left(\frac{1}{2}\right)^n$	M1	for $\left(\frac{1}{2}\right)^n$ oe	
		A1	oe eg $1 - \left(\frac{1}{2}\right)^{n-1}$	

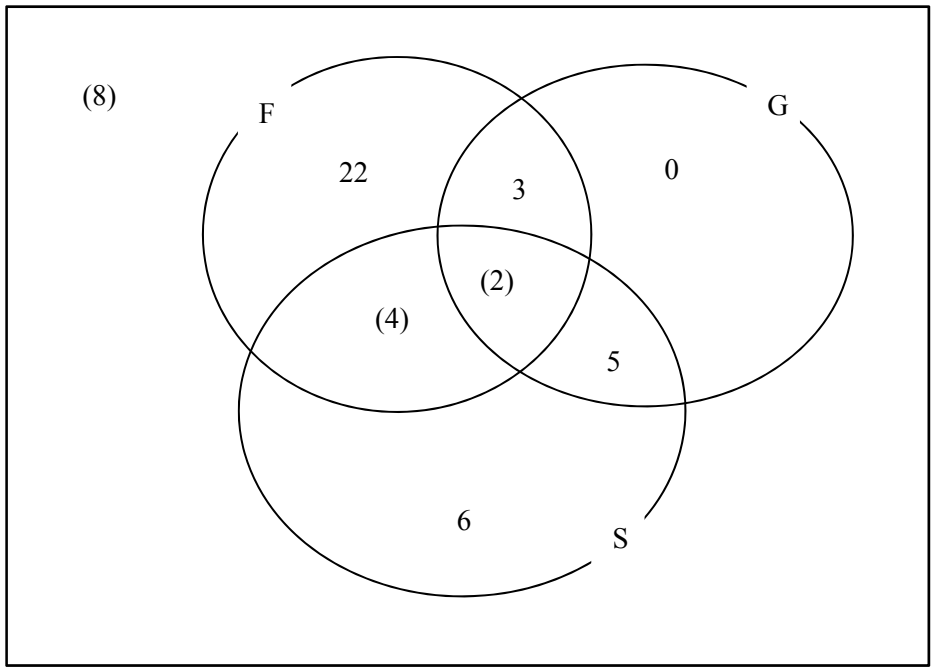
Question	Answer	Mark	Mark scheme	Additional guidance
32 (a)	$\frac{1}{3}, \frac{2}{3}$ $\frac{1}{3}, \frac{2}{3}, \frac{1}{3}, \frac{2}{3}$	B2	six fully correct probabilities	Accept any equivalent fraction, decimal form 0.33(3...) and 0.66(6...) or 0.67 or percentage form 33(.3...)% and 66(.6...)% or 67%
		(B1	at least 2 correct probabilities)	
(b)	$\frac{2}{9}$	M1	for $\frac{1}{3} \times \frac{2}{3}$ oe or ft probabilities from diagram	
		A1	for $\frac{2}{9}$ oe	Accept any equivalent fraction, decimal form 0.22(2...) or percentage form 22(.2...)%
33	24	P1	for start to process of working out the unknown probabilities, eg $1 - 0.32 - 0.20$ (= 0.48) **or** assigning probabilities as $5x$ and x **or** process to work out the number of blue or green counters, eg 0.32×300 (= 96) or 0.20×300 (= 60) or 0.52×300 (= 156)	Award for P(R) + P(Y) = 0.48, may be seen in table
		P1	for process to find the probability, eg $5x + x$ = "0.48" or "0.48" ÷ 6 (= 0.08) **or** process to find the number of red or yellow counters, eg 300 – "96" – "60" or 300 × "0.48"	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
34	0.1709	M1	for one product, 0.07 × 0.98 (=0.0686) **or** 0.93 × 0.11 (=0.1023) **or** 0.07 × 0.02 (=0.0014) **or** 0.93 × 0.89 (= 0.8277)	If all products shown, award this mark
		M1	for a fully correct method, eg 0.07 × 0.98 + 0.93 × 0.11 **or** 1 – (0.07 × 0.02) – (0.93 × 0.89)	
		A1	oe	
35	$\frac{1}{81}$	M1	for finding the probability of heads eg $\sqrt[4]{\frac{16}{81}}$ $(=\frac{2}{3})$ **or** for finding the probability of tails $1-\sqrt[4]{\frac{16}{81}}$ $(=\frac{1}{3})$	Seeing a probability of $\frac{2}{3}$ or $\frac{1}{3}$ is enough for this mark
		A1	oe	
36 (a)	6, 9	M1	for 6, 9 in the intersection only	Ignore all entries except the region you are marking for each method mark
	1, 5, 8 2 3, 4, 7	M1	for 1, 5, 8 in set *A* only or 2 in set *B* only or 3, 4, 7 in set $(A\cup B)'$ only	
		C1	for all numbers correctly placed in the Venn Diagram	
(b)	$\frac{2}{9}$	M1	ft for identification of 2 or 9 or ft diagram	Need not be written in correct form at this stage eg could be a ratio 2 : 9 Repeated digits in the diagram should be counted as 2 elements
		A1	$\frac{2}{9}$ oe or ft diagram	Accept any equivalent fraction, decimal form 0.22(22..) or percentage form 22(.22…)%

