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CAMBRIDGE
International Education

Cambridge International AS & A Level

MATHEMATICS **9709/52**

Paper 5 Probability & Statistics 1 **May/June 2026**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **24** printed pages.

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[Turn over

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: • the specific **content** defined in the mark scheme • the specific **skills** defined in the mark scheme or in the level descriptions • the **standard of response** required as exemplified by the standardisation scripts.
2	Examiners must award **whole marks** (not half marks, or other fractions).
3	Examiners must award marks **positively**. This means that: • marks are not deducted for errors or omissions • marks are awarded for correct/valid answers as defined in the mark scheme and also for **other valid answers** which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate • the quality of spelling, punctuation and grammar are judged **only** when the mark scheme indicates that these features are **specifically assessed** in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must **consistently** apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the **full range of marks** defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and **must not** award marks with grade thresholds or grade descriptions in mind.

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Mathematics-Specific Marking Principles

1 Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2 Unless specified in the question, non-integer answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.

3 Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.

4 Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).

5 Where a candidate has misread a number or sign in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 A or B mark for the misread.

6 Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate's intent clear.

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Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	More information required
	Accuracy mark awarded zero
	Accuracy mark awarded one
	Independent accuracy mark awarded zero
	Independent accuracy mark awarded one
	Independent accuracy mark awarded two
	Benefit of the doubt
	Blank Page
	Incorrect
Dep	Used to indicate DM0 or DM1

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Annotation	Meaning
DM1	Dependent on the previous M1 mark(s)
FT	Follow through
	Indicate working that is right or wrong
Highlighter	Highlight a key point in the working
ISW	Ignore subsequent work
J	Judgement
JU	Judgement
M0	Method mark awarded zero
M1	Method mark awarded one
M2	Method mark awarded two
MR	Misread
O	Omission or Other solution
Off-page comment	Allows comments to be entered at the bottom of the RM marking window and then displayed when the associated question item is navigated to.
On-page comment	Allows comments to be entered in speech bubbles on the candidate response.
PE	Judgment made by the PE
Pre	Premature approximation
SC	Special case
SEEN	Indicates that work/page has been seen

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Annotation	Meaning
SF	Error in number of significant figures
✓	Correct
TE	Transcription error
XP	Correct answer from incorrect working

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Mark Scheme Notes

The following notes are intended to aid interpretation of mark schemes in general, but individual mark schemes may include marks awarded for specific reasons outside the scope of these notes.

Types of mark

M Method mark, awarded for a valid method applied to the problem. Method marks are not lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, e.g. by substituting the relevant quantities into the formula. Correct application of a formula without the formula being quoted obviously earns the M mark and in some cases an M mark can be implied from a correct answer.

A Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated method mark is earned (or implied).

B Mark for a correct result or statement independent of method marks.

DM or **DB** When a part of a question has two or more 'method' steps, the M marks are generally independent unless the scheme specifically says otherwise; and similarly, when there are several B marks allocated. The notation DM or DB is used to indicate that a particular M or B mark is dependent on an earlier M or B (asterisked) mark in the scheme. When two or more steps are run together by the candidate, the earlier marks are implied and full credit is given.

FT Implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A or B marks are given for correct work only.

- A or B marks are given for correct work only (not for results obtained from incorrect working) unless follow through is allowed (see abbreviation FT above).
- For a numerical answer, allow the A or B mark if the answer is correct to 3 significant figures or would be correct to 3 significant figures if rounded (1 decimal place for angles in degrees).
- The total number of marks available for each question is shown at the bottom of the Marks column.
- Wrong or missing units in an answer should not result in loss of marks unless the guidance indicates otherwise.
- Square brackets [ ] around text or numbers show extra information not needed for the mark to be awarded.

