Mark scheme

Question			Answer/Indicative content	Marks	Guidance	
1	a		80	2	**M1** for 0.2 × 400 **oe**	e.g. $\frac{400}{5}$ Final answer $\frac{80}{400}$ implies **M1**
	b		Fair/Yes **oe** and valid reason	1	**FT** *their* 80 from **12(a)** to appropriate conclusion with correct reasons	Candidates must either: compare *their* answer to **12(a)** approximately to the number 77 or compare *their* **12(a)** answer to 77 and correctly explain why the spinner is or isn't fair or state that 400 spins is enough/a lot of spins Accept "maybe/don't know because 400 is not enough spins" Do not allow incorrect statements For additional information refer to '2024 November, J560/02, Alternative, Mark Scheme Appendix ' within downloadable extra resource materials

			Total	**3**	
2	a	i	A	1	For all (a) only condone the following values: Condone 0
		ii	C	1	Condone 0.25
		iii	F	1	Condone 1
	b		32	2	**M1** for 8 + 8 + 8 + 8 **oe** or 20 + 3 + 4 + 5 If **0** scored **SC1** for answer any multiple of 4 > 32
			Total	**5**	
3	a		4	1	
	b		Correctly completes frequency tree with Football 35 Hockey 25 Athletics 23 Athletics 9	4	**B1** for each correct entry OR **M1** for option 1 sums to 60 or option 2 sums to 60 and **M1FT** *their* football – 12 and *their* hockey – 16 Do not allow empty boxes to imply 0 **FT** dep on no negative answers
			Total	**5**	
4			Relative frequency can be used as an estimate of probability Probability/proportion of rainy days is the same as last year	1	For additional information refer to '2024 November, J560/03, Alternative, Mark Scheme

						Appendix' within downloadable extra resource materials. Do not accept amount / number of times / rain / weather for "number of rainy days"
			Total	**1**		
5	a		$\frac{3}{5}$ oe $\frac{3}{6}$ oe $\frac{1}{6}$ oe $\frac{3}{6}$ oe $\frac{1}{6}$ oe	3	**B2** for all red and yellow correct or **B1** for $\frac{3}{5}$ correctly placed **B1** for both red or both yellow correct	Accept equivalent fractions or decimals 0.6, 0.5 and $0.1\dot{6}$ or 0.167 or better, or 60%, 50% and $16.\dot{6}\%$ % or 16.7% or better red $\frac{3}{6}$ oe yellow $\frac{1}{6}$ oe
	b		$\frac{2}{15}$ oe	2	M1 for $\frac{2}{5} \times \frac{1}{3}$ oe	Accept $0.1\dot{3}$ or 0.133 or better and $13.\dot{3}\%$ or 13.3% or better **M1** do not accept 40% × 33%
			Total	**5**		
6	a		6	1		$\frac{6}{60}$ scores 0
	b		30	1		$\frac{30}{60}$ scores 0
			Total	**2**		
7	a			3		

			19 8 21 60 10		**FT** *their* 19 – 11 for *their* 8 **B2** for 3 correct or **B1** for 2 correct	
	b		Rafting and [R=] 41 or 8 + 12 + 10 + 11 [S=] 23 or 3 + 5 + 5 + their 10 [T=] 36 or *their* 8 + 4 + 20 + 4	3	**FT** *their* (a) even if **NR** **M2** for two from [R=] 41 or 8 + 12 + 10 + 11 [S=] 23 or 3 + 5 + 5 + their 10 [T=] 36 or *their* 8 + 4 + 20 + 4 or **M1** for one from [R=] 41 or 8 + 12 + 10 + 11 [S=] 23 or 3 + 5 + 5 + their 10 [T=] 36 or *their* 8 + 4 + 20 + 4 If 0 or 1 scored, instead award **SC2** for Rafting = 41 which is 18 more than S and 5 more than T	Accept *their* most popular with **strict FT** from *their* three correct totals for these sports Sums must be correctly evaluated May be on diagram Accept labelled or in correct order Check 13 + *their* 10 Check 28 + *their* 8 If (a) is **NR, FT** all marks. The values will be: [R=] 8 + 12 + 10 + 11 or 41 [S=] 3 + 5 + 5 or 13 [T=] 4 + 20 + 4 or 28 and the answer R[afting] and the sums or totals seen
	c		$\frac{46}{100}$ **oe**	2	**FT** *their* 21	Ignore attempts to change form Accept fraction, decimal (e.g. 0.57) and

					B1 for *their* 21 + 25 correctly evaluated or 46 seen If (a) is **NR**, award **SC1** for answer $\frac{25}{100}$ **oe or** answer $\frac{1}{25}$	percentage (e.g. 57%) but not ratio nor in words For **B1**, condone $\frac{1}{46}$ as 46 seen
	d		[That] these [100] children are representative of all children [who attend the adventure park] **oe**	1		See Appendix Representative sample
			Total	**9**		
8			$\frac{21}{40}$ **oe** with correct working	5	**M1** for 40 – 9 – 1 **M1** for *their* 30 ÷ (3 + 2) **A1** for 12 or 18 AND **B1** for answer $\frac{21}{k}$.	<u>Correct working requires evidence of at least **M1M1A1**</u> **isw** conversion/cancelling after correct answer seen Do not accept ratio or words All method marks may be seen on diagram **M1** implied by 30 **M1** implied by 6 Repeated addition/subtraction see appendix 18:12 or 12:18 implies **M1M1A1** Where k>21 and an integer

					or answer $\frac{p}{40}$.	Where p<40 and a positive integer
					If **0** or **1** scored, instead award **SC2** for answer of $\frac{21}{40}$ **oe**	For algebraic method, refer to 'Qn26, 2024 June, Alternative J560/02, Mark Scheme Appendix' within downloadable resource materials.
			Total	**5**		
9	a		$\frac{1}{10}$	1		Maybe seen on the diagram Accept equivalent fractions
	b		Arrow at $\frac{9}{10}$	1	Accept any clear intention of identification of $\frac{9}{10}$	
			Total	**2**		
10	a		Activities in either order with no repeats: C and R C and S P and R P and S R and S	2	**M1** for at least 3 new correct combinations, ignoring repeats or incorrect combinations	Accept initial, word or abbreviation if clear
	b		$\frac{3}{6}$ **oe**	1FT	Strict **FT** of *their* list including the given combination	**isw** incorrect cancelling or changing to decimals **FT** allow repeats
			Total	**3**		
11	a		2	1	**Examiner's Comments**	

					Most candidates answered this question successfully. A small number gave incorrect answers of 12, 14 or 26
	b		Correctly completes frequency tree with Football 45 Hockey 35 Athletics 33 Athletics 21	4	**B1** for each correct entry OR **M1** for option 1 sums to 80 or option 2 sums to 80 and **M1FT** *their football* – 12 and *their hockey* – 14 Do not allow empty boxes to imply 0. FT dep on no negative answers **<u>Examiner's Comments</u>** Many candidates scored marks on this question, however only a small proportion scored full marks. A common error was to have 50 students choosing football and 30 choosing hockey. This however often resulted in 38 and 16 choosing Athletics in Option 2, which resulted in 2 marks being awarded. Candidates who were successful showed their working in the space provided below Question 9 (b), while those less successful tended to show no working. **Key point: Finding two numbers given their sum and difference.** A number of candidates struggled to find two numbers whose sum was 80 and that had a difference of 10. The most successful gave one of the following methods. **Method 1**

					Hockey = x and Football = x + 10 $x + x + 10 = 80$ $2x + 10 = 80$ $2x = 70$ $x = 35$ Candidates then found football as 45. **Method 2** The sum is 80 and the difference is 10. $\frac{80}{2} = 40$ $\frac{10}{2} = 5$ 40 + 5 = 45 40 – 5 = 35 Irrespective of the method used, those who were most successful checked that their numbers for football and hockey had a sum of 80 **and** a difference of 10.
			Total	**5**	
12	a		60	2	**M1** for 0.2 × 300 oe e.g. $\frac{300}{5}$ Final answer $\frac{60}{300}$ implies M1 **Examiner's Comments** Most candidates successfully answered this question. Those who scored 1 mark often made an arithmetic error in calculating 0.2 × 300, or calculated the correct value and then responded with it out of 300, such as $\frac{60}{300}$ or '60 out of 300'. Of those candidates who did not score,

					common errors included 300 ÷ 2, 300 ÷ 0.2, or giving 0.2 as a fraction $(\frac{2}{10}$ or $\frac{1}{5})$.
	b		Fair/Yes oe and valid reason	1	**FT** *their* 60 from 12(a) to appropriate conclusion with correct reasons. Candidates must either: compare their answer to 12(a) approximately to the number 58 or compares their 12(a) answer to 58 and correctly explain why the spinner is or isn't fair or state that 300 spins is enough/a lot of spins Accept "maybe/don't know because 300 is not enough spins" Do not allow incorrect statements For additional information refer to '2024 November, J560/02, Mark Scheme Appendix: item 1' within downloadable extra resource materials. **Examiner's Comments**