Question	Answer	Mark	Mark scheme	Additional guidance
37	Probabilities should sum to 1	C1	for stating that the probabilities should total 1 eg 0.25 should be 0.35	
	0.35 and 0.65 reversed	C1	for recognising that the 0.35 and 0.65 in the first branches for the 2nd throw should be reversed eg, "for the second throw, the probability it lands on 4 should be 0.65"	Can be shown on the diagram
38 (a)	8	P1	for process to find sum of unknown probabilities, eg $1 - 0.45 - 0.25$ (= 0.3) **OR** to find the total number of counters in the bag, eg $\frac{18}{0.45}$ (= 40) **OR** to find the number of yellow counters, eg $\frac{0.25}{0.45} \times 18$ (= 10)	Award mark for any two probabilities given that sum to 0.3 eg given in the table.
		P1	for process to find P(red) = 0.2 oe **or** P(white) = 0.1 oe **OR** for process to find the total number of red and white counters, eg "40" – 18 – "10" (=12) **OR** for process to derive an equation in x, eg $2x + x = 1 - 0.45 - 0.25$ or $2x + x =$ "0.3" or $x = 0.1$	Award P2 for P(red) or P(white) (could be shown in table) Equations could be given as written statements or working but must be fully equivalent.
		P1	for a complete process to find the number of red counters, eg $\frac{2 \times 0.1}{0.45} \times 18$ or $\frac{2}{3} \times$ "12" or $0.2 \times$ "40" or $\frac{0.2}{0.025}$	
		A1	cao	
(b)	Explanation	C1	for explanation eg 0.5 multiplied by an odd number will never be a whole number, for half of a number to be an integer that number must be even, you can't have half a marble	

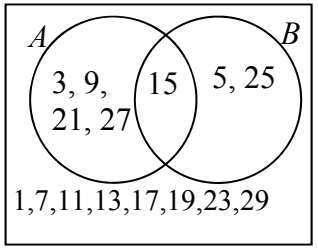
Question	Answer	Mark	Mark scheme	Additional guidance
39	$\frac{6}{490}$	P1	for start to process information, eg draws Venn diagram and shows at least 1 unknown amount, eg 5 speak German and Spanish but not French	See Venn Diagram at end of mark scheme – rectangle not needed
		P1	for process to find at least 3 unknown amounts from, eg 5 speak German and Spanish but not French 3 speak French and German but not Spanish 22 speak French but not German or Spanish 0 speak German but not French or Spanish	
		P1	for complete process to find number of people who speak only Spanish (= 6)	Award first 3 marks to students who show this on the Venn diagram or in a statement.
		P1	for $\frac{\text{[number speaking Spanish only]}}{50} \times \frac{\text{[number speaking Spanish only]} - 1}{49}$, eg $\frac{6}{50} \times \frac{5}{49}$	Award this mark for use of their number of students who speak Spanish. Must be a clear link, eg from Venn diagram
		A1	for $\frac{6}{490}$ oe	See note 8 in general marking guidance but 0.01 or 1% must be from seen correct working.

39

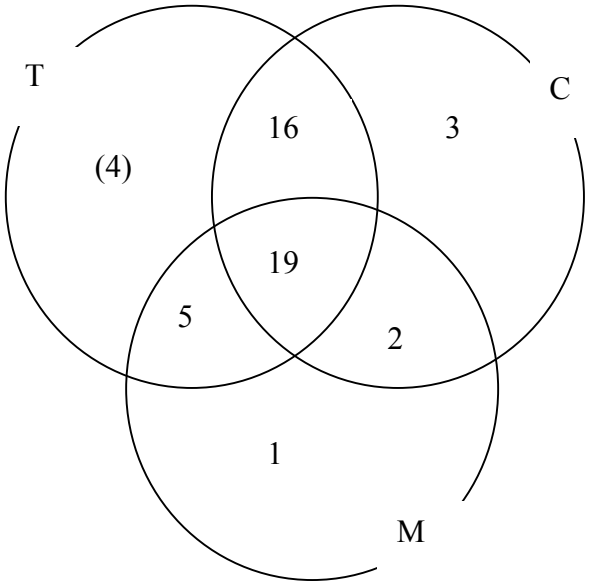


EXPERT TUITION

Question	Working	Answer	Mark	Notes
40 (a)		Mel (supported)	B1	Mel with reference to greatest number of throws
(b)		$\frac{2}{9}$	M1	selects overall total and multiplies P(point up)×P(point down) eg $\frac{50}{150}\times\frac{100}{150}$ oe (accept $\frac{14}{45}\times\frac{31}{45}$ or $\frac{27}{80}\times\frac{53}{80}$ or $\frac{9}{25}\times\frac{16}{25}$)
			A1	for $\frac{2}{9}$ oe
41 (a)		0.05	B1	for 0.05 oe
(b)		20	C1	for stating that at least 20 required
		Reason	C1	for reason eg explains that number of each colour must be a whole number or that there must be (at least) 1 red counter or shows that 0.05 = $\frac{1}{20}$
42		48	M1	for 0.25×0.6 (= 0.15) or 0.75×0.4 (= 0.3)
			M1	for 0.25×0.6 (= 0.15) and 0.75×0.4 (= 0.3) or for 24 ÷ "0.15" (= 160)
			A1	cao

Question	Working	Answer	Mark	Notes
43 (a)		Venn Diagram	B1 M1 M1 C1	for labels on diagram for just 15 in the intersection for just 5 and 25 in only set B or just 3, 9, 21 and 27 in only set A or just 1, 7, 11, 13, 17, 19, 23, 29 in $(A \cup B)'$ for all numbers correctly placed in the Venn Diagram Ignore all entries except the region you are marking for each method mark
(b)		$\frac{7}{15}$	P1	ft for $\frac{"7"}{a}$ where $a \geq$ "7" or $\frac{b}{"15"}$ where $b \leq$ "15"
			A1	ft $\frac{7}{15}$ oe
44		Explanation	C1	No with statement about not being mutually exclusive events eg a person could be in both categories