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Abbreviations

AEF/OE	Any Equivalent Form (of answer is equally acceptable) / Or Equivalent
AG	Answer Given on the question paper (so extra checking is needed to ensure that the detailed working leading to the result is valid)
CAO	Correct Answer Only (emphasising that no 'follow through' from a previous error is allowed)
CWO	Correct Working Only
ISW	Ignore Subsequent Working
SOI	Seen Or Implied
SC	Special Case (detailing the mark to be given for a specific wrong solution, or a case where some standard marking practice is to be varied in the light of a particular circumstance)
WWW	Without Wrong Working
AWRT	Answer Which Rounds To

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Question	Answer	Marks	Guidance
1(a)	**EITHER:** **Method 1**		
	5M 0W $^6C_5$ = 6 4M 1W $^6C_4 \times {}^9C_1$ = 135 3M 2W $^6C_3 \times {}^9C_2$ = 720 Or 2M 3W $^6C_2 \times {}^9C_3$ = 1260 1M 4W $^6C_1 \times {}^9C_4$ = 756 0M 5W $^6C_0 \times {}^9C_5$ = 126	**(M1** **M1**	Product of form $^6C_x \times {}^9C_y$, $x + y = 5$, $x,y \neq 0$. 3 correct identified outcomes added, accept un-simplified. Or Total – 3 correct identified outcomes added, accept un-simplified. May be identified by correct un-simplified expressions.
	[Total number of ways =] $^{15}C_5$	**M1**	Seen, used as denominator in a probability.
	[Probability =] $\frac{861}{3003} = \frac{41}{143} = 0.287$	**A1)**	Accept 0.286713… to at least 3SF.

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Question	Answer	Marks	Guidance
1(a)	**OR:** **Method 2**		
	5M 0W $\frac{6}{15}\times\frac{5}{14}\times\frac{4}{13}\times\frac{3}{12}\times\frac{2}{11}$ 4M 1W $\frac{6}{15}\times\frac{5}{14}\times\frac{4}{13}\times\frac{3}{12}\times\frac{9}{11}\times 5$ 3M 2W $\frac{6}{15}\times\frac{5}{14}\times\frac{4}{13}\times\frac{9}{12}\times\frac{8}{11}\times 10$ Or 2M 3W $\frac{6}{15}\times\frac{5}{14}\times\frac{9}{13}\times\frac{8}{12}\times\frac{7}{11}\times 10$ 1M 4W $\frac{6}{15}\times\frac{9}{14}\times\frac{8}{13}\times\frac{7}{12}\times\frac{6}{11}\times 5$ 0M 5W $\frac{9}{15}\times\frac{8}{14}\times\frac{7}{13}\times\frac{6}{12}\times\frac{5}{11}$	**(M1** **M1**	5 term **probability** of form. $\frac{a}{15}\times\frac{b}{14}\times\frac{c}{13}\times\frac{d}{12}\times\frac{e}{11}$, $a,b,c,d,e\geqslant 1$ seen. $\frac{a}{15}\times\frac{b}{14}\times\frac{c}{13}\times\frac{d}{12}\times\frac{e}{11}\times {}^5\mathrm{C}_f$, $f=1,2,3,4$ or $\frac{a}{15}\times\frac{b}{15}\times\frac{c}{15}\times\frac{d}{15}\times\frac{e}{15}\times {}^5\mathrm{C}_f$, $f=1,2,3,4$ seen, $a,b,c,d,e\geq 1$.
		M1	Probabilities of 3 identified correct scenarios added, may be identified by un-simplified expressions. Or 1 – Probabilities of 3 identified correct scenarios added, may be identified by un-simplified expressions.
	[Probability =] $\frac{861}{3003}=\frac{41}{143}=0.287$	**A1)**	Accept 0.286713… to at least 3SF.
	Available marks	**4**	