					Most candidates did not correctly answer this. Those that were successful compared 58 to their answer to Question 12 (a), then responded about it being fair because the numbers are 'very close'. Less successful responses stated that for the spinner to be fair it must land on the number 1 exactly the same number of times as in Question 12 (a), or showed that 58 × 5 = 290 and not 300.
			Total	**3**	
13	a	i	F	1	For all (a) only condone the following values:Condone 1 **Examiner's Comments** Roughly the same number of candidates were successful in this question as were unsuccessful. Along with the other parts of this question, a small number of candidates gave a numerical value instead of using the given letters on the probability scale (this was condoned if the value was correct). Incorrect responses generally either gave C, E or an incorrect numerical value.
		ii	E	1	Condone 0.5 **Examiner's Comments** Few candidates correctly answered this question. Common errors were C, D or F.
		iii	A	1	

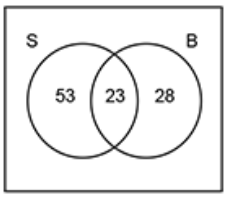
					Condone 0 **Examiner's Comments** Most candidates gave the correct answer A. Common errors were B, C, F, or giving an incorrect numerical value.
	b		24	2	**M1** for 8 + 8 + 8 oe or 16 + 2 +6 If 0 scored **SC1** for answer any multiple of 3 > 24 **Examiner's Comments** Nearly half the candidates scored marks on this question, with most of these scoring full marks for the correct answer of 24. Of those who scored 1 mark, it tended to be the Special Case (SC) mark for a multiple of 3 greater than 24. Candidates who did not score generally gave a multiple of 3 that was lower than 24, or another incorrect value without working. Out of Questions 1–10, this was the one most omitted.
			Total	**5**	
14			Relative frequency can be used as an estimate of probability Probability/proportion of rainy days is the same as last year	1	For additional information refer to '2024 November, J560/03, Mark Scheme Appendix: item 2' within downloadable extra resource materials.

					Do not accept amount / number of times / rain / weather for "number of rainy days" **Examiner's Comments** Most candidates attempted this question, but many seemed unsure how to answer it clearly. Many commented that there would be the same amount of rain without mentioning the number of rainy days. Almost no-one gave the response that relative frequency can be used to form a probability.
			Total	**1**	
15	a		$\frac{3}{5}$ oe $\frac{2}{4}$ oe $\frac{1}{4}$ oe $\frac{2}{4}$ oe $\frac{1}{4}$ oe	3	**B2** for all red and yellow correct or **B1** for $\frac{3}{5}$ correctly placed **B1** for both red or both yellow correct Accept equivalent fractions or decimals 0.6, 0.5 and 0.25 or 60%, 50% and 25% red $\frac{2}{4}$ oe yellow $\frac{1}{4}$ oe **Examiner's Comments** Most candidates attempted this question and many scored marks. $\frac{3}{5}$ was usually correctly placed on the first branch to score B1, but some used $\frac{1}{4}$. Many candidates placed $\frac{1}{4}$ correctly on one or both of the second branches (both had to be correct for the B1 to be awarded). Occasionally, fractions involving fifths appeared on the second branches. Some candidates put one

					pair of probabilities on one set of second branches and different probabilities on the other set. Less successful candidates sometimes used whole numbers. Fortunately, very few candidates used percentages or decimals.
	b		$\frac{1}{10}$ oe	2	M1 for $\frac{2}{5} \times \frac{1}{4}$ oe Accept 0.1 and 10% and equivalent fractions e.g. $\frac{2}{20}$ M1 do not accept 40% × 25% **Examiner's Comments** This was not well done and only a few candidates scored marks. The common error was $\frac{2}{5} + \frac{1}{4}$, though a few subtracted the fractions instead.
			Total	**5**	
16	a		8	1	$\frac{8}{60}$ scores 0 **Examiner's Comments** This was answered well and most candidates scored the mark.
	b		25	1	$\frac{25}{60}$ scores 0 **Examiner's Comments** This part was less successfully answered than part (a). The common error was 12.

					Misconception Many candidates did not appreciate that the 13 people in the intersection had also visitedGreece.	
			Total	**2**		
17	a		0.28 , 0.36 , 0.06 , 0.1[0]	2	**B1** for 3 correct values or [total =] 50 seen	Condone missing/added non-essential zeros throughout e.g. .10 for 0.1 50 may be seen in part (b) even as denominator or implied by $\frac{1}{5}$
	b		0.20 **oe**	2	**M1** for 0.08 + 0.12 **oe** or $\frac{4+6}{14+18+3+4+6+5}$ oe	No **FT** Accept equivalent fraction e.g. $\frac{10}{50}$ or 20% for **2** marks Ignore attempts to cancel or change form once correct answer seen
			Total	**4**		
18	a	i	$\frac{1}{4}$ or 0.25 or 25%	1		Accept an equivalent fraction or “one quarter” or “one fourth” but not ratio e.g. 1 : 4 or 1 in 4 or words e.g. unlikely Ignore attempts to cancel or change form once correct answer seen
		ii	$\frac{3}{4}$ or 0.75 or 75%	1FT		

					FT 1 – *their* (a)(i)	Accept equivalent fraction or "three quarters" or "three fourths" but not ratio e.g. 3 : 4 or 3 in 4 or words e.g. likely Ignore attempts to cancel or change form once correct answer seen
	b		An example using the spinner that has a probability of 0 e.g. [landing/spinning/getting a] 5	1		Condone: "Getting a number that is not on the spinner" **oe** Do not accept descriptions of events other than numbers e.g. it never stops spinning "There's no 0 on the spinner" scores **0** "Getting a 0" scores **1** Condone "dice" for "spinner"
			Total	**3**		
19			7	4	**B3** for 30 OR **M2** for $\frac{3}{5} = \frac{18}{n}$ or 18 ÷ 3 × 5 or **M1** for 18 ÷ 3 **oe** **M1** for *their* 30 – (18 + 5)	Allow embedded calculation 3 × 6 = 18 or list of multiples [3], 6, 9, 12, 15, 18 with no extras
			Total	**4**		
20	a		0.4 0.3, 0.7, 0.3, 0.7 or 0.3, 0.7, 0.7, 0.3	1 1 1		

			Does not stop, stops, does not stop			Accept fractions or percentages Diagram must be fully correct for **3** marks
	b		0.54	3	**M2** for 0.6 × 0.7 + 0.4 × 0.3 or better or for 1 – (0.6 × 0.3 + 0.4 × 0.7) or better OR **M1** for one correct product shown or implied	**FT** for **M1** and **M2** and **3** *their* 0.7, 0.3 and *their* 0.4 (must be less than 1) e.g. 0.6 × 0.7 or 0.4 × 0.3 or 0.6 × 0.3 or 0.4 × 0.7 **soi** by 0.42, 0.12, 0.18 or 0.28
			Total	**6**		
21	a			1		In this part, condone **b(i)** misplaced
	b	i	16	1		
		ii	16 in correct place on diagram	1	**FT** *their* (b)(i)	Not strict **FT** as they may have started again
	c		$\frac{51}{120}$ oe	2	FT $\frac{\textit{their } 28 + \textit{their } 23}{120}$	Accept 0.425 or 42.5% **isw** an incorrect simplification of *their* correct probability or incorrect conversion to decimal or percentage Do not accept ratio

