OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics

Advanced Subsidiary GCE

Unit **4732:** Probability and Statistics 1

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations and abbreviations

Annotation in scoris	Meaning
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	

Other abbreviations in mark scheme	Meaning
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Subject-specific Marking Instructions for GCE Mathematics (OCR) Statistics strand

a. Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b. An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct solutions leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an apparently incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c. The following types of marks are available.

M
A suitable method has been selected and applied in a manner which shows that the method is essentially understood. Method marks are not usually 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, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

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). Therefore M0 A1 cannot ever be awarded.

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

E

A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d. When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e. The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise A and B marks are given for correct work only – differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f. Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.

Candidates are expected to give numerical answers to an appropriate degree of accuracy. 3 significant figures may often be the norm for this, but this always needs to be considered in the context of the problem in hand. For example, in quoting probabilities from Normal tables, we generally expect some evidence of interpolation and so quotation to 4 decimal places will often be appropriate. But even this does not always apply – quotations of the standard critical points for significance tests such as 1.96, 1.645, 2.576 (maybe even 2.58 – but not 2.57) will commonly suffice, especially if the calculated value of a test statistic is nowhere near any of these values. Sensible discretion must be exercised in such cases.

Discretion must also be exercised in the case of small variations in the degree of accuracy to which an answer is given. For example, if 3 significant figures are expected (either because of an explicit instruction or because the general context of a problem demands it) but only 2 are given, loss of an accuracy ("A") mark is likely to be appropriate; but if 4 significant figures are given, this should not normally be penalised. Likewise, answers which are slightly deviant from what is expected in a very minor manner (for example a Normal probability given, after an attempt at interpolation, as 0.6418 whereas 0.6417 was expected) should not be penalised. However, answers which are grossly over- or under-specified should normally result in the loss of a mark. This includes cases such as, for example, insistence that the

value of a test statistic is (say) 2.128888446667 merely because that is the value that happened to come off the candidate's calculator. Note that this applies to answers that are given as final stages of calculations; intermediate working should usually be carried out, and quoted, to a greater degree of accuracy to avoid the danger of premature approximation.
The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g. Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

h. Genuine misreading (of numbers or symbols, occasionally even of text) occurs. If this results in the object and/or difficulty of the question being considerably changed, it is likely that all the marks for that question, or section of the question, will be lost. However, misreads are often such that the object and/or difficulty remain substantially unaltered; these cases are considered below.

The simple rule is that all method ("M") marks [and of course all independent ("B") marks] remain accessible but at least some accuracy ("A") marks do not. It is difficult to legislate in an overall sense beyond this global statement because misreads, even when the object and/or difficulty remains unchanged, can vary greatly in their effects. For example, a misread of 1.02 as 10.2 (perhaps as a quoted value of a sample mean) may well be catastrophic; whereas a misread of 1.6748 as 1.6746 may have so slight an effect as to be almost unnoticeable in the candidate's work.

A misread should normally attract some penalty, though this would often be only 1 mark and should rarely if ever be more than 2. Commonly in sections of questions where there is a numerical answer either at the end of the section or to be obtained and commented on (eg the value of a test statistic), this answer will have an "A" mark that may actually be designated as "cao" [correct answer only]. This should be interpreted strictly – if the misread has led to failure to obtain this value, then this "A" mark must be withheld even if all method marks have been earned. It will also often be the case that such a mark is implicitly "cao" even if not explicitly designated as such.

On the other hand, we commonly allow "fresh starts" within a question or part of question. For example, a follow-through of the candidate's value of a test statistic is generally allowed (and often explicitly stated as such within the marking scheme), so that the candidate may exhibit knowledge of how to compare it with a critical value and draw conclusions. Such "fresh starts" are not affected by any earlier misreads.

A misread may be of a symbol rather than a number – for example, an algebraic symbol in a mathematical expression. Such misreads are more likely to bring about a considerable change in the object and/or difficulty of the question; but, if they do not, they should be treated as far as possible in the same way as numerical misreads, mutatis mutandis. This also applied to misreads of text, which are fairly rare but can cause major problems in fair marking.
The situation regarding any particular cases that arise while you are marking for which you feel you need detailed guidance should be discussed with your Team Leader.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

"3 sf" means "answer which rounds to … to 3 sf". Penalise over–rounding if no better answer is seen and penalise only once in the paper.