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Question	Answer	Marks	Guidance
1(b)	**EITHER:** **Method 1**		
	$^{13}C_6 \times {}^{7}C_4[\times {}^{3}C_3]$	**(M1**	$^{13}C_x \times {}^{13-x}C_y [\times {}^{13-x-y}C_{13-x-y}] \times k$, $x \neq y \neq 0$, $k = 1, 6$ or $^{13}P_x \times {}^{13-x}P_y \times {}^{13-x-y}P_{13-x-y}$ $x \neq y \neq 0$.
	60060	**A)1**	CAO. If **M1** not scored, **SCB1** for 60060 WWW.
	OR: **Method 2**		
	$\frac{13!}{6! \times 4! \times 3!}$	**(M1**	$\frac{13!}{a! \times b! \times c!}$, $a+b+c=13$, $a \neq b \neq c \neq 0$.
	60060	**A1)**	CAO. If **M1** not scored, **SCB1** for 60060 WWW.
	Available marks	**2**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td rowspan="4">2(a)</td><td rowspan="3"><table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X=x)</td><td>$\frac{8}{27}$</td><td>$\frac{12}{27}, \frac{4}{9}$</td><td>$\frac{6}{27}, \frac{2}{9}$</td><td>$\frac{1}{27}$</td></tr>
<tr><td></td><td>0.2963</td><td>0.4444</td><td>0.2222</td><td>0.03704</td></tr>
</table></td><td>B1</td><td>Table with correct values of x and at least one identified non-zero probability correct.
Condone extra x values if probability stated as 0.</td></tr>
<tr><td>B1</td><td>Two more correct non-zero probabilities linked with correct outcome (3 correct probabilities present).
Accept probabilities not in table if clearly identified.</td></tr>
<tr><td>B1</td><td>4 correct non-zero probabilities linked with correct outcome.
Accept probabilities not in table if clearly identified.
Non-exact decimals correct to at least 3SF.
SCB1 for 4 non-zero probabilities (not all ¼) in table with correct x values adding to 1 if B1 max scored.</td></tr>
<tr><td></td><td></td><td>If the probabilities of tails are calculated SCB1 4 non-zero probabilities summing to 1 placed in a probability distribution table with correct x values and $\mathrm{P}(0)=\frac{1}{27}$ or $\mathrm{P}(3)=\frac{8}{27}$.
SCB2 for<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X=x)</td><td>$\frac{1}{27}$</td><td>$\frac{6}{27}$</td><td>$\frac{12}{27}$</td><td>$\frac{8}{27}$</td></tr>
<tr><td></td><td>0.03704</td><td>0.2222</td><td>0.4444</td><td>0.2963</td></tr>
</table></td></tr>
<tr><td></td><td>3</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
2(b)	$\left(\frac{20}{27}\right)^6 \times \frac{7}{27}$	**M1**	$(1-p)^6 \times p$, $p = their\ \mathrm{P}(2 \cup 3)\ or\ P(2)\ or\ P(3)$, un-simplified. No other terms present.
	0.0428	**A1**	AWRT. If **M1** not scored, **SCB1** for 0.04282838… to at least 4SF.
		2	
2(c)	$5\left(\frac{20}{27}\right)^4\left(\frac{7}{27}\right)^2 + 6\left(\frac{20}{27}\right)^5\left(\frac{7}{27}\right)^2$	**M1**	Either $5(r)^4(s)^2$ or $6(r)^5(s)^2$, $0<r,\ s<1$ seen, similar terms must be considered combined, no incorrect form terms present.
		M1	$at^4(1-t)^2 + bt^5(1-t)^2$, $a,\ b \geqslant 1,\ 0<t<1$.
	= 0.191	**A1**	AWRT. If one or more **M** mark not scored, **SCB1** for 0.19112165 to at least 4SF.
		3	