					M1 for *their* 28 + *their* 23 may be implied by 51	*Their* 28 + *their* 23 must be < 120 for **2** or **1** mark
			Total	**5**		
22	a		22 8 23 55 7	3	**FT** *their* 22 – 14 for *their* 8 **B2** for 3 correct or **B1** for 2 correct **Examiner's Comments** Many candidates gained 3 marks for a correctly completed tree. A few made numerical slips when calculating some of the entries. A small number of candidates placed values in the wrong place, such as placing '55' where the value should have been '22'. Some interchanged '22' and '23' in their respective positions. A tiny minority did not attempt the question.	
	b		Tennis and [R=] 37 or 11 + 12 + 5 + 9 [S=] 20 or 3 + 5 + 5 + *their* 7 [T=] 43 or *their* 8 + 6 + 25 + 4	3	**FT** *their* (a) even if NR **M2** for two from [R=] 37 or 11 + 12 + 5 + 9 [S=] 20 or 3 + 5 + 5 + *their* 7 [T=] 43 or *their* 8 + 6 + 25 + 4 or **M1** for one from [R=] 37 or 11 + 12 + 5 + 9	Accept *their* most popular with **strict FT** from *their* three correct totals for these sports Sums must be correctly evaluated May be on diagram Accept labelled or in correct order Check 13 + *their* 7 Check 35 + *their* 8

					[S=] 20 or 3 + 5 + 5 + *their* 7 [T=] 43 or *their* 8 + 6 + 25 + 4 If 0 or 1 scored, instead award **SC2** for Tennis = 43 which is 6 more than R and 23 more than S	If (a) is NR, FT all marks. The values will be: [R=] 11 + 12 + 5 + 9 or 37 [S=] 3 + 5 + 5 or 13 [T=] 6 + 25 + 4 or 35 and the answer R[afting] and the sums or totals seen
					Examiner's Comments Many correct answers were seen. 'Show how you decide' indicated that working or values were needed to score and most candidates followed this request. Some however placed their totals not in the answer space, but anywhere around the tree or even beside the initial table. Examiners followed through from the candidate's tree and so many scored full marks here despite making errors in part (a). A few candidates only showed the highest total, not considering that to show which was the most popular activity it would be necessary to show all three totals.	
	c		$\frac{57}{100}$ oe	2	**FT** *their* 22 or 11 + 3 + *their* 8	Ignore attempts to change form Accept fraction, decimal (e.g. 0.57) and percentage (e.g. 57%) but not ratio nor in words

					B1 for *their* 22 + 35 correctly evaluated or 57 seen If (a) is **NR**, award **SC1** for answer $\frac{35}{100}$ oe or answer $\frac{1}{35}$ For **B1**, condone $\frac{1}{57}$ as 57 seen **Examiner's Comments** Many correct answers were seen. Follow through could be awarded where candidates had an incorrect tree. Some candidates just responded with '57', which scored 1 mark. Candidates generally gave their answer as a fraction, but quite a few decimals were seen and a couple of percentages. A few candidates gave their answer as a ratio or in words (e.g. 'Fairly likely') and these scored 0 marks.
	d		[That] these [100] children are representative of all children [who attend the adventure park] oe	1	Representative sample **Assumption** / **Mark** / **Reason** All children choose in the same way as these children / **1** / Has the idea of a representative sample Every group of 100 will chose the same options every time / **1** / BOD does not say "in the same proportion" but implies representative sample 45% of children that weren't in the 100 would choose football / **1** / Indicates representative sample

That every child that turns up for the adventure park will choose the same options as the 100	**1**	BOD. Does not say "in the same way as the 100" but indicates representative sample
The same proportions apply to all other children coming to the park	**1**	Representative sample
Because 45 is 45% of every 100 children that come to the park	**1**	Representative sample
45%/0.45 of ALL children will choose football	**0**	Repeats question

Examiner's Comments

Most candidates did not get a mark. Many answers restated the comment in some way or gave suggestions such as that Alex assumed each person was 1%, or that they all turned up, or that football was very popular, or that they didn't want to play golf.

Many seemed to not understand what an assumption was. There was very little understanding that Alex had assumed the sample represented the preferences of all people at the adventure park.

Assessment for learning

Candidates need to practise giving concise reasons and presenting these for peer consideration.

			Total	**9**	
23			$\frac{23}{50}$ **oe** with correct working	5	Correct working requires evidence of at least **M1M1A1** isw

						conversion/cancelling after correct answer seen Do not accept ratio or words All method marks may be seen on Diagram
					M1 for 50 – 10 – 1 **M1** for *their* 39 ÷ (2 + 1) **A1** for 13 or 26	**M1** implied by 39 **M1** implied by 13 Repeated addition/subtraction see appendix 26:13 or 13:26 implies **M1M1A1**
					AND **B1** for answer $\frac{23}{k}$ or answer $\frac{p}{50}$	Where $k>23$ and an integer Where $p<50$ and a positive integer
					If 0 or 1 scored, instead award **SC2** for answer of $\frac{23}{50}$ **oe**	Algebraic method see Appendix 5

<u>Algebraic method</u>

Allow any 2 different letters to represent 'only car' and 'only bike'.

M1 $b + c = 39$ or $2c = b$
M1 $3c = 39$ or $3b = 78$
A1 $b = 26$ or $c = 13$

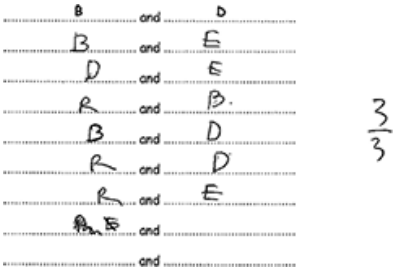
AND
B1 for answer $\frac{23}{k}$ or answer $\frac{p}{50}$

<u>Examiner's Comments</u>

A good proportion of candidates picked up marks here, often M1M1A1 and often subsequently B1 too.

Many candidates showed the use of

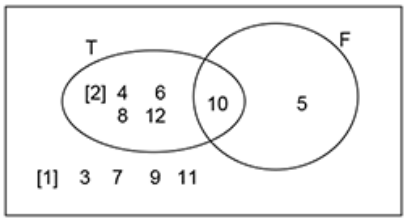
					'bus stop' method when completing $\frac{39}{3}$. Some however disregarded the 1 and attempted $\frac{40}{3}$. Where the B1 was given, it was almost always for $\frac{p}{50}$ rather than $\frac{23}{k}$. Poorer responses often attempted to divide 50 into the ratio 2 : 1, although some of these were able to go on to give a fractional answer with 50 as the denominator, scoring the B1.
			Total	**5**	
24	a		$\frac{1}{8}$	1	Maybe seen on the diagram Accept equivalent fractions **Examiner's Comments** Correct responses to this question were rare. Many either did not count the sections correctly, counted the vertical lines instead, or presumed that there were 10 sections. Those that responded correctly almost always gave $\frac{1}{8}$, although a few gave a correct equivalent fraction. Some candidates didn't follow the request for a fraction and gave a decimal instead.
	b		Arrow at $\frac{7}{8}$	1	Accept any clear intention of identification of $\frac{7}{8}$ **Examiner's Comments** Candidates were slightly more successful in this part than in (a). The request in the question was also frequently followed, with the vast

					majority of candidates identifying their answer with an arrow.
			Total	**2**	
25	a		Activities in either order with no repeats: B and E B and R D and E D and R E and R	2	**M1** for at least 3 new correct combinations, ignoring repeats or incorrect combinations | Accept initial, word or abbreviation if clear **Examiner's Comments** This question asked candidates to show all possible combinations, which many did. Some however repeated the given combination, or repeated a combination in a different order (e.g. giving both B E and E B). Exemplar 1  This candidate repeats the given combination (B and D) and so has an incomplete list. This response is given 1 mark.
	b		$\frac{3}{6}$oe	1FT	Strict **FT** of *their* list including the given combination | isw incorrect cancelling or changing to decimals **FT** allow repeats **Examiner's Comments** This part was generally well answered with either the correct probability from a correct set in part (a), or by applying a