Question			Answer	Marks	Guidance	
1	(i)		$2k + 4k + 6k + 8k = 1$ $k = \frac{1}{20}$ AND $6 \times \frac{1}{20} = \frac{3}{10}$ **AG**	M1 A1 **[2]**	or $2 + 4 + 6 + 8 = 20$ M1 Must see both for A1 or $2k + 4k + 6k + 8k = 20k$ M1 $P(X = 6) = \frac{6k}{20k} = \frac{3}{10}$ A1	Must see correct wk'g for $k = \frac{1}{20}$, otherwise M0A0 NB $k \times 6 = \frac{3}{10} \Rightarrow k = \frac{1}{20}$ M0A0 (even if tested by showing that $k = \frac{1}{20}$ gives $\Sigma p = 1$) Just showing $\frac{1}{10} + \frac{2}{10} + \frac{3}{10} + \frac{4}{10} = 1$ M0A0
1	(ii)		$2 \times \frac{1}{10} + 4 \times \frac{2}{10} + 6 \times \frac{3}{10} + 8 \times \frac{4}{10}$ oe $= 6$ $2^2 \times \frac{1}{10} + 4^2 \times \frac{2}{10} + 6^2 \times \frac{3}{10} + 8^2 \times \frac{4}{10}$ oe (= 10) $-$ '6'^{2} $= 4$	M1 A1 M1 M1 A1 **[5]**	$\geq$ 3 terms correct ft their values of p, dep $\Sigma p = 1$ cao $\geq$ 3 terms correct; ft their values of p; dep $\Sigma p = 1$ ft their values of p; dep +ve result & $\Sigma p = 1$ cao	Allow i.t.o. k for M1 $\div 4$ M0 Allow ito k for M1M1 $\div 4$ M0 NOT $- m^2 \div 4$ $\sqrt{4} = 2$ lose final A1, not ISW, unless labelled sd
2	(i)		$\frac{3}{4} + \frac{1}{4} \times \frac{3}{8}$ $+ \frac{1}{4} \times \frac{5}{8} \times \frac{3}{16}$ $= \frac{447}{512}$ or 0.873 (3 sf)	M1 M1 A1 **[3]**	$\frac{1}{4} \times \frac{5}{8} \times \frac{13}{16}$ $(= \frac{65}{512}$ or 0.127) $1 - \frac{1}{4} \times \frac{5}{8} \times \frac{13}{16}$	
2	(ii)		$0.6p$ or equiv seen $0.4 + 0.6p = 0.58$ $p = 0.3$	B1 M1 A1 **[3]**	Tree diag alone insufficient for mark. Or $0.6p = 0.18$. "0.18" alone insufficient	NB $0.6 \times 0.3 = 0.18$ seen at the end is probably a check, not an answer. But if 0.3 seen and 0.18 is very clearly indicated as the ans then B1M1A0

Question			Answer	Marks	Guidance	
3	(i)		$S_{xx} = 8700000 - \frac{7000^2}{6}$ (= 533333) $S_{xy} = 509900 - \frac{7000\times456}{6}$ (= –22100) $b = -\frac{"22100"}{"533333"}$ or $-\frac{663}{16000}$ (= –0.0414) $y - \frac{456}{6} =$ "–0.0414"$(x - \frac{7000}{6})$ $y = –0.0414x + 124$ (3 sf)	M1 M1 M1 A1 **[4]**	Correct subst'n in any correct *S* formula Correct subst'n in any correct *b* formula from two correct *S* formulae ft their *b* except if using *r* or $y = -\frac{663}{16000}x + \frac{3979}{32}$ or $y = –0.041x+124$	or $a = \frac{456}{6} -$ ("–0.0414")$\times \frac{7000}{6}$ oe ft "*b*" Allow y=–0.04x+124 if –0.041… seen above
3	(ii)		70 to 72	B1 **[1]**	or 71 per thousand, NOT 71000	No ft from **(i)** Ignore method
3	(iii)		Extrapolation oe Corr'n not high or small sample	B1 B1 **[2]**	Allow "2400 is beyond graph" } "Not shown on the graph" or }1st B1 only "Line drops low, or below 0" } "Outlier" } Poor corr'n oe, or pts not close to line oe 2nd B1	"Line only allows for countries poorer than Nigeria" 1st B1 Allow "Value for Nigeria is –ve 1st B1 NOT "Other factors may apply" oe Ignore all else
3	(iv)		$S_{xx} = 8700000 + 1300^2 - \frac{(7000+1300)^2}{7}$ $S_{yy} = 36262 + 96^2 - \frac{(456+96)^2}{7}$ $S_{xy} = 509900 + 1300\times96 - \frac{8300\times552}{7}$ $r = \frac{"–19814.3"}{\sqrt{"548571"\times"1948.86"}}$ = –0.606 (3 sf)	M1 A1 M1 A1 **[4]**	or $10390000 - \frac{(8300)^2}{7} = \frac{3840000}{7}$ or 548571 or $45478 - \frac{552^2}{7} = \frac{13642}{7}$ or 1948.86 or $634700 - \frac{8300\times552}{7} = -\frac{138700}{7}$ or –19814.3 Correct subst'n in any correct *r* formula from 3 correct subs in 3 correct *S* formulae, ie all correct method	Correct sub in any correct *S* formula M1 Correct value of any *S* seen or implied by *r* A1 SC If n = 6, but otherwise correct allow M1A0M1A0 (ans r = –0.574, must see wking)