Question	Answer	Marks	Guidance
3(a)	$[6 \times 7 \times 1 =]42$	**B1**	
		1	

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Question	Answer	Marks	Guidance
3(b)	**EITHER:** **Method 1** – considering first digit		Condone × ${}^{n}C_1$ or × ${}^{n}P_1$ as × n throughout.
	first digit even: ${}^{3}C_1 \times {}^{5}C_1 \times {}^{2}C_1 = 30$ first digit odd: ${}^{3}C_1 \times {}^{5}C_1 \times {}^{3}C_1 = 45$ or First digit 2 = [1 ×] ${}^{5}C_1 \times {}^{2}C_1$ [× 1] = 10 First digit 3 = [1 ×] ${}^{5}C_1 \times {}^{3}C_1$ [× 1] = 15 First digit 4 = [1 ×] ${}^{5}C_1 \times {}^{2}C_1$ [× 1] = 10 First digit 5 = [1 ×] ${}^{5}C_1 \times {}^{3}C_1$ [× 1] = 15 First digit 6 = [1 ×] ${}^{5}C_1 \times {}^{2}C_1$ [× 1] = 10 First digit 7 = [1 ×] ${}^{5}C_1 \times {}^{3}C_1$ [× 1] = 15	**(B1**	One identified outcome correct. or Three identified outcomes correct. The last digits can be considered individually and listed…
		M1	Two correct odd/even scenarios added. May be implied by un-simplified expression or 30+45. or Six correct first digit scenarios added, may be implied by un-simplified expression or 10+15+10+15+10+15.
	[Total number of numbers =] 75	**A1)**	Only dependent on **M** mark.
	OR: **Method 2** Considering last digit		Condone × ${}^{n}C_1$ or × ${}^{n}P_1$ as × n throughout.
	Last digit 2 = ${}^{5}C_1 \times {}^{5}C_1$ [× 1] = 25 Last digit 4 = ${}^{5}C_1 \times {}^{5}C_1$ [× 1] = 25 Last digit 6 = ${}^{5}C_1 \times {}^{5}C_1$ [× 1] = 25 Or	**(B1**	Two identified outcomes correct. or One identified outcome correct.
	Last digit even = ${}^{5}C_1 \times {}^{5}C_1 \times {}^{3}C_1$	**M1**	Three correct last digit scenarios added, condone 3 for ${}^{3}C_1$. May be implied by un-simplified expression or 25 + 25 + 25.
	[Total number of numbers =] 75	**A1)**	Only dependent on **M** mark.

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Question	Answer	Marks	Guidance
3(b)	**OR:** **Method 3** Considering last digit, with 1 treated separately		Condone × ${}^{n}C_1$ or × ${}^{n}P_1$ as × n throughout.
	Last digit 2 = ${}^{5}P_2$ [× 1] = 20 Last digit 4 = ${}^{5}P_2$ [× 1] = 20 Last digit 6 = ${}^{5}P_2$ [× 1] = 20 And ^ 1 2 = ${}^{5}C_1$[× 1 × 1] = 5 ^ 1 4 = ${}^{5}C_1$[× 1 × 1] = 5 ^ 1 6 = ${}^{5}C_1$[× 1 × 1] = 5	**(B1**	Two identified outcomes from **both** groups correct.
		M1	Three correct last digit and three '1' and last digit scenarios added, May be implied by un-simplified expression or 20 + 20 + 20 + 5 + 5 + 5.
	[Total number of numbers =] 75	**A1)**	Only dependent on **M** mark.
	OR: **Method 4** – types of 'all 3 digits' identified		Condone × ${}^{n}C_1$ or × ${}^{n}P_1$ as × n throughout.
	EEE ${}^{3}C_1$× ${}^{2}C_1$ × ${}^{1}C_1$ = 6 EOE ${}^{3}C_1$× ${}^{4}C_1$ × ${}^{2}C_1$ = 24 OEE ${}^{3}C_1$× ${}^{3}C_1$ × ${}^{2}C_1$ = 18 OOE ${}^{3}C_1$× ${}^{3}C_1$ × ${}^{2}C_1$ = 27	**(B1**	Two identified outcomes correct.
		M1	Four correctly fully identified scenarios added, may be implied by un-simplified expression or 6 + 24 + 18 + 27.
	[Total number of numbers =] 75	**A1)**	Only dependent on **M** mark.
			SCB2 If no marks scored and an answer of 75 stated with correct listing of possible values.
	Available marks	**3**	

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Question	Answer	Marks	Guidance
4(a)	**EITHER:** **Method 1**		
	[P($X \geqslant 7$) = P(7, 8, 9) =] $^9C_7 (0.6)^7 (0.4)^2 + {}^9C_8 (0.6)^8 (0.4) + [{}^9C_9] (0.6)^9$ [= 0.161243 + 0.060466 + 0.010078]	**(M1**	One term of the form $^9C_x (p)^x (1-p)^{9-x}$, $0 < p < 1$, $x \neq 0$ or 9. Note: $\sum {}^9C_x (p)^x (1-p)^{9-x}$ implies **M1** With $0 < p < 1$, $x \neq 0$ or 9, condone p not substituted if clearly stated, e.g. $p = 0.8$.
		A1	Correct un-simplified expression. Note: $\sum_{x=7}^{9} {}^9C_x (0.6)^x (0.4)^{9-x}$ implies **M1A1**, condone p not substituted if clearly stated, e.g. $p = 0.6$.
	= 0.232	**B1)**	$0.2315 < p \leqslant 0.232$.