					correct follow through. A small minority of candidates wrote a fraction with a denominator that equalled the number of letters listed (usually 12) rather than the number of combinations. Another common error was to exclude the combination given in the question.	
			Total	**3**		
26	a		[T F W] [T F B] [T S W] T S B T P W T P B C F W C F B C S W C S B C P W C P B	2	**B1** for at least five new correct combinations	For full marks there must be no repeats or extras but condone the three given combinations included and e.g. FE for Fried Eggs etc
	b		$\frac{\textit{their } P}{\textit{their total}}$ isw	1 FT	Strict FT of *their* table including the three given combinations	FT allow repeats and misplaced letters Accept 3 sf answers if decimal or percentage e.g. 0.333[...] or 33.3[...]% If (a) is not attempted, allow $\frac{4}{12}$ or $\frac{2}{6}$ or $\frac{1}{3}$
			Total	**3**		
27	a		423	2	**M1** for 900 – (72 + 90 + 315) or 900 × 0.47 oe	
	b	i	5	2	**M1** for $\frac{n}{50} = 0.1$ or 50 × 0.1 oe	Answer $\frac{5}{50}$ implies M1 Do not accept →

						for × M1 for $\frac{90}{900}=\frac{5}{50}$ or $\frac{900}{50}=18$ and $\frac{90}{18}$
		ii	Yes oe and large number of trials oe or No and it is an estimate [of the actual number] oe	1		If "Yes" must state or imply large sample. Mention of 900 without saying sample is large is not enough. e.g. Yes, they picked lots of times. **1** Yes, they picked 900 times. **0** If "no" must state or imply estimate e.g. No, the relative frequency is only close to the real value **1** No, it's an estimate of probability **0**
			Total	**5**		
28			No **oe** and $\frac{29}{49}$ **oe**	5	**M4** for $\frac{5}{7}\times\frac{5}{7}+\frac{2}{7}\times\frac{2}{7}$ **oe** or **M3** for $\frac{5}{7}\times\frac{5}{7}$ or $\frac{2}{7}\times\frac{2}{7}$ **oe** or **B2** for $\frac{5}{7}$ and $\frac{2}{7}$ **oe** or **B1** for $\frac{5}{7}$ **oe** or $\frac{2}{7}$ **oe**	M3, B2 or B1 may be seen on the diagram or in working. Diagram does not need to be labelled. Accept equivalent decimals and percentages
			Total	**5**		
29			$\frac{43}{50}$ or 0.86 or 86% or $\frac{86}{100}$	2		

					M1 for 43 or 50 – 7 or 27 + 10 + 6 or 1 $-\frac{7}{50}$	Isw incorrect cancelling of correct fraction but do not allow conversion to incorrect form e.g. 43 out of 50 or 43 : 7 for **2** marks
			Total	**2**		
30	a		16	1		
	b		24 in correct position	2	**M1** for 58 – (16 + 7+ 11), may be implied by 24 in working space	For **2** marks only 24 added to diagram
	c		$\frac{27}{58}$ or 0.47, 0.466 or 47%, 46.6%	2	**M1** for 16 + 11, implied by 27	27 must clearly be *their* final total Isw incorrect cancelling of correct fraction but do not allow conversion to incorrect form e.g. 27 out of 58 or 27 : 58 for **2** marks
			Total	**5**		
31	a		Arrow at 0.4	1		In both parts allow clear indication other than an arrow. 2 mm by eye
	b		Arrow at 0	1		
			Total	**2**		
32	a		ξ	2		

					**B1** for one correct region	Condone number 1 and/or number 2 repeated
	b		$\frac{1}{12}$ or 0.083 to 0.084	1	**FT** *their* diagram for numerator	Accept 8.3% to 8.4% **isw** after correct, or **FT**, fraction seen
	c		10 has been counted twice **oe** $\frac{7}{12}$ or 0.58[3..] to 0.59	1 1		Accept 58[3..]% to 59% **Statement Reason Mark** She has included the 10 as being in set F and set T separately BOD counting 10 twice for "included the 10 and separately" **1** The 10 is included in both fractions Implies has been counted twice **1** She has counted the 10 for both BOD "for both" implies "twice" **1** 10 appears in both F and T Does not say "counted twice" **0** The element may be in both T and F Wrong as the element IS in both and this doesn't imply double counting **0** One number is in both sets Does not say "counted twice" **0** Not all go into both Does not say counting an element twice **0** She has included the shared number Does not say "twice" **0** You do not count numbers that are in both sets False, you do but once for each **0** She has not accounted for the ones between them Does not say "counted twice" **0**
			Total	**5**		
33	a		9 3 2 7 9 2 3 7 2 3 9 7 2 9 3 7 3 2 9 7 3 9 2 7	2	**B1** for at least 5 out of 6 correct with maximum 1 repeat/extra or for 4 out of 6	If 9 3 2 7 is omitted allow **2** marks for 5 correct or

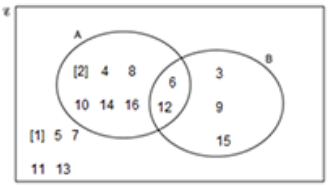
					correct (no repeats/extras)	**B1** for at least 4 out of 5 correct with maximum 1 repeat/extra or for 3 out of 5 correct (no repeats/extras)
	b		$\frac{2}{6}$ **oe**	1	**FT** *their* (a)	Mark to candidate's advantage. Allow for FT either their total written combinations or their combinations including the given combination Allow 0.33 [3….] or 33.[3….]% Do not accept ratio or words **isw** attempts to convert to decimals or percentages when acceptable fraction seen
			Total	**3**		
34	a		0.7 **oe** 0.6, 0.4, 0.6, 0.4 **oe**	1 1		
	b		[0].12 **oe**	2	Correct or ft *their* 0.4 **M1** for 0.3 × *their* 0.4	*Their* 0.4 <1
			Total	**4**		
35	a		B	1		Condone $\frac{1}{6}$
	b		A	1		Condone 0 or $\frac{0}{6}$

	c		C	1		Condone $\frac{2}{6}$ or $\frac{1}{3}$
			Total	**3**		
36	a		All branches completed with 0.45 and 0.15 in correct places	3	**B1** for 0.45 correctly placed at least once **B1** for 0.15 correctly placed at least once	
	b		0.4 × 0.4 + 0.45 × 0.45 + 0.15 × 0.15 [= 0.385]	3	**M2** for 0.4 × 0.4, 0.45 × 0.45 and 0.15 × 0.15 may be 0.16 0.2025 0.0225 or **M1** for 0.4 × 0.4 or 0.45 × 0.45 or 0.15 × 0.15 may be 0.16, 0.2025, 0.0225	Answer given: for 3 marks products and additions must be explicitly seen Accept e.g. $(0.4)^2$ for 0.4 × 0.4 Values may be seen on diagram in (a) If all values shown on ends of tree, must select 3 values to use for **M2** and 1 value for **M1** Equivalent fractions are OK but for 3 marks must convert to the decimal
			Total	**6**		
37	a		H5 H6 H8 H9 T5 T6 T7 T8 T9	2	**B1** for 7 correct in correct place	Accept 5H etc
	b		$\frac{1}{5}$	2	**B1** for $\frac{\textit{their } 2}{10}$ isw If 0 scored, **SC1** for 0.2 or 20%	Follow through *their*

						number of "T and even number" from table in (a)
			Total	**4**		
38	a		$\frac{1}{8}$	1		Accept equivalent fractions e.g. $\frac{2}{16}$
	b		15 ÷ 8 oe or 15 ÷ 8 × [1 or 7] oe 1.875 oe or 13.125 and recognise not integer OR $\frac{R}{R+B}=\frac{2}{16}$ or R : B = 2 : 14 and 16 sides 15 is missing oe	M1 A1 M1 A1	If 0 scored, **SC1** for 15 is not a multiple of 8 oe	No FT as the scale can be used but allow 15 × (0.125 or 0.875) for **M1** May be fractions $\frac{R}{B}=\frac{2}{14}$ and 16sides oe e.g. 8, 16, 24 and 15 is not here
			Total	**3**		
39	a		125 29 75 31	4	**B1** each correct OR **B1** for 75 **B1 FT** for 125 **B1 FT** for 29 and 31	Mark to candidate's advantage, ie **B1** each correct or part marks including possible **FT** Negative numbers will not score.