Question			Answer	Marks	Guidance	
3	(v)		No effect oe	B1 **[1]**	Stay the same oe Allow just "No"	Ignore all else
4	(i)	(a)	6	B1 **[1]**		
4	(i)	(b)	3×3×3 = 27	M1 A1 **[2]**	3! + 7×3 3 + 3×6 + 6 3! × 4 + 3 Complete correct method. Allow methods equiv to these. Only allow other methods if they appear correct	(Explanation for 3! × 4 + 3: 123: 3!, 112 & 122: 3!, 223 & 233: 3!, 331 & 311: 3! 111, 222, 333: 3 Candidates need not include this)
4	(i)	(c)	**(i)(b)** – 3 If answer is not 24, this method must be explicitly stated in order to give M1A1ft = 24 ft their **(i)(b)**	M1 A1ft **[2]**	or 3! + 6×3 or 3! + 3!×3 or 6 + 3!×3!÷2! or 3! × 4 Complete correct method. Allow methods equiv to these. Only allow other methods if they appear correct	or 8 × 3 (Explanation: there are 8 possible orders starting with 1. Candidates need not include this)
4	(ii)		eg 1123: $\frac{4!}{2!}$ × 3 alone allow M1 for $\frac{4!}{2!}$ × 3! alone eg 1122: $\frac{4!}{2!2!}$ × 3 alone allow M1 for $\frac{4!}{2!2!}$ × 3! alone Total = 54	M2 M2 A1 **[5]**	$3! \times {}^4C_1 \times 3$ or 3! × 12 M1 ÷ 2 M1dep (= 36) $3! \times {}^4C_2$ M1 ÷ 2 M1dep (= 18) Allow methods equiv to these, eg correctly listing cases Only allow other methods if they appear correct. NB 3×3×2×2 = 36 & 3×3×2 × 1 = 18 are incorrect methods unless clear justification given	This method only scores if 3×3×3×3 –…. is used: No. with 4 rep'ns = 3 M1 No. with 3 rep'ns = $\frac{4!}{3!}$ M1 × 6 (= 24) M1 or 8 × 3 M2 81–('3'+'24') or 81–27 M1 (allow 81–3 or 81–24) 18, 36 only score if a correct method seen,, or eg: 18 orders listed starting with "1" or 18 orders listed with two repetitions

Question			Answer	Marks	Guidance	
5			If incorrect p used consistently in all parts of qu 5, no mks in **(i)(a)** & **(b)** but can score M–marks in **(ii)** and **(iii)**.			
5	(i)	(a)	1.25 oe	B1 **[1]**		
5	(i)	(b)	0.8965 – 0.6328 = 0.264 (3 sf)	M1 A1 **[2]**	${}^5C_2(\frac{3}{4})^3(\frac{1}{4})^2$ $= \frac{135}{512}$ or 0.264 (3 sf)	 Answer which rounds to 0.264
5	(ii)		Answer which rounds to 0.244	M1 M1 M1 A1 **[4]**	$((\frac{3}{4})^5)^2$ or $(\frac{243}{1024})^2$ or $(\frac{3}{4})^{10}$ oe $(= \frac{59049}{1048576})$ $(\frac{3}{4})^5 \times 5(\frac{3}{4})^4(\frac{1}{4})$ or $\frac{243}{1024} \times \frac{405}{1024}$ or $5(\frac{3}{4})^9(\frac{1}{4})$ $(= \frac{98415}{1048576})$ 2×(attempt P(1, 0) alone), (NOT 2×(P(1,0) + P(0,0)) If P(sum $\leq$ 2), all three M-mks are available, but for 3rd M1, must be 2×(P(1,0)+P(2,0)) only Ans 0.150 probably M1M1M0A0 but check working Ans 0.188 probably M0M1M1A0 but check working	B(10. 0.25) seen or implied M1 Table or formula with n = 10 used M1 P($X \leq 1$) from table or $(\frac{3}{4})^{10} + 10(\frac{3}{4})^9 \times (\frac{1}{4})$ M1 0.244 (3 sf) A1 P($X \leq 2$) = 0.526 from table n = 10 M1M1M1A0 SC P(X = 2) answer 0.282: B1
5	(iii)		Use of 0.2637 or 0.264 ${}^{10}C_3 \times (1 - \text{'0.2637'})^7 \times \text{'0.2637'}^3$ = 0.258 (3 sf)	M1 M1 A1 **[3]**	or their **(i)(b)** ft **(i)(b)** allow ft their **(ii)** for this M1 only Correct ans, no working: M1M1A1	SC allow ${}^{10}C_3 \times (1 - \text{'0.282'})^7 \times \text{'0.282'}^3$ M0M1 (0.282 comes from P(3 totals = 2))