Question	Working	Answer	Notes
45 (a)	Draws correct Venn diagram	$\frac{44}{50}$	M1 Begin to interpret given information e.g. 3 overlapping labelled ovals with central region correct M1 Extend interpretation of given information e.g. 3 overlapping labelled ovals with at least 5 regions correct M1 Method to communicate given information e.g. 3 overlapping labelled ovals with all regions correct including outside A1 oe
(b)		$\frac{21}{44}$	P1 For correct process to identify correct regions in Venn diagram and divide by '44' A1
46		0.49	P1 for $\sqrt{0.09}$ P1 for $(1-"\sqrt{0.09}")^2$ A1 cao



Question	Working	Answer	Notes
47 (a)		chain of reasoning	C1 for a relevant product eg $\frac{y}{y+5}\times\frac{5}{y+4}$ C1 for a correct equation eg $2\times\left(\frac{y}{y+5}\times\frac{5}{y+4}\right)=\frac{6}{11}$ C1 for method to eliminate fractions from algebraic expression C1 complete chain of reasoning
(b)		$\frac{3}{11}$	M1 method to solve equation eg $(ax + b)(cx + d)$ with $ac = 3$ and $bd = \pm 60$ A1 for selecting $y = 6$ A1 for $\frac{3}{11}$ oe

Question	Working	Answer	Mark	Notes
48		$\frac{4}{15}$	3	M1 for a method to find the total number of people eg 3×5 (= 15) or $\frac{5}{15} = \frac{1}{3}$ M1 (dep) for "15" – 5 – 6 (= 4) A1 oe OR M1 for a method to find prob (boy) eg $\frac{6}{5} \times \frac{1}{3}$ (= $\frac{6}{15}$) M1 (dep) for $1 - \text{“}\frac{6}{15}\text{”} - \frac{1}{3}$ A1 oe OR M1 for an expression for the number of adults eg $\frac{5}{5+6+x}$ M1 (dep) for $\text{“}\frac{5}{5+6+x}\text{”} = \frac{1}{3}$ or $x = 4$ A1 oe **SC:** B2 for $\frac{4}{n}$ where $n > 4$, $n \neq 15$

Question	Working	Answer	Mark	Notes
49 (a)		$\frac{42}{110}$	3	M1 for use of 11 and 10 in the denominators M1 for $\frac{7}{11} \times \frac{6}{10}$ oe A1 for $\frac{42}{110}$ oe **SC for replacement**: B1 for $\frac{7}{11} \times \frac{7}{11}$ $(= \frac{49}{121})$
(b)		$\frac{62}{110}$	3	M1 for correct method for GG $\frac{3}{11} \times \frac{2}{10}$ $(= \frac{6}{110})$ M1 (dep) $1 - (BB + GG)$ $= 1 - (\text{“}\frac{42}{110}\text{”} + \text{“}\frac{6}{110}\text{”})$ A1 for $\frac{62}{110}$ oe OR M1 for at least two of $\frac{7}{11} \times \frac{3}{10}$, $\frac{7}{11} \times \frac{1}{10}$, $\frac{3}{11} \times \frac{1}{10}$ oe M1 for a complete method eg $2 \times (\frac{7}{11} \times \frac{3}{10} + \frac{7}{11} \times \frac{1}{10} + \frac{3}{11} \times \frac{1}{10})$ oe A1 for $\frac{62}{110}$ oe **SC for replacement**: B2 for $2 \times (\frac{7}{11} \times \frac{3}{11} + \frac{7}{11} \times \frac{1}{11} + \frac{3}{11} \times \frac{1}{11})$ oe $(= \frac{62}{121})$ or $(\frac{7}{11} \times \frac{4}{11} + \frac{3}{11} \times \frac{8}{11} + \frac{10}{11} \times \frac{1}{11})$ oe $(= \frac{62}{121})$ or $1 - (\text{“}\frac{49}{121}\text{”} + \frac{9}{121} + \frac{1}{121})$ oe $(= \frac{62}{121})$ (B1 for at least two of $\frac{7}{11} \times \frac{3}{11}$, $\frac{7}{11} \times \frac{1}{11}$, $\frac{3}{11} \times \frac{1}{11}$ oe)

Question	Working	Answer	Mark	Notes
50		$\frac{52}{72}$	4	B1 for $\frac{3}{8}$ or $\frac{2}{8}$ or $\frac{1}{8}$ seen as second probability M1 for $\frac{4}{9}\times\frac{3}{8}$ or $\frac{3}{9}\times\frac{2}{8}$ or $\frac{2}{9}\times\frac{1}{8}$ M1 for $1-(\frac{4}{9}\times\frac{3}{8}+\frac{3}{9}\times\frac{2}{8}+\frac{2}{9}\times\frac{1}{8})$ or $\frac{4}{9}\times\frac{3}{8}+\frac{4}{9}\times\frac{2}{8}+\frac{3}{9}\times\frac{4}{8}+\frac{3}{9}\times\frac{2}{8}+\frac{2}{9}\times\frac{4}{8}+\frac{2}{9}\times\frac{3}{8}$ A1 for $\frac{52}{72}$ oe OR B1 for $\frac{5}{8}$ or $\frac{6}{8}$ or $\frac{7}{8}$ seen as second probability M1 for $\frac{4}{9}\times\frac{5}{8}$ or $\frac{3}{9}\times\frac{6}{8}$ or $\frac{2}{9}\times\frac{7}{8}$ M1 for $\frac{4}{9}\times\frac{5}{8}+\frac{3}{9}\times\frac{6}{8}+\frac{2}{9}\times\frac{7}{8}$ A1 for $\frac{52}{72}$ oe SCB2 $\frac{52}{81}$ oe