						Values must be integers.
	b		96 + 44 = 140 and $\frac{140}{200}$ = 70% nfww OR 200 × 0.7 = 140 and 96 + 44 = 140 oe	2	**M1** for 96 + 44 = 140 OR **M1** for 200 × 0.7 = 140 OR **M1** for $\frac{140}{200}$ = 70% nfww	Accept $\frac{7}{10}$ for 70% Allow equivalent methods using 30% or $\frac{3}{10}$ for **M1** or **2** If using 30% for **2** marks they must also show 100% – 30% = 70% oe Breakdown methods must be complete and correct Do not accept e.g. 0.70 **of** 200 Do not accept e.g. 70% × 200 Do not accept 70% for 0.70 or $\frac{70}{100}$ as this is a show that question
			Total	**6**		
40	a		$\frac{5}{8}$	1		In (a) and (b) accept equivalent fractions, decimals or %'s with the % sign Isw attempts to convert after correct answer seen Do not accept ratio or words
	b		$\frac{1}{4}$	2		

					M1 for 12 and 18 chosen	Accept $\frac{2}{8}$ For M1 12 and 18 may be circled or underlined – intention that only these 2 numbers selected must be clear
			Total	**3**		
41	a		B K R S B K S R B R K S B R S K B S K R B S R K	2	**B1** for at least 3 additional correct arrangements	For **2** marks no repeats or extras apart from B K R S
	b		$\frac{2}{6}$ **oe isw**	2	FT *their* table **M1** for correct numerator or denominator FT *their* table	For **2** marks or **M1** denominator < 11 Not ratio or words **isw** cancelling/conversion to other forms
			Total	**4**		
42			0.15 0.05	4	**B3** for 0.05 OR **M2** for 1 – (0.3 + 0.2 + 0.3) **soi** by 0.2 in working or two values in the table which sum to 0.2 Or **M1** for 0.3 + 0.2 + 0.3 **soi** by 0.8 in working **M1** for *their* 0.2 ÷ 4	Accept percentages or fractions
			Total	**4**		

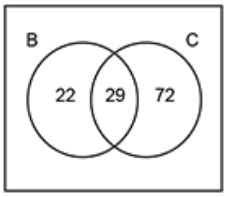
43	a			3	**B2** for one element misplaced or repeated or missing Or **B1** for one correct region Condone 1 and/or 2 repeated
	b		[Venn diagram] 3 and [because] multiples of 4 are always even **oe** and no contradictions	2	**B1** for choice of diagram 3 Must justify using properties of elements Accept 'Multiples of 4 cannot be odd' **Response Mark** 3 all numbers in set M are even so a subset of set L **2** 3 L and M have everything in common **2** 3 evens are the same *1 mark for '3', reason insufficient as doesn't say same as what* **1**
			Total	**5**	
44	a		0.2 , 0.42 , 0.14 , 0.08	2	**B1** for 3 correct values or [total =] 50 seen Condone missing/added non-essential zeros throughout e.g. .20 for 0.2 50 may be seen in part (b) even as denominator or implied by $\frac{4}{25}$ **Examiner's Comments** Some candidates did not attempt this. Of those who did, some earned one mark for working out the total frequency (50).

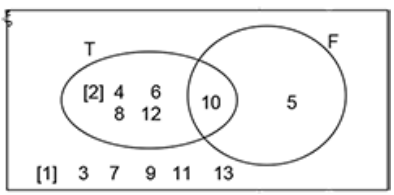
					Many incorrect relative frequencies were seen. It appeared that the term was not well understood and the given examples were not used to aid any misunderstanding.
	b		0.16 oe	2	**M1** for 0.06 + 0.10 oe or $\frac{3+5}{10+21+7+4+3+5}$ oe No FT Accept equivalent fraction e.g. $\frac{8}{50}$ or 16% for 2 marks Ignore attempts to cancel or change form once correct answer seen **Examiner's Comments** Candidates did a little better here in (b) than in (a). Of those attempting the question, many knew to add 0.06 and 0.10, however some did not add them successfully (often appearing to be adding them without using a calculator). There was no discernible pattern to the errors. Many clearly felt they should give the answer as a fraction and some correctly converted 0.16 to $\frac{16}{100}$. Responses such as $\frac{2}{6}$ and even $\frac{3}{6}$ were also seen.
			Total	**4**	
45	a	i	$\frac{1}{5}$ or 0.2 or 20%	1	Accept an equivalent fraction or "one fifth" but not ratio e.g. 1 : 5 or 1 in 5 or words e.g. unlikely

						Ignore attempts to cancel or change form once correct answer seen
					Examiner's Comments Many correct responses were seen. Candidates sometimes gave 0.2 or 20%. A common error was $\frac{2}{5}$, possibly from incorrectly using the given outcome 2.	
		ii	$\frac{4}{5}$ or 0.8 or 80%	1FT	**FT** 1 – *their* (a)(i)	Accept equivalent fraction or "four fifths" but not ratio e.g. 4 : 5 or 4 in 5 or words e.g. likely Ignore attempts to cancel or change form once correct answer seen
					Examiner's Comments Many correct responses were seen here too. Examiners followed through from an error in part (a)(i).	
	b		An example using the spinner that has a probability of 0 e.g. [landing/spinning/getting a] 6	1		Condone: "Getting a number that is not on the spinner" oe Do not accept descriptions of events other than numbers e.g. it never stops spinning "There's no 0

					on the spinner" scores 0 "Getting a 0" scores 1 Condone "dice" for "spinner"	
					Examiner's Comments Many candidates misinterpreted the question and explained a probability of 0 (e.g. responding 'It could not happen') rather than giving an outcome. Explanations were frequently poorly expressed.	
			Total	**3**		
46			17	4	**B3** for 40 OR **M2** for $\frac{3}{8} = \frac{15}{n}$ or 15 ÷ 3 × 8 or **M1** for 15 ÷ 3 oe **M1** for *their* 40 – (15+8)	Allow embedded calculation 3 × 5 = 15 or list of multiples [3],6,9,12,15 with no extras
					Examiner's Comments Most candidates were unable to access this question. Candidates struggled to work with a simplified probability and to use a reverse process from the probability to the total number of counters in the bag. A few candidates were able link the information together to state that $\frac{3}{8} = 15$ and these generally went on to be	

					given all 4 marks. Few candidates used equivalent fractions ($\frac{3}{8} = \frac{6}{16} = \frac{9}{24} = \frac{12}{32} = \frac{15}{40}$) to reach the answer. Many candidates attempted trials with a number for blue counters (often 7, from 15 – 8), but when this didn't work for them it was often abandoned.
			Total	**4**	
47	a		0.3 0.2, 0.8, 0.2, 0.8 or 0.2, 0.8, 0.8, 0.2 Does not stop, stops, does not stop	1 1 1	Accept fractions or percentages Diagram must be fully correct for 3 marks **Examiner's Comments** A significant number of candidates gave a fully correct diagram to gain all 3 marks. Many were given 1 mark for 0.3 on the first branch. A variety of numbers were used on the second branches. Some candidates correctly added 0.2 and 0.8 to the top second pair of branches, but did not complete the bottom second pair of branches. Some candidates were able to complete the labels, but many left this blank or used numerical values.
	b		0.62	3	**M2** for 0.7 × 0.8 + 0.3 × 0.2 or better or for 1 – (0.7 × 0.2 + 0.3 × 0.8) or better or **M1** for one correct product shown or implied **FT** for **M1** and **M2** and **3** *their* 0.8, 0.2 and *their* 0.3 (must be less than 1) eg 0.7 × 0.8 or 0.3 × 0.2 or 0.7 × 0.2 or 0.3 × 0.8 soi by 0.56, 0.06, 0.14 or 0.24

					Examiner's Comments Few marks were given on this question. Some gained 1 for one correct product. Of those who attempted to use probabilities, many added the values rather than multiplying them, with some then giving a response greater than one.
			Total	**6**	
48	a			1	In this part, condone b(i) misplaced **Examiner's Comments** The correct response was usually seen in parts (a), (b) (i) and (b) (ii). Almost all candidates who gave the answer 17 in part (b) (i) were able to successfully place this on their Venn diagram. Of those who arrived at an incorrect response for (b) (i), most were given the mark in (b) (ii) for correctly placing their value on the diagram.
	b	i	17	1	**Examiner's Comments** The correct response was usually seen in parts (a), (b) (i) and (b) (ii). Almost all candidates who gave the answer 17 in part (b) (i) were able to successfully place this on their Venn diagram. Of those who arrived at an incorrect response for (b) (i), most were given the mark in (b) (ii) for correctly placing their value on the diagram.
		ii	17 in correct place on diagram	1	FT their (b)(i) Not strict FT **as** they may have started again