Question			Answer	Marks	Guidance	
6	(i)		Attempt find total area, (even if includes a^2) eg $20\times1.4a+10\times3.4a+6\times4.6a+4\times2.6a+10\times3a+30a$ or $28a+34a+27.6a+10.4a+30a+30a$ or $20\times1.4+10\times3.4+6\times4.6+4\times2.6+10\times3+30$ or $28+34+27.6+10.4+30+30$ or $7\times20+17\times10+23\times6$ + …… or $160a$ or 160 or 16 or $16a$ (if area, not ht) 800 ÷ their total (must involve area, not ht) eg $160a = 800$, 800÷ $a = 5$ "Box" ⇒ area. "Square" possibly ⇒ area	M1 M1dep A1 **[3]**	eg tot area = $16cm^2$ or $16a$ M1 800/16 (= 50) M1 $a \times 10 = 50$ $a = 5$ A1 eg tot area = 400 (sqs) M1 800/400 (= 2) M1 $1.4a \times 20 = 70 \times 2$ $a = 5$ A1 Correct ans with nothing incorrect seen: M1M1A1 But where the correct answer clearly results from incorrect working, eg $a = 800/167 = 4.8$ rounded to $a = 5$, then max M1M1A0	Trial methods, eg: $a = 5$ gives $7\times20+17\times10+23\times6$ + …. = 800 M1 But no of apples = 800 M1 Hence $a = 5$ A1 $a = 10$ gives $14\times20+34\times10+46\times6$+. = 1600 M1 But no of apples = 800 M1 Hence $a = 5$ A1 NOT "1cm = 5" (because may just come from counting squares) NB total ht = 16cm so if 16 seen, must clearly be area eg 800/16 may score 0 or 2
6	(ii)		$\frac{1}{2}$ total area or $\frac{1}{2}$ total no. apples ft their 6(i) Median is in 50 – 56 class stated or implied Calculate (approx) $\frac{2}{3}$ of way along class or $\frac{1}{3}$ of way from top of class Median = 53.9 to 54 Not eg 54.2	B1f M1 M1 A1 **[4]**	Correct ans with nothing incorrect seen: M1M1A1 But where the correct answer clearly results from incorrect working, eg $a = 800/167 = 4.8$ rounded to $a = 5$, then max M1M1A0	Examples of correct methods: $400 - (7\times20+17\times10)$ (= 90) $50 + \frac{"90"}{23\times6} \times 6 = 54$ $200 - (70+85)$ (= 45) $50 + \frac{"45"}{69} \times 6 = 54$ $400.5 - (7\times20+17\times10)$ (= 90.5) $50 + \frac{"90.5"}{23\times6} \times 6 = 54$ Use of LB = 49.5: eg median = 49.5 +appr $\frac{2}{3} \times 6 = 53.4$ B1M1A1A0