Question	Working	Answer	Mark	Notes
51		90	3	M1 for $1-\frac{3}{5}$ (=$\frac{2}{5}$ or 40%) oe M1 for a complete method to find the number of female teachers (54) eg $36 \div 2 \times 3$ or determines $\frac{3}{5}$(60%) is 54, or 10% is 9 A1 cao **OR** M1 for F : M = 3 : 2 M1 for a complete method to find the number of female teachers (54) eg $\frac{3}{2} \times 36$ oe A1 cao
52 (a)		0.7 0.2 0.3 0.8 0.05 0.95	3	B1 for 0.2, 0.8 oe B1 for 0.7, 0.3 oe B1 for 0.05, 0.95 oe
(b)		0.04	2	M1 for "0.8" × "0.05" A1 oe

Question		Working	Answer	Mark	Notes
53	(a)		60	2	M1 for 200 × 0.3 oe A1 cao
	(b)		0.1	2	M1 subtracting sum of probabilities from 1, e.g. 1−(0.3+0.2+0.4) A1 cao
54		2p 1p ½ p Tot Sat 7 16 (31) 54 Sun (15) 14 17 (46) Tot (22)(30) 48 (100)	14	4	M1 for total Sat bottles 100 – 46 (=54) or for total ½ pint bottles 100 – 22 – 30 (=48) or (total 2 pint bottles on Sat) 22 – 15 (=7) M1 for total Sun bottles of ½ pint "48" – 31 (=17) or for total Sat bottles of 1 pint: "54" – 31 – (22 −15) (=16) M1 for 46 – 15 – "17" or for 30 – "16" A1 cao NB: any of the above figures could be shown in a 2-way table

Question		Working	Answer	Mark	Notes
55	(a		$\frac{2}{10}$	2	M1 for $\frac{2}{a}$ with a > 2 or $\frac{b}{10}$ with $b < 10$ A1 for $\frac{2}{10}$ oe
	(b)		£10 or 1000p	3	M1 for "$\frac{2}{10}$" × 100 (= 20) or 30(p) × 100 (= 3000p or £30) M1 (dep) for "30(p) × 100" – (£)1 × "20" oe A1 ft from (a), provided the answer is not negative. Units must be shown
56	(a		Proof		M1 for $\frac{6}{n}$ or $\frac{5}{n-1}$ M1 for $\frac{6}{n} \times \frac{5}{n-1} \left(= \frac{1}{3}\right)$ A1 for fully correct algebra leading to $n^2 - n - 90 = 0$
	(b)		10	3	M1 for correct start to a solution, eg. $(n \pm 10)(n \pm 9)$ or substitution into the quadratic formula, condoning one sign error or $(n - 0.5)^2 - 0.25 - 90$ A1 for $(n - 10)(n + 9)$ or for 10 and –9 or $\frac{1 \mp 19}{2}$ oe A1 for 10 only

Question		Working	Answer	Mark	Notes
57			$\frac{156}{336}$	4	**Method 1 (Combinations for odd T)** M1 for one probability for odd *T*, eg P(2,3,4) = $\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or P(2,4,5) = $\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}$ or P(3,3,5) = $\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}$ or P(3,5,5) = $\frac{2}{8}\times\frac{4}{7}\times\frac{3}{6}$ or P(5,5,5) = $\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}$ M1 for adding at least two probabilities for odd *T*, eg $\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}+\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}$ or $3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)$ M1 for completely correct method, ie $6\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)+6\left(\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{2}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+\left(\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}\right)$ oe A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **OR** **Method 2 (Combinations for even T)** M1 for one probability for even *T*, eg P(3,4,5) = $\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}$ or P(2,3,3) = $\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or P(2,5,5) = $\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}$ or P(2,3,5) = $\frac{1}{8}\times\frac{2}{7}\times\frac{4}{6}$ or P(4,5,5) = $\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}$ or P(3,3,4) = $\frac{2}{8}\times\frac{1}{7}\times\frac{1}{6}$ M1 for adding at least two probabilities for even *T*, eg $\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}+\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or $3\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)$ M1 for completely correct method, ie $1-[6\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)+3\left(\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+6\left(\frac{1}{8}\times\frac{2}{7}\times\frac{4}{6}\right)+3\left(\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{1}{6}\right)$ oe A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **PTO**