					Examiner's Comments The correct response was usually seen in parts (a), (b) (i) and (b) (ii). Almost all candidates who gave the answer 17 in part (b) (i) were able to successfully place this on their Venn diagram. Of those who arrived at an incorrect response for (b) (i), most were given the mark in (b) (ii) for correctly placing their value on the diagram.
	c		$\frac{101}{140}$ oe	2	FT $\frac{\text{their } 72+\text{their } 29}{140}$ **M1** for *their* 72 + *their* 29 may be implied by 101 *their* 72 + *their* 29 must be <140 for 2 or 1 mark Accept 0.721 or 72.1% isw an incorrect simplification of their correct probability or incorrect conversion to decimal or percentage Do not accept ratio **Examiner's Comments** This question proved more challenging for some candidates. A common error was $\frac{72}{140}$, from considering those who owned only a car. Of those who added 72 and 29 there were very few errors, although occasionally just 101 was given as their final response.
			Total	**5**	
49	a			2	**B1** for one correct region Condone number 1 and/or number 2 repeated **Examiner's Comments** Most candidates attempted this question and a range of marks were

					scored. The correct answer was seen from around a third of candidates. Some candidates first listed all the elements in the region outside the two sets T and F. They then selected the elements to go in the remaining regions, but often forgot to also delete them from the region outside the sets. These candidates were often able to score the B1, though. Some candidates correctly placed many of the elements, but placed 10 in two or three regions, often leading to 0 marks. Some candidates left the region outside the two sets blank.
	b		$\frac{1}{13}$ or 0.076 to 0.077	1	**FT** *their* diagram for numerator | Accept 7.6% to 7.7% isw after correct, or FT, fraction seen **Examiner's Comments** The mark scheme enabled candidates to follow through from their sets, however few did so correctly. A little under half gave the correct answer. The denominator was often incorrect. The question stated that there were 13 elements being picked from, so 13 should have been used as the denominator. A number of candidates appeared to write the probability that the element was a member of set T or set F. Some weaker responses gave an integer as their answer, indicating misunderstanding of probability.
	c		10 has been counted twice oe $\frac{7}{13}$ or 0.53[8..] to 0.54	1 1	Accept 53[8..]% to 54%

					Statement **Reason** **Mark** For additional information refer to **2023 June (J56003) Mark scheme Appendix** within downloadable additional mark guidance. **<u>Examiner's Comments</u>** Candidates tended to write at length, but not with clarity. Many skirted around the correct response that the common element (i.e. 10) had been counted twice, but did not actually make that point, writing incomplete statements that focused on a number being in the middle or a number being in both sets, without saying that this had been counted twice. Less able candidates said that Sam should have added the denominators or multiplied the fractions. In the classroom, candidates should be given the opportunity to present their responses to questions such as this to peers for constructive criticism. Almost a quarter of candidates did not attempt the question. Very few gained both marks.
			Total	**5**	
50	a		9 3 2 7 9 3 7 2 9 7 3 2 9 7 2 3 9 2 3 7 9 2 7 3	2	**B1** for at least 5 out of 6 correct with maximum 1 repeat/extra or for 4 out of 6 correct (no repeats/extras) If 9 3 2 7 is omitted allow 2 marks for 5 correct or B1 for at least 4 out of 5 correct with maximum 1 repeat/extra or for 3 out of 5 correct (no repeats/extras)

					Examiner's Comments The majority of candidates were given 2 marks here. The candidates that systematically listed the possibilities performed the best, even without a blank table being given as has been there in similar past listing questions. Some candidates didn't repeat the original combination given, but they were given full marks still if they responded with the remaining correct combinations. Common errors were writing 24 combinations, listing repeated combinations and missing some combinations.
	b		$\frac{2}{6}$ oe	1	FT *their* (a) **Examiner's Comments**

Mark to candidate's advantage. Allow for FT either their total written combinations or their combinations including the given combination.

Allow 0.33 [3….] or 33.[3….]%

Do not accept ratio or words

isw attempts to convert to decimals or percentages when acceptable fraction seen

					Most candidates were able to follow through from their part (a) and give a correct fraction (or in some cases a decimal or percentage). Responses that did not score this mark were generally either an answer in words, a ratio or just the number of combinations that had 2 as their last digit, i.e. 2 as an answer.
			Total	**3**	
51	a		0.6 oe 0.2, 0.8, 0.2, 0.8 oe	1 1	**Examiner's Comments** The majority of candidates were able to access the first mark for 0.6 on Monday. The majority of errors were made on the second set of branches of the diagram. Some just repeated 0.4 and 0.6 from the first 2 branches, while others just put 0.2 on the top branch.
	b		[0]. 32 oe	2	Correct or ft *their* 0.8 **M1** for 0.4 × *their* 0.8 | *Their* 0.8 < 1 **Examiner's Comments** The majority of candidates scored zero marks for this question. Those who attempted it often added together their probabilities rather than multiplying them. Where marks were given, this was normally 2 marks for a correct response. Very few candidates scored M1 for showing 0.4 × 0.8. Candidates could be awarded 2 marks through correct follow through, but this was rare as candidates that hadn't completed (a) correctly often made little progress with (b).
			Total	**4**	

52	a		B	1	Condone $\frac{1}{6}$ **Examiner's Comments** Only more able candidates managed to score marks in all parts of this question. Some candidates gave fractional answers. The most common incorrect answers to part (a) were E and F, presumably as candidates identified their positions with the number 5 on the dice.
	b		A	1	Condone 0 or $\frac{0}{6}$ **Examiner's Comments** This was the most successful part of the question, with many correct answers seen.
	c		E	1	Condone $\frac{4}{6}$ or $\frac{2}{3}$ **Examiner's Comments** Many responses contained the four letters D, E, F and G, presumably corresponding with the numbers on the dice greater than 2.
			Total	**3**	
53	a		376	2	**M1** for 800 – (48 + 80 + 296) or 80 + 296 or 800 × 0.47 oe **Examiner's Comments**

					Many correct answers were seen and more able candidates included working. Some candidates could not complete the addition and subtraction from 800 correctly. Very few used 800 × 0.47 to arrive at the frequency.
	b	i	4	2	M1 for $\frac{n}{40} = 0.1$ or 40 × 0.1 oe Answer $\frac{4}{40}$ implies M1 Do not accept → for × M1 for $\frac{80}{800} = \frac{4}{40}$ or $\frac{800}{40} = 20$ and $\frac{80}{20}$ **Examiner's Comments** This question was not answered well. Candidates rarely used 40 × 0.1, which was the simplest route to the answer. Workings such as 40 ÷ 4 = 10 or 40 ÷ 10 = 4 lead to the very common wrong value of 10. Scaling the total sample down, 800 ÷ 20 = 40, followed by scaling the number of blue marbles, 80 ÷ 20 = 4, was sometimes seen. The number of incorrect approaches seen, suggested that many did not understand the concept of relative frequency.
		ii	Yes oe and large number of trials oe or No and it is an estimate [of the actual number] oe	1	If "Yes" must state or imply large sample. Mention of 800 without saying sample is large is not enough. e.g. Yes, they picked lots of times. **1** Yes, they picked 800 times. **0** If "no" must state or imply estimate

					e.g. No, the relative frequency is only close to the real value **1** No, it's an estimate of probability **0** **Examiner's Comments** The number of incorrect responses to this part of the question confirmed the lack of understanding of relative frequency. Very few candidates gave the response that there were a large number of trials and so the results were reliable. Many candidates repeated how they had worked out the number of blue balls, some referred to the selection being random and some just stated yes or no without a reason. Some candidates commented on the use of 'likely' in the question and some indicated that this was an estimate but in such a way as to suggest the result was a 'guess'. **Assessment for learning** In probability, relative frequency is the number of times an event happens divided by the total number of outcomes. Candidates need to know how to calculate a relative frequency or inversely, how to work out a frequency when the relative frequency is given. They should also be able to discuss and interpret the use of relative frequency as an estimate of probability. Candidates might find it useful to discuss their responses to this type of question, reading to others in the group and evaluating the validity and coherence of the answer.
			Total	**5**	