Question			Answer	Marks	Guidance	
7	(i)		$\Sigma d^2 = n$ seen or implied $1 - \frac{6\times\text{anything}}{n(n^2-1)} = \frac{63}{65}$ or $\frac{6\times\text{anything}}{n(n^2-1)} = \frac{2}{65}$ $\frac{6}{(n^2-1)} = \frac{2}{65}$ or eg $390 = 2(n^2 - 1)$ $n = 14$ NOT $n = \pm 14$	M1 M1 A1 depM2 A1 **[4]**	eg $1-\frac{6\times\Sigma d^2}{n(n^2-1)}$ or $1-\frac{6\times n^2}{n(n^2-1)}$ or $1-\frac{6\times 1^n}{n(n^2-1)}$ or $1-\frac{6\times 6^2}{n(n^2-1)} = \frac{63}{65}$ Any correct eqn after cancelling n or take out factor of n; can be implied by $n = 14$ But A0 if $n = 14$ clearly follows from incorrect working If no working or unclear working, but n = 14, M1M1A1A1	Trial method: $\Sigma d^2 = 14$ M1 $1 - \frac{6\times 14}{14(14^2-1)}$ oe M1 $= \frac{63}{65}$ A1 (0.969 : A0) $\Rightarrow n = 14$ A1 Conclusion needed
7	(ii)	(a)	$r = 1 \Rightarrow$ st line, hence true (or $r_s = 1$) oe Explanation essential Must state or imply "true"	B1 **[1]**	$r = 1 \Rightarrow y$ incr as x incr, so $r_s = 1$ oe Allow "True because perfect corr'n" or "True because $r = 1$ means pts ranked in order so $r_s = 1$" "$r = 1$ means the ranks will agree" "$r = 1$ means all d's are 0, hence $r_s = 1–0 = 1$"	NOT "r incr so ranks incr" NOT "$r_s = r$ for ranks so true" NOT "True because strong corr'n"
7	(ii)	(b)	Diag, $\geq$ 3 pts, not on st line but with $x_{n+1}>x_n$ & $y_{n+1}>y_n$, Zig zag line or curve, moving up & right so r_s can still be 1 eg "expon'l curve gives $r \neq 1$ but $r_s = 1$" B1B1	B1 B1dep **[2]**	Ignore explan if correct diag given Ignore any st line drawn Allow numerical example for which $r \neq 1$ but $r_s = 1$. If expl'n contradicts diag, mark diag For 2nd B1 must state or imply "false"	

Question			Answer	Marks	Guidance	
8	(i)	(a)	$0.9^4 \times 0.1$ $= \frac{6561}{100000}$ or 0.0656 (3sf)	M1 A1 **[2]**		
8	(i)	(b)	0.9^5 $= \frac{59049}{100000}$ or 0.59 (2 sf)	M1 A1 **[2]**	Allow 0.9^4 or $1–0.9^5$:M1 but $1–0.9^n$ ($n \neq 5$) or 0.1×0.9^n :M0	$1 – (0.1+0.9\times0.1+0.9^2\times0.1 + \ldots 0.9^4\times0.1)$ Allow without "1 –" OR omit last term NB $0.9^5\times0.1 = 0.0590$ M0A0
8	(i)	(c)	0.1×0.1 or $[0.1\times0.1\times0.9 + 0.1\times0.1\times0.1]$ oe $+ 0.1\times0.9\times0.1$ oe $+ 0.9\times0.1\times0.1$ oe $= 0.028$	M1 M1 M1 A1 **[4]**	M1M1 two correct terms, no incorrect multiples M1 all correct Ans 0.027 probably M0M1M1A0 but check working SC if no M-mks scored: SSF, SSS, FSS, SFS or SS, FSS, SFS seen or implied: B1	$3\times0.1^2\times0.9+0.1^3$ no incorrect multiples M2 for 1st term; M1 for 2nd This method only scores using "1 – ": 0.9^3; $3\times0.9^2\times0.1$ no incorrect multiples M1; M1 1 – one or both terms with no further wking: M1(dep M1) eg $1 – 0.9^3$ alone M1M0M1
8	(ii)	(a)	$0.9\times 0.8 \times 0.1$ $= \frac{9}{125}$ or 0.072	M1 A1 **[2]**	alone or allow × 0.8 (ie girls in wrong order) (= 0.0576)	NOT $0.9\times0.8\times0.1\times0.2= 0.0144$: M0A0 NOT $0.9\times0.8\times0.2= 0.144$: M0A0
8	(ii)	(b)	$0.9^{9 \text{ or } 10} \times 0.8^{9 \text{ or } 10} \times 0.1$ (or ×0.2, not ×0.1×0.2) $(0.9 \times 0.8)^9 \times 0.1$ oe $= 5.2\times10^{-3}$ or 0.0052 (2 sf)	M1 M1 A1 **[3]**	allow $0.9^{9 \text{ or } 10} \times 0.8^{9 \text{ or } 10} \times 0.1 \times {}^{18,19,20}C_1$ fully correct SC Consistent use of 0.8 for both girls: **(ii)(a)** 0.128 **(ii)(b)** 0.00360 or 0.9 for both girls: **(ii)(a)** 0.081 **(ii)(b)** 0.0150 If both these ans seen, allow (a) 0 (b) B1	If ans = 0.00360 or 0.0150 see SC below

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OCR is an exempt Charity

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