					Method 3 (Combinations of odd and even numbers- odd totals) M1 for one probability for odd T, eg P(E,E,O) =. $\frac{2}{8}\times\frac{1}{7}\times\frac{6}{6}$ or P(O,O,O) = $\frac{6}{8}\times\frac{5}{7}\times\frac{4}{6}$ M1for adding at least two probabilities for odd *T,* eg 3 $\left(\frac{2}{8}\times\frac{1}{7}\times\frac{6}{6}\right)$ or $\left(\frac{2}{8}\times\frac{1}{7}\times\frac{6}{6}\right)+\left(\frac{6}{8}\times\frac{5}{7}\times\frac{4}{6}\right)$ M1 for completely correct method, ie 3 $\left(\frac{2}{8}\times\frac{1}{7}\times\frac{6}{6}\right)+\left(\frac{6}{8}\times\frac{5}{7}\times\frac{4}{6}\right)$ A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **OR** **Method 4 (combinations of odd and even numbers- even totals)** M1 for probability for even T, ie = $\frac{2}{8}\times\frac{6}{7}\times\frac{5}{6}$ M1 for adding at least two probabilities for even *T,* eg 3 $\left(\frac{2}{8}\times\frac{6}{7}\times\frac{5}{6}\right)$ M1 for completely correct method, ie $1-3\left(\frac{2}{8}\times\frac{6}{7}\times\frac{5}{6}\right)$ A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **SC (with replacement)** For example, M0 M1 for adding at least two probabilities for odd or even *T,* eg P(E,E,O) = $\frac{2}{8}\times\frac{2}{8}\times\frac{6}{8}$ or P(O,O,O) = $\frac{6}{8}\times\frac{6}{8}\times\frac{6}{8}$ M1 for completely correct method, eg 3 $\left(\frac{2}{8}\times\frac{2}{8}\times\frac{6}{8}\right)+\left(\frac{6}{8}\times\frac{6}{8}\times\frac{6}{8}\right)$ or $\frac{288}{512}$ oe, eg $\frac{9}{16}$ or 0.56(25) A0

Question		Working	Answer	Mark	Notes
58	(a)		$\frac{3}{10}, \frac{6}{9}, \frac{3}{9}, \frac{7}{9}, \frac{2}{9}$	2	B1 for $\frac{3}{10}$ on LH yellow branch B1 for $\frac{6}{9}, \frac{3}{9}, \frac{7}{9}, \frac{2}{9}$ correct on tree diagram
	(b)		$\frac{48}{90}$	3	M1 for $\frac{7}{10} \times "\frac{3}{9}"$ or $"\frac{3}{10}" \times "\frac{7}{9}"$ or $"\frac{3}{10}" \times "\frac{2}{9}"$ M1 for $\frac{7}{10} \times "\frac{3}{9}" + "\frac{3}{10}" \times "\frac{7}{9}" + "\frac{3}{10}" \times "\frac{2}{9}"$ A1 for $\frac{48}{90}$ oe OR M1 for $\frac{7}{10} \times "\frac{6}{9}"$ M1 for $1 - \frac{7}{10} \times "\frac{6}{9}"$ A1 for $\frac{48}{90}$ oe

Question		Working	Answer	Mark	Notes
59	(a)		0.25	1	B1 oe
	(b)		150	2	M1 for 0.75 × 200 oe A1 cao
60			0.82	3	M1 for 1 – 0.7 (= 0.3) or 1 – 0.4 (= 0.6) M1for 1– '0.3'×'0.6' A1 for 0.82 oe OR M1 for 1 – 0.7 (= 0.3) or 1 – 0.4 (= 0.6) M1 (0.7 × 0.4) + (0.7 × '0.6') + ('0.3'× 0.4) A1 for 0.82 oe

Question		Working	Answer	Mark	Notes
61		50 1 1 1 50 1 1 1 50	$\frac{126}{720}$	4	M1 for 3 fractions $\frac{a}{10}$, $\frac{b}{9}$, $\frac{c}{8}$ where a < 10, b < 9 and c < 8 M1 for $\frac{7}{10}\times\frac{3}{9}\times\frac{2}{8}$ or $\frac{3}{10}\times\frac{7}{9}\times\frac{2}{8}$ or $\frac{3}{10}\times\frac{2}{9}\times\frac{7}{8}$ $(=\frac{42}{720})$ M1 for $\frac{7}{10}\times\frac{3}{9}\times\frac{2}{8}+\frac{3}{10}\times\frac{7}{9}\times\frac{2}{8}+\frac{3}{10}\times\frac{2}{9}\times\frac{7}{8}$ or $3\times\frac{3}{10}\times\frac{2}{9}\times\frac{7}{8}$ A1 for $\frac{126}{720}$ oe. eg. $\frac{7}{40}$ **Alternative Scheme for With Replacement** M1 for $\frac{7}{10}\times\frac{3}{10}\times\frac{3}{10}$ $(=\frac{63}{1000})$ M1 for $\frac{7}{10}\times\frac{3}{10}\times\frac{3}{10}\times 3$ $(=\frac{189}{1000})$ M0 A0 No further marks