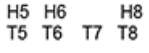
54	a		[H B C] [H B L] [H F C] H F L H S C H S L V B C V B L V F C V F L V S C V S L	2	**B1** for at least five new correct combinations For full marks there must be no repeats or extras but condone the three given combinations included and e.g. VB for Veggie Burger etc **Examiner's Comments** Most candidates gave a correct list of 12 combinations. Those that scored both marks usually showed a clear system when writing the combinations to avoid missing, or repeating, combinations.
	b		$\frac{\textit{their}\ \text{B}}{\textit{their}\ \text{total}}$ isw	1 FT	Strict FT of *their* table including the three given combinations FT allow repeats and misplaced letters Accept 3 sf answers if decimal or percentage e.g. 0.333[...] or 33.3[...]% If (a) is not attempted, allow $\frac{4}{12}$ or $\frac{2}{6}$ or $\frac{1}{3}$ **Examiner's Comments** Many candidates gained the mark for $\frac{1}{3}$ (or equivalent) or their follow through correct answer. A small number of candidates gave the number that included baked beans over 36 rather than 12.
			Total	**3**	
55			No **oe** and $\frac{34}{64}$ **oe**	5	**M4** for $\frac{3}{8}\times\frac{3}{8}+\frac{5}{8}\times\frac{5}{8}$ oe or **M3** for M3, B2 or B1 may be seen on the diagram or in

					$\frac{3}{8} \times \frac{3}{8}$ or $\frac{5}{8} \times \frac{5}{8}$ oe or **B2** for $\frac{3}{8}$ and $\frac{5}{8}$ oe or **B1** for $\frac{3}{8}$ oe or $\frac{5}{8}$ oe	working. Diagram does not need to be labelled. Accept equivalent decimals and percentages
					Examiner's Comments The inclusion of the tree diagram in this question allowed more candidates to access partial marks. Candidates commonly gave both correct fractions, $\frac{3}{8}$ and $\frac{5}{8}$, to score B2. Candidates rarely progressed beyond this initial start and few showed any understanding of how to use the probabilities to answer the question given.	
			Total	**5**		
56	a		19 in correct position	2	**M1** for 53 – (16 + 7+ 11) may be implied by 19 in working space	For 2 marks only 19 added to diagram
					Examiner's Comments Most correctly added 19 to the diagram, with a wrong value of 34 also seen. Where slips in arithmetic arose, those who showed their method earned a mark. Only a very small number calculated 19 but did not add it to the diagram.	
	b		$\frac{23}{53}$ or 0.43, 0.434 or 43%, 43.4%	2	**M1** for 16 + 7 implied by 23	23 must clearly be their final total Isw incorrect cancelling of correct fraction but do not allow

					conversion to incorrect form e.g 23 out of 53 or 23 : 53 for 2 marks **Examiner's Comments** Many scored both marks, the most common incorrect answer was $\frac{16}{53}$.
			Total	**4**	
57			Arrow at 0	1	**Examiner's Comments** Most candidates gave the correct answer for this part.
			Total	**1**	
58			$\frac{43}{50}$ or 0.86 or 86% or $\frac{86}{100}$	2	**M1** for 43 or 50 – 7 or 31 + 3 + 9 or $1-\frac{7}{50}$ lsw incorrect cancelling of correct fraction but do not allow conversion to incorrect form e.g 43 out of 50 or 43 : 7 for 2 marks **Examiner's Comments** Candidates often knew that probability adds up to 1 (or 100%) and usually added up the groups other than motorbike to 43. Many were then able to express this in the correct form for 2 marks. Incorrect answers included $\frac{7}{50}$, 43% and $\frac{1}{4}$.
			Total	**2**	
59			11	1	

					Examiner's Comments Most candidates gave the correct answer though answers of 4 and 18 were seen.
			Total	**1**	
60			Arrow at 0.4	1	In both parts allow clear indication other than an arrow. 2mm by eye **Examiner's Comments** Part (a) proved to be a more difficult concept than part (b). 0.6 and 0.8 were common errors.
			Total	**1**	
61	a		75 11 45 19	4	**B1** each correct OR **B1** for 75 **B1 FT** for 45 **B1 FT** for 11 and 19 Mark to candidate's advantage, ie **B1** each correct or part marks including possible **FT** Negative numbers will not score. Values must be integers. **Examiner's Comments** Candidates who found the first value of 75 correctly, generally proceeded to full marks. If this was not calculated correctly, candidates usually scored 2 marks for their 45 and for having values that added to 120.
	b		64 + 26 = 90 and $\frac{90}{120}$ = 75% nfww OR 120 × 0.75 = 90 and 64 + 26 = 90 oe	2	M1 for 64 + 26 = 90 OR **M1** for 120 × 0.75 = 90 Accept $\frac{3}{4}$ for 75% Allow equivalent methods using 25% or $\frac{1}{4}$ for **M1** or

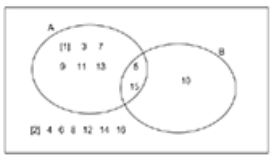
					OR **M1** for $\frac{90}{120}$ = 75% nfww **Examiner's Comments** Many candidates scored full marks here, showing where 90 had come from, and then showing this was equivalent to 75%. Some candidates did not fulfil the 'show that' aspect of the demand, instead simply stating that 75% of 120 was 90, without showing the calculation required.	**2** If using 25% for **2** marks they must also show 100% − 25% = 75% oe Breakdown methods must be complete and correct Do not accept e.g. 0.75 **of** 120 Do not accept e.g. 75**%** × 120 Do not accept 75% for 0.75 or $\frac{75}{100}$ as this is a show that question
			Total	**6**		
62	a		All branches completed with 0.55 and 0.05 in correct places	3	**B1** for 0.55 correctly placed at least once **B1** for 0.05 correctly placed at least once **Examiner's Comments** A number of candidates gained 1 mark for correctly placing 0.55 at least once on the tree diagram. Candidates who correctly placed 0.55 once often, but not always, did so correctly on all the branches. Some candidates placed 0.5 rather than 0.05 on the lower branches.	

					Others made errors in subtracting 0.4 and 0.55 from 1 (although this subtraction was rarely shown) and 0.41 was a common error. Some left the other branches blank.
	b		0.4 × 0.4 + 0.55 × 0.55 + 0.05 × 0.05 [=0.465]	3	**M2** for 0.4 × 0.4, 0.55 × 0.55 and 0.05 × 0.05 may be 0.16 0.3025 0.0025 or **M1** for 0.4 × 0.4 or 0.55 × 0.55 or 0.05 × 0.05 may be 0.16, 0.3025, 0.0025 Answer given: for 3 marks products and additions must be explicitly seen Accept e.g. $(0.4)^2$ for 0.4×0.4 Values may be seen on diagram in (a) If all values shown on ends of tree, must select 3 values to use for **M2** and 1 value for **M1** Equivalent fractions are OK but, for 3 marks must convert to the decimal **Examiner's Comments** Many candidates did not attempt to show this result. Some candidates were not aware of the demands of a "Show that…" question and only gave the addition of the three products to score 2 marks. A common "informed" error was to add the pairs of probabilities. Some candidates tried a variety of combinations of the probabilities to make 0.465.
			Total	**6**	
63	a			2	**B1** for 5 correct in correct place Accept 5H etc **Examiner's Comments** This question was often completed

					correctly. A few candidates did not insert H and T and a few candidates offered 'no response'.
	b		$\frac{1}{4}$	2	**B1** for $\frac{\text{their } 2}{8}$ isw If 0 scored, **SC1** for 0.25 or 25% Follow through *their* number of "T and even number" from table in (a) **Examiner's Comments** Few candidates were able to accurately answer this question. The most common incorrect answer was $\frac{2}{4}$ or $\frac{1}{2}$, from just looking at one of the conditions. A number of candidates did not cancel $\frac{2}{8}$ A few candidates gave 0.25 to score an SC mark.
			Total	**4**	
64	a		$\frac{2}{8}$	1	Accept equivalent fractions eg $\frac{1}{4}$ or $\frac{4}{16}$ **Examiner's Comments** Few candidates were able to accurately answer this question. Most candidates did give a fraction as their answer, as the question demanded. However, the fractions given were often incorrect such as $\frac{2}{9}$ or $\frac{6}{10}$.Some appeared to be counting the lines on the diagram, rather than the spaces on the probability scale. A very few gave the incorrect $\frac{6}{8}$oe from not reading the question carefully.