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Question	Answer	Marks	Guidance
4(a)	**OR:** **Method 2**		
	[P($X \geqslant 7$) = 1 – P(0, 1, 2, 3, 4, 5, 6) =] $1 - ([{}^9C_0](0.4)^9 + {}^9C_1(0.6)(0.4)^8 + {}^9C_2(0.6)^2(0.4)^7 + {}^9C_3(0.6)^3(0.4)^6 + {}^9C_4(0.6)^4(0.4)^5 + {}^9C_5(0.6)^5(0.4)^4 + {}^9C_6(0.6)^6(0.4)^3)$	**(M1**	One term of the form ${}^9C_x(p)^x(1-p)^{9-x}$, $0 < p < 1,\ x \neq 0$ or 9 Note: $\sum {}^9C_x(p)^x(1-p)^{9-x}$ implies **M1** With $0 < p < 1,\ x \neq 0$ or 9, condone p not substituted if clearly stated, e.g. $p = 0.8$.
		A1	Correct un-simplified expression- Condone omission of final bracket. If **both** brackets omitted in un-simplified expression allow recovery from final stated calculation of 1 – 0.7682 or final answer which round to 0.2318 (to 4SF). Note: $1-\sum_{x=0}^{7} {}^9C_x(0.6)^x(0.4)^{9-x}$ implies **M1A1**, condone p not substituted if clearly stated, e.g. $p = 0.6$.
	= 0.232	**B1)**	$0.2315 < p \leqslant 0.232$.
	Available marks	**3**	

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Question	Answer	Marks	Guidance
4(b)	[Mean =] $0.6\times120=72$ [variance =] $120\times0.6\times0.4=28.8$	**B1**	72 and 28.8 (CAO) seen, allow un-simplified. May be in standardisation formula. ($\sigma=\sqrt{28.8}$, $\frac{12\sqrt{5}}{5}$ *or* 5.36656… to at least 4SF implies correct variance. **Withold mark if variance clearly identified as standard deviation.** Condone N(72, $\sqrt{28.8}$) if standardisation formula correct or variance/standard deviation stated correctly as well.
	[P($X<66$) = P$\left(Z<\right]\frac{65.5-72}{\sqrt{28.8}}\right)$	**M1**	Substituting *their* μ and positive σ into the ± standardisation formula (any number for 65.5), allow σ^2.
		M1	Continuity correction 65.5 or 66.5 used in ±standardisation formula. Note: If no standardisation formula seen $\pm\left(\frac{6.5}{\sqrt{28.8}}\right)$ *or* $\pm\left(\frac{6.5}{5.367}\right)$ scored **M2** BOD.
	[P($Z<-1.211$)= $\Phi(-1.211)=1-\Phi(1.211)$] 1 – 0.8871	**M1**	Appropriate area Φ, from final process, must be a probability. May be implied by a sketch of the required probability area. Note: **correct** final answer implies this **M1**. Expect final answer < 0.5. If *their* μ < 66, the appropriate probability area will be > 0.5.
	= 0.113 final answer	**A1**	**AWRT.**
		5	