Question		Working	Answer	Mark	Notes
62		EE + CC + HH	$\frac{76}{110}$	5	M1 for use of 10 as denominator for 2nd probability M1 for $\frac{4}{11}\times\frac{3}{10}$ *or* $\frac{5}{11}\times\frac{4}{10}$ *or* $\frac{2}{11}\times\frac{1}{10}$ M1 for $\frac{4}{11}\times\frac{3}{10}+\frac{5}{11}\times\frac{4}{10}+\frac{2}{11}\times\frac{1}{10}\left(=\frac{34}{110}\right)$ M1 (dep on previous M1 for $1-$ '$\frac{34}{110}$' A1 for $\frac{76}{110}$ oe
		Or EC+EH+CE+CH+HE+HC			**Or** M1 for use of 10 as denominator for 2nd probability M1 for $\frac{4}{11}\times\frac{5}{10}$ or $\frac{4}{11}\times\frac{2}{10}$ or $\frac{5}{11}\times\frac{4}{10}$ or $\frac{5}{11}\times\frac{2}{10}$ or $\frac{2}{11}\times\frac{4}{10}$ or $\frac{2}{11}\times\frac{5}{10}$ M2 for $\frac{4}{11}\times\frac{5}{10}+\frac{4}{11}\times\frac{2}{10}+\frac{5}{11}\times\frac{4}{10}+\frac{5}{11}\times\frac{2}{10}+\frac{2}{11}\times\frac{4}{10}+\frac{2}{11}\times\frac{5}{10}$ (M1 for at least 3 of these) A1 for $\frac{76}{110}$ oe
		Or E,not E+ C,not C + H,not H			**Or** M1 for use of 10 as denominator for 2nd probability M1 for $\frac{4}{11}\times\frac{7}{10}$ *or* $\frac{5}{11}\times\frac{6}{10}$ *or* $\frac{2}{11}\times\frac{9}{10}$ M2 for $\frac{4}{11}\times\frac{7}{10}+\frac{5}{11}\times\frac{6}{10}+\frac{2}{11}\times\frac{9}{10}$ (M1 for two of these added) A1 for $\frac{76}{110}$ oe **PTO for SC's**
					SC: B2 for $\frac{76}{121}$ **SC:** B1 for $\frac{4}{11}\times\frac{4}{11}+\frac{5}{11}\times\frac{5}{11}+\frac{2}{11}\times\frac{2}{11}\left(=\frac{45}{121}\right)$ **Or** $\frac{4}{11}\times\frac{5}{11}+\frac{4}{11}\times\frac{2}{11}+\frac{5}{11}\times\frac{4}{11}+\frac{5}{11}\times\frac{2}{11}+\frac{2}{11}\times\frac{4}{11}+\frac{2}{11}\times\frac{5}{11}$ **Or** $\frac{4}{11}\times\frac{7}{11}+\frac{5}{11}\times\frac{6}{11}+\frac{2}{11}\times\frac{9}{11}$

Question		Working	Answer	Mark	Notes
63	(a)		0.15	2	M1 for 1 – (0.2 + 0.5) oe or sight of 0.3 A1 oe
	(b)		48	2	M1 for 240 × 0.2 oe or 48 + 120 + 36 +36 A1 cao
64	(a		0.6 0.7, 0.3, 0.7	2	B1 for 0.6 in correct position on tree diagram B1 for 0.7, 0.3, 0.7 in correct positions on tree diagram
	(b)	0.4 × 0.3 =	0.12	2	M1 for 0.4 × 0.3 oe **or** a complete alternative method ft from tree diagram A1 for 0.12 oe

Question		Working	Answer	Mark	Additional Guidance
65.		$x + 4x + \frac{1}{2} = 1$ $5x = \frac{1}{2}$, $x = \frac{1}{10}$ **OR** Chooses a suitable number of balls (say 10) 5 will be red The other 5 need to be shared out in the ratio 1:4, Hence 1 yellow and 4 blue	$\frac{4}{10}$	3	M1 $x + 4x + \frac{1}{2} = 1$ A1 $x = \frac{1}{10}$ A1 $\frac{4}{10}$ oe
					Total for Question: 3 marks

Question		Working	Answer	Mark	Additional Guidance
66.		Reds 6, 12, 18, 24, 30… Greens 9, 18, 27…	$\frac{1}{20}$	3	B1 list of red and green multiples (both to at least 18) or explicitly states 'LCM' B1 works out highest number (90 seen) B1 $\frac{1}{20}$ (accept $\frac{5}{100}$)
					Total for Question: 3 marks

Question		Working	Answer	Mark	Additional Guidance
67	(a)	4 6 8 10 6 8 10 12 8 10 12 14 10 12 14 16 **OR** $\frac{1}{4} \times \frac{1}{4}$ $\frac{1}{4} \times \frac{1}{4} \times 4$	$\frac{4}{16}$	3	M1 Attempts to list all outcome pairs A1 all 16 found A1 cao **OR** M2 $\frac{1}{4} \times \frac{1}{4} \times 4$ (M1 $\frac{1}{4} \times \frac{1}{4} \times 1, 2$ or 3) A1 $\frac{4}{16}$ oe
	(b)	Prob Ali wins = $\frac{6}{16}$ Number of wins = $\frac{6}{16} \times 80$	30	3	B1 Prob Ali wins = $\frac{6}{16}$ oe M1 $'\frac{6}{16}' \times 80$ A1 ft
					Total for Question: 6 marks

Question		Working	Answer	Mark	Additional Guidance
68		$\frac{4}{10}\times\frac{6}{9}\times\frac{5}{8} = \frac{120}{720}$ $\frac{120}{720} + \frac{6}{10}\times\frac{5}{9}\times\frac{4}{8} + \frac{6}{10}\times\frac{4}{9}\times\frac{5}{8}$	$\frac{360}{720}$	4	M1 for $\frac{4}{10}\times\frac{6}{9}\times\frac{5}{8}$ A1 for $\frac{120}{720}$ oe M1 $\frac{'120'}{720}$ + 2 correct cases (M1 any 2 correct cases) **or** $\frac{'120'}{720}$ X 3 A1 cao SC with replacement M1 $\frac{4}{10}\times\frac{6}{10}\times\frac{6}{10}$ M1 $\frac{4}{10}\times\frac{6}{10}\times\frac{6}{10}\times3$
					Total for Question: 4 marks

Question	Working	Answer	Mark	Notes
69 (a)		0.98 0.95, 0.05, 0.95	2	B1 for 0.98 oe for machine A B1 for 0.95, 0.05, 0.95 in correct positions for machine B
(b)		0.069	3	M1 for 0.02 × 0.05 or 0.02 × "0.95" or "0.98" × "0.05" or "0.98" × "0.95" M1 for 0.02 × 0.05 + 0.02 × "0.95" + "0.98" × "0.05" or 1 – "0.98" × "0.95" A1 for 0.069 oe