	b		15 ÷ 4 oe or 15 ÷ 8 ÷ [2 or 6] oe 3.75 oe or 1.875 or 11.25 and recognise not integer OR $\frac{R}{R+B}=\frac{3}{12}$ and $\frac{4}{16}$ or R:B = 3:9 and 12 sides and 4:12 and 16 sides 15 is missing oe	M1 A1 M1 A1	If 0 scored, **SC1** for 15 is not a multiple of 4 or 8 oe **Examiner's Comments** Around half of all candidates submitted 'no response' to this question. Among those who did attempt the question, many incorrectly thought that "fair" meant "an equal chance of red or blue" and said that 15 was an odd number so there could not be the same number of red and blue faces. A few candidates did divide 15 by 4 (or 8) but did not explain what their answer implied for the spinner. Some candidates stated that it couldn't be fair because spinners are round.	No FT as the scale can be used but allow 15 × (0.25 or 0.75) for M1 May be fractions $\frac{R}{B}=\frac{3}{9}$ and 12 sides etc oe e.g. 4, 8, 12, 16 and 15 is not here
			Total	**3**		
65	a		$\frac{1}{8}$	1		In (a) and (b) accept equivalent fractions, decimals or %'s with the % sign Isw attempts to convert after correct answer seen Do not accept ratio or words
	b		$\frac{3}{8}$	2	**M1** for 12, 15, 18 chosen	For M1 12, 15, 18 may be circled or underlined – intention that only these 3 numbers

					selected must be clear **Examiner's Comments** Part (a) was successfully answered by many candidates. Wrong representations of probability were evident with frequent errors of 1 : 8, 1 to 8, 1 in 8, 1 out of 8. Incorrect fractions included $\frac{1}{7}, \frac{1}{18}$ from assuming all numbers from 1 to 18 were used and $\frac{2}{8}$ as a result of including both 11 and 12 for "less than 12". Some gave word answers such as "unlikely". Where candidates did not achieve full marks in part (b), M1 was often awarded either by writing out 12, 15, 18 in the part (b) answer space or clearly indicating that these were selected on the spinner, or in the list of numbers stated in the question. Those that answered with an incorrect representation of probability, or in words for part (a), generally gave answers in the same incorrect format in part (b).
			Total	**3**	
66	a		0.14, 0.09, (0.19), 0.2[0], 0.13, 0.25	2	**B1** for three or four correct relative frequencies in the correct place Accept fractions **Examiner's Comments** This common question was rarely answered correctly. The relative frequencies were often incorrect or not attempted. Many candidates divided the number on the die by the number of throws, or vice versa.
	b	i	[Unbiased dice] would have each [rf =] 0.16 − 0.17	1	

			or [Unbiased dice] would have each [f =] 50 or comment about very unequal [relative] frequencies and implied comparison			Accept "about 0.16" Accept "about 50" Not enough to say one number was rolled the most. Must say 6 [and 4] or some numbers are much higher or 2 or 5 or some numbers are much lower
					Examiner's Comments In some candidates did score a mark for recognising that the results for 2, 4 and 6 were **very** different from that which should be expected, but few gave the expected outcome of 50 (or the relative frequencies) for each number. Most could not answer in this part and only referred to reasons such as results being random.	
		ii	need larger sample oe	1		
			Total	**4**		
67	a			3	**B2** for one element misplaced or repeated or missing or **B1** for one correct region	Condone 1 and/or 2 repeated
					Examiner's Comments This saw many correct, or nearly correct, responses. Sometimes candidates misplaced one element or repeated it, scoring 2 marks. Poorer responses saw candidates place no elements outside the two sets.	

	b		[Venn diagram] 2 and [because] odd numbers cannot be multiples of 2 oe and no contradictions	2	**B1** for choice of diagram 2 Must justify using properties of elements. Accept "Odd numbers cannot be even" and "All multiples of 2 are even" **Examiner's Comments** In this part most candidates chose the second diagram. When they appreciated that there could be no odd multiples of 2 (recognising the properties of the elements of the respective sets) both marks were scored. Some candidates chose Venn diagram 1, saying that it was clearer to see what was happening, which scored no marks.
			Total	**5**	
68			0.12 0.48	4	**B3** for 0.12 OR **M2** for 1 – (0.1 + 0.1 + 0.2) soi by 0.6 in working or two values in the table which sum to 0.6 or **M1** for 0.1 + 0.1 + 0.2 soi by 0.4 in working **M1** for *their* 0.6 ÷ 5 Accept percentages or fractions **Examiner's Comments** Many realised the values in the table needed to add to 1 and several were able to get to 0.6. Many of these were however unable to calculate the values using the given ratio.

			Total	**4**		
69			$\frac{4}{16}$ oe nfww	4	**M2** for 16 correct outcomes shown or for [4 × 4 =] 16 [outcomes] or **M1** for table, list etc, with at least 10 correct outcomes to a maximum of 16 (ignoring repeats) AND **M2FT** for correctly indicating all the primes in *their* outcomes (at least 6) **and** gives the correct response for *their* outcomes or **M1FT** for writing *their* correct response from *their* outcomes **or** for indicating all the primes in *their* outcomes with maximum one error to a maximum of **3** marks if **0** scored then **SC3** for a correct response from adding 16 outcomes i.e. $\frac{9}{16}$ or **SC2** for a correct response from adding (at least 6 outcomes), primes must be indicated or **SC1** for correct response from adding (at least 6 outcomes), primes are not indicated Note : an	<u>M marks are for products</u> The outcomes may be a list or table showing 16 outcomes which may have numbers or ticks and crosses to show primes etc, if just numbers with nothing above 8 assume addition By e.g. shading, underlining or ringing **M1** implied by a correct numerator and a correct denominator for *their* list Note that $\frac{2}{4} \times \frac{2}{4}$ is an incorrect method

					alternative method is **M3** for [P(1 with 2,3 OR 2,3 with 1)=] $\frac{1}{4}\times\frac{2}{4}+\frac{2}{4}\times\frac{1}{4}$ or **M2** for the above method with one error or **M1** for a correct tree diagram drawn **Examiner's Comments** Candidates who produced and used an organised list did better than those who did not. The most common error was to include 1 as a prime number. Some candidates added rather than multiplied.
			Total	**4**	
70	a	i	0.2 and 0.8 in all the correct places	2	**B1** for first branch correct or second branches correct Accept equivalent fractions and percentages (need % sign) **Examiner's Comments** Many scored 1 mark in **(i)**, usually for 0.8 on the first branch. Some did complete the tree diagram though reversed 0.2 and 0.8 on some branches.
		ii	0.64 or $\frac{16}{25}$oe or 64%	2	**FT** *their* tree for **1** or **2** marks (*their* values < 1) **M1** for 0.8 × 0.8 oe Allow long method : e.g. 1 – (0.04 + 0.16 + 0.16) **Examiner's Comments** In **(ii)** many correctly used 0.8 and 0.8, but the majority of these added to give 0.16 rather than multiplying to give 0.64.

		iii	Suggestion of dependence between the trains or unexpected events or data may not be applicable	1		Accept any correct reason, e.g. if first train is late second train may be held up e.g. unexpected delays can occur e.g. changed schedule that day (implies data not applicable)
	b		0.73[4] or $\frac{734}{1000}$ oe or 73.4%	3	**M2** for 1 – 0.35 × 0.76 or 0.35 × 0.24 + 0.65 × 0.24 + 0.65 × 0.76 oe or **M1** for two correct products or 0.35 × 0.76	e.g. common equivalent $\frac{367}{500}$ products implied by 0.266, 0.084, 0.156, 0.494
			Total	**8**		
71	a		A B R S A R B S R A B S R B A S B R A S B A R S	2	**B1** for at least 3 additional correct arrangements	For 2 marks no repeats or extras apart from A B R S **Examiner's Comments** In this part, candidates who worked systematically did well. The most common error was placing Sam in one of the first three columns, missing the information in the question that Sam always had to be in 4th place. This led to a number of incorrect combinations and often caused confusion and repeat arrangements.
	b		$\frac{2}{6}$ **oe** isw	2	**FT** *their* table **M1** for correct numerator or denominator **FT** *their* table	For 2 marks or M1 denominator < 11 Not ratio or words isw cancelling/conversion to other forms **Examiner's Comments**

					Candidates tended to do well in this part by following through from their table. Word or ratios responses were not credited, but these were few in number. A small number of candidates counted the number of runners in the arrangements, leading to an incorrect denominator of 24 for the probability.
			Total	**4**	