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Question	Answer	Marks	Guidance
5(a)	$\left[\frac{5}{10}\times\frac{4}{10}=\right]\frac{1}{5}$	**B1**	OE.
		1	
5(b)	$\left[\text{P(R,R)}+\text{P(B,R)}+\text{P(G,R)}=\right]$ $\frac{3}{10}\times\frac{2}{10}+\frac{5}{10}\times\frac{3}{10}+\frac{2}{10}\times\frac{3}{10}$ **Or** $\left[\text{P(R,R)}+\text{P(R}',\text{R})=\right]$ $\frac{3}{10}\times\frac{2}{10}+\frac{7}{10}\times\frac{3}{10}$	**M1**	$\frac{a}{10}\times\frac{b}{10}+\frac{c}{10}\times\frac{d}{10}+e \quad a,b,c,d\neq 0,\ 0\leqslant e<1$ **Or** $\frac{a}{10}\times\frac{b}{11}+\frac{c}{10}\times\frac{d}{11}+e \quad a,b,c,d\neq 0,\ 0\leqslant e<1$ **Or** $\frac{a}{10}\times\frac{b}{9}+\frac{c}{10}\times\frac{d}{9}+e \quad a,b,c,d\neq 0,\ 0\leqslant e<1$ May be implied by correct use of tree diagram. Correct fraction values may be simplified.
		M1	$\left[\text{P(R,R)}+\text{P(B,R)}+\text{P(G,R)}=\right]$ $\frac{3}{10}\times\frac{b}{10}+\frac{5}{10}\times\frac{d}{10}+\frac{2}{10}\times\frac{g}{10} \quad b,d,g\neq 0.$ **or** $\left[\text{P(R,R)}+\text{P(R',R)}=\right]$ $\frac{3}{10}\times\frac{b}{10}+\frac{7}{10}\times\frac{d}{10} \quad b,\ d\neq 0.$ May be implied by correct use of tree diagram. Probabilities need to be in a consistent order unless scenarios clearly stated. Correct fraction values may be simplified.

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Question	Answer	Marks	Guidance
5(b)	$= \frac{27}{100}$, 0.27[0]	**A1**	If one or more **M** mark not scored, **SCB1** for $\frac{27}{100}$, 0.27[0] as final answer, WWW.
		3	
5(c)	$P(R1 \mid B2 \text{or } G2) = \frac{P(R1 \cap (B2 \text{ or } G2))}{P(B2 \text{ or } G2)}$	***B1**	$\frac{3}{10} \times \frac{8}{10}$ OE or 0.24 or $\frac{3}{10} \times \frac{8}{11}$ or $\frac{3}{10} \times \frac{8}{9}$ seen as numerator of fraction.
	$= \frac{\frac{3}{10} \times \frac{8}{10}}{1-(b)}$	***B1**	1 – *their* **5(b)** or $\frac{3}{10} \times \left(\frac{5}{10} + \frac{3}{10}\right) + \frac{5}{10} \times \left(\frac{4}{10} + \frac{3}{10}\right) + \frac{2}{10} \times \left(\frac{5}{10} + \frac{2}{10}\right)$ OE. or $\frac{3}{10} \times \left(\frac{8}{10}\right) + \frac{7}{10} \times \left(\frac{7}{10}\right)$ OE. Or 0.73. Seen as the denominator of fraction.
	$= \frac{24}{73}$, 0.329	**DB1**	0.328767… to 3 or more SF.
		3	

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Question	Answer	Marks	Guidance
6(a)	Hippos | Zebras 8 5 | 16 | 7 8 6 2 2 | 17 | 1 2 5 7 9 8 8 5 4 1 | 18 | 2 3 4 6 6 9 5 2 1 0 | 19 | 1 2 4	**B1**	Correct stem, cannot be upside down, ignore extra values. If a split stem-and-leaf plot used (i.e. the stem values are repeated) the remaining **B** marks are available.
		B1	Correct Hippos labelled on left, leaves in order from right to left and lined up vertically (less than halfway to next column), no commas or other punctuation.
		B1	Correct Zebras labelled on same diagram, leaves in order and lined up vertically (less than halfway to next column), no commas or other punctuation. Condone misalignment, commas, reverse order or omission of label if error penalised already in Hippos. If **leaves are not single digit**, treat as a single error. If the correct data for Hippos and Zebras is transposed, treat as a single error (condone in Zebras if penalised in Hippos). If 2 errors in Hippos and 1 error repeated in Zebras, **B0B0**.
	Key: 2|17|9 represents 172 cm for Hippos and 179 cm for Zebras	**B1**	Correct **non-symmetrical** single key for their diagram, need both teams identified and 'cm' stated at least once here or in leaf headings or title. If **2 separate diagram** drawn max marks: **B1** if both stems correct **B1** if Hippos correct to the left of the stem **B1** if both keys correct including 'cm' and team name.
		4	