Question	Working	Answer	Mark	Notes
70 (a)		0.3	2	M1 for 1 − (0.25 + 0.10 + 0.20 + 0.15) oe A1 for 0.3 oe
(b)		21	3	M1 for 0.25 + 0.10 (= 0.35) or 0.25 × 60 (= 15) or 0.10 × 60 (= 6) M1(dep) for 60 × "0.35" or "15" + "6" A1 cao

Question		Working	Answer	Mark	Notes
71			$\frac{9}{20}$ oe	2	B2 for $\frac{9}{20}$ oe or ft from stem and leaf diagram (B1 for $\frac{x}{20}$ where $x < 20$, $x \neq 9$ or $\frac{9}{y}$ where $y > 9$ or ft from stem and leaf diagram)
72			0.09, 0.36	3	M1 for 1 – 0.4 – 0.15 oe (= 0.45) or 100 – 100×0.4 – 100×0.15 (= 45) M1 for (1 – 0.4 – 0.15) ÷ 5 (= 0.09) or (100 – 100×0.4 – 100×0.15) ÷ 5 (= 9) A1 for 0.09 and 0.36 oe OR M1 for $0.4 + 0.15 + x + 4x = 1$ M1 for $x = (1 – 0.4 – 0.15) \div 5$ A1 for 0.09 and 0.36 oe [SC: B1 for 0.162 and 0.648 if M0 scored]

Question		Working	Answer	Mark	Notes
73		$\frac{18}{30}\times\frac{12}{29}+\frac{7}{30}\times\frac{23}{29}+\frac{5}{30}\times\frac{25}{29}$ or $1-(\frac{18}{30}\times\frac{17}{29}+\frac{7}{30}\times\frac{6}{29}+\frac{5}{30}\times\frac{4}{29})$ or $\frac{18}{30}\times\frac{7}{29}+\frac{18}{30}\times\frac{5}{29}+\frac{7}{30}\times\frac{18}{29}$ $+\frac{7}{30}\times\frac{5}{29}+\frac{5}{30}\times\frac{18}{29}+\frac{5}{30}\times\frac{7}{29}$	$\frac{502}{870}$	4	B1 for a second 'branch' probability seen (could be seen in a tree) M1 for a product of any first and second stage correct probabilities M1 for a complete method to find the required probability A1 for $\frac{502}{870}$ oe Note if decimals used they must be correct to 2 decimal places SC with replacement B2 for $\frac{502}{900}$ oe B0 M1 $\frac{18}{30}\times\frac{12}{30}$ or $\frac{7}{30}\times\frac{23}{30}$ or $\frac{5}{30}\times\frac{25}{30}$ M1 $\frac{18}{30}\times\frac{12}{30}+\frac{7}{30}\times\frac{23}{30}+\frac{5}{30}\times\frac{25}{30}$ A0

Question		Working	Answer	Mark	Notes
74	(a)		$\frac{1}{30}$	1	B1 for $\frac{1}{30}$ oe
	(b)		$\frac{3}{10}$	2	M1 for method to sum the number of white chocolates in the bag, eg 4 + 4 + 1 (= 9), A1 for $\frac{3}{10}$ or $\frac{9}{30}$ oe
	(c)		0.48	2	M1 for 1− (0.35 + 0.17) oe A1 for 0.48 oe

Question		Working	Answer	Mark	Notes
75	(a)		0.2	2	M1 for 1 – 0.16 – 0.4 – 0.24 oe A1 cao
	(b)		20	2	M1 for 0.16 × 125 oe A1 cao
76	(a)		0.3 0.3, 0.7, 0.3	2	B1 for 0.3 as first spin oe B1 for 0.3, 0.7, 0.3 in correct positions for second spin oe
	(b)		0.42	3	M1 for '0.3' × '0.7' or 0.7 × '0.3' (=0.21) M1 for '0.3' × '0.7 + 0.7 × '0.3 (OR M2 for $1 - 0.7^2 - 0.3^2$) A1 for 0.42 oe

Question		Working	Answer	Mark	Notes
77			$\frac{29}{100}$	2	M1 for 13 + 11 + 5 (=29) A1 for $\frac{29}{100}$ oe (SC B1 for $\frac{16}{100}$ oe)
*78			Yes	3	M1 for 1 − 0.6 (=0.4) M1 for ("0.4")³ oe C1 (dep on M1) for 0.064 oe leading to a correct deduction OR M1 for 1−Pr(3H, 0T) − Pr(2H, 1T) − Pr(1H, 2T) oe M1 for 1−(0.6)³−3(0.6)²(0.4)−3(0.6)(0.4)² C1 (dep on M1) for 0.064 oe leading to a correct deduction
79			4	2	M1 for 14 **or** $\frac{3+7}{n} = \frac{5}{7}$ **or** any fraction equivalent to $\frac{2}{7}$ or $\frac{5}{7}$ A1 cao

Question		Working	Answer	Mark	Notes
80			126	3	M1 for 1 – 0.05 – 0.32 (= 0.63) M1 for '0.63' × 200 A1 cao OR M1 for 0.05 × 200 (= 10) or 0.32 × 200 (= 64) or 0.37 × 200 (=74) M1 for 200 – '10' – '64' A1 cao OR M1 for 100 – 5 – 32 (= 63) M1 for $\frac{"63"}{100}\times 200$ A1 cao SC: B2 for $\frac{126}{200}$ as the answer.