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Question	Answer	Marks	Guidance
6(b)	190 – 172	**M1**	$188 \leqslant$ UQ $\leqslant 191 - 168 \leqslant$ LQ $\leqslant 176$. Implied if both quartile values are stated and appropriate IQR calculated accurately.
	= 18 (cm)	**A1**	WWW. If **M0** scored, **SCB1** for 18 WWW.
		2	
6(c)	**EITHER:** **Method 1**		
	[Height of new player =] $184 + 15 \times \frac{1}{2}$	**(M1**	$15 \times \frac{1}{2}$ or 7.5 seen.
	[184 + 7.5 =]191.5 [cm] or 192 [cm]	**A1)**	
	OR: **Method 2**		
	New mean height = $\frac{2541+x}{15} = \frac{2725}{15} + \frac{1}{2}$	**(M1**	$\frac{2725}{15}$ *or* $\frac{545}{3}$ *or* $\frac{2541+x}{15}$ *or* $(181.66\ldots$ *or* $182.16\ldots)$ to at least 4SF seen.
	Height of new player = 191.5 [cm]) or 192 [cm]	**A1)**	Accept $191.5 \leqslant x \leqslant 191.51, 191.55, 191.6$. If **M0** scored, **SCB1** for correct un-simplified expression for either $\frac{2541+x}{15}$ or $\frac{2725}{15}$.
		2	

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Question	Answer	Marks	Guidance
7(a)	$\frac{3.6-\mu}{\sigma}=-0.842$ $\frac{5.4-\mu}{\sigma}=-0.524$	**B1**	$0.841 < z_1 < 0.843$ *or* $-0.843 < z_1 < -0.841$ seen.
		B1	$0.523 < z_2 < 0.525$ *or* $-0.525 < z_2 < -0.523$ seen.
		M1	Use of the ± standardisation formula once with μ, σ and either 3.6 or 5.4, equated to a z-value (**not** 0.20, 0.80, 0.70, 0.30, 0.6179, 0.3821, 0.7580, 0.2420, 0.5793, 0.4207, 0.7881, 0.2119, $1-z$-value, 0.476, 0.158 etc). Not $\sigma^2, \sqrt{\sigma}$, allow continuity correction ±0.05.
	Solve, obtaining values for μ and σ	**M1**	Solve 2 equations in μ and σ with an attempt at the elimination method, substitution method or other appropriate approach to obtain values for both μ and σ.
	$\mu = 8.37, \sigma = 5.66$	**A1**	AWRT $\mu = 8.37$ or $8.38, \sigma = 5.66$ or 5.67. Condone $\sigma = 5.675$. There must be consistency with the signs in the solution, e.g. $\sigma = \frac{-1.8}{0.318} = 5.66$ is not acceptable, **A0.** If one or both **M** marks have been withheld, **SCB1** for both correct WWW.
		5	

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GradeMax

Question	Answer	Marks	Guidance
7(b)	[P(4.63 – 0.6 < X < 4.63 + 0.6) =] $\mathrm{P}\left(\frac{4.03-4.63}{0.55} < Z < \frac{5.23-4.63}{0.55}\right)$ *or* $\mathrm{P}\left(\frac{-0.6}{0.55} < Z < \frac{0.6}{0.55}\right)$	**M1**	**Either** use of ± standardisation formula once with 4.63, 0.55 and either 4.03 or 5.23, or use of ± standardisation formula once with 0.55 and either −0.6 or 0.6 as numerator. **No** $\sigma^2, \sqrt{\sigma}$. No continuity correction.
	[P(- 1.091 < Z < 1.091)= $2\Phi(1.091)-1$] $2\times0.8623-1$ or $2\times(0.8623-0.5)$ or $0.3623+0.3623$ or $1-2\times0.1377$ or 0.8623 – 0.1377	**M1**	Calculating the appropriate probability area, must be a probability. May be implied by a sketch. (leading to their final answer. Expect > 0.5).
	0.7246	**A1**	AWRT 0.725. If 1 or more **M** mark not awarded, **SCB1** for AWRT 0.725 WWW.
	[Expected number =] 0.7246 × 600 (= 434.76) so 434	**B1FT**	Strict **FT** *their* 4-figure probability × 600 (check with calculator). **One integer answer** expect 434, 435. No indication of choice or approximation, e.g. ≈, ≅, about, 3SF, approximately,… Allow a 'conclusion after approximation' e.g. 434.76 is about 434, so 434 leaves.
		4	

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