Question		Working	Answer	Mark	Notes
81	(a)	$1 - 0.2 - 0.1$ $0.7 \div 2$	0.35	3	M1 for correctly using total probability is 1 or 100% if percentages used M1 (dep) for complete correct method to complete the solution A1 for 0.35 or 35% or $\frac{35}{100}$oe
	(b)		20	2	M1 for 0.1×200 oe A1 cao SC : If M0 then award B1 for an answer of $\frac{20}{200}$

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<tr><th colspan="2">Question</th><th>Working</th><th>Answer</th><th>Mark</th><th>Notes</th></tr>
<tr>
<td>82</td>
<td>(a)</td>
<td>$\frac{2}{7}\times\frac{1}{6}$

OR

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<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td>X</td></tr>
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<td>$\frac{2}{42}$</td>
<td>2</td>
<td>M1 $\frac{2}{7}\times\frac{1}{6}$
A1 $\frac{2}{42}$ oe

OR

M1 Fully correct sample space with the correct cases identified
A1 $\frac{2}{42}$ oe
SC : B1 for an answer of $\frac{4}{49}$</td>
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<td>82</td>
<td>(b)</td>
<td>$\frac{2}{7}\times\frac{5}{6}+\frac{3}{7}\times\frac{2}{6}$

OR

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<tr><td>1</td><td>X</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
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<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td>X</td></tr>
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</td>
<td>$\frac{16}{42}$</td>
<td>3</td>
<td>M1 for identifying all 3 possibilities of (1,2) and (1,3) and (2,3)
OR
at least one of $\frac{2}{7}\times\frac{3}{6}$ (1, 2) or $\frac{2}{7}\times\frac{2}{6}$ (1, 3) or $\frac{3}{7}\times\frac{2}{6}$ (2, 3) or $\frac{2}{7}\times\frac{5}{6}$ (1, 2 or 3)

M1 $\frac{2}{7}\times\frac{5}{6}+\frac{3}{7}\times\frac{2}{6}$ or $\frac{2}{7}\times\frac{3}{6}+\frac{2}{7}\times\frac{2}{6}+\frac{3}{7}\times\frac{2}{6}$
A1 $\frac{16}{42}$ oe
OR
M2 Fully correct sample space with the correct cases identified
(M1 for 1,2 and 1,3 and 2,3 identified on a sample space)
A1 $\frac{16}{42}$ oe

SC: B2 for an answer of $\frac{16}{49}$</td>
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Question		Working	Answer	Mark	Notes
83		0.3 × 400	120	2	M1 for 0.3 × 400 oe A1 cao

Question		Working	Answer	Mark	Notes
84		$\frac{12}{20}\times\frac{11}{19}+\frac{5}{20}\times\frac{4}{19}+\frac{3}{20}\times\frac{2}{19}$ $1-\left(\frac{12}{20}\times\frac{11}{19}+\frac{5}{20}\times\frac{4}{19}+\frac{3}{20}\times\frac{2}{19}\right)$	$\frac{222}{380}$	4	B1 for $\frac{12}{19}$ or $\frac{5}{19}$ or $\frac{3}{19}$ (could be seen in working or on a tree diagram) M1 for $\frac{12}{20}\times\frac{5}{19}$ *or* $\frac{12}{20}\times\frac{3}{19}$ *or* $\frac{5}{20}\times\frac{12}{19}$ *or* $\frac{5}{20}\times\frac{3}{19}$ *or* $\frac{3}{20}\times\frac{12}{19}$ *or* $\frac{3}{20}\times\frac{5}{19}$ M1 for $\frac{12}{20}\times\frac{5}{19}+\frac{12}{20}\times\frac{3}{19}+\frac{5}{20}\times\frac{12}{19}+\frac{5}{20}\times\frac{3}{19}+\frac{3}{20}\times\frac{12}{19}+\frac{3}{20}\times\frac{5}{19}$ A1 for $\frac{222}{380}$ oe or 0.58(421...) **OR** B1 for $\frac{8}{19}$ or $\frac{15}{19}$ or $\frac{17}{19}$ M1 for $\frac{12}{20}\times\frac{8}{19}$ *or* $\frac{5}{20}\times\frac{15}{19}$ *or* $\frac{3}{20}\times\frac{17}{19}$ M1 for $\frac{12}{20}\times\frac{8}{19}+\frac{5}{20}\times\frac{15}{19}+\frac{3}{20}\times\frac{17}{19}$ A1 for $\frac{222}{380}$ oe or 0.58(421...) **OR** (continued overleaf…)

Question		Working	Answer	Mark	Notes
84 contd					B1 for $\frac{11}{19}$ or $\frac{4}{19}$ or $\frac{2}{19}$ M1 for $\frac{12}{20}\times\frac{11}{19}$ *or* $\frac{5}{20}\times\frac{4}{19}$ *or* $\frac{3}{20}\times\frac{2}{19}$ M1 for $1-\left(\frac{12}{20}\times\frac{11}{19}+\frac{5}{20}\times\frac{4}{19}+\frac{3}{20}\times\frac{2}{19}\right)$ A1 for $\frac{222}{380}$ oe or 0.58(421...) **NB** if decimals used they must be correct to at least 2 decimal places **SC : with replacement** B2 for $\frac{111}{200}$ oe **OR** e.g. B0 M1 for $\frac{12}{20}\times\frac{8}{20}$ *or* $\frac{5}{20}\times\frac{15}{20}$ *or* $\frac{3}{20}\times\frac{17}{20}$ M1 for $\frac{12}{20}\times\frac{8}{20}+\frac{5}{20}\times\frac{15}{20}+\frac{3}{20}\times\frac{17}{20}$ A0