

Non-Replacement Problems

Mark Scheme 2

Level	IGCSE
Subject	Maths
Exam Board	Edexcel
Topic	Handling Data Statistics
Sub Topic	Non-Replacement Problems(Probability)
Booklet	Mark Scheme 2

Time Allowed: 64 minutes

Score: /53

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

Question	Working	Answer	Mark	Notes
1. (a)	$\frac{4}{10} + \frac{2}{10}$ or $4 + 2$ or 6		2	M1
		$\frac{6}{10}$ or $\frac{3}{5}$		A1
(b)	eg $\frac{4}{10} \times 200$		2	M1
		80		A1 cao
(c)(i)	$\frac{3}{10} \times \frac{2}{9}$		5	M1
		$\frac{6}{90}$ oe		A1 $\frac{6}{90}$ oe inc $\frac{1}{15}$ SC M1 for $\frac{3}{10} \times \frac{3}{10}$
(ii)	$\frac{3}{10} \times \frac{2}{9} + \frac{4}{10} \times \frac{3}{9} + \frac{2}{10} \times \frac{3}{9}$			M1 for one correct product M1 for sum of all 3 correct products
		$\frac{24}{90}$ oe		A1 for $\frac{24}{90}$ oe inc $\frac{4}{15}$
				SC: M1 for $\frac{3}{10} \times \frac{2}{10}$ or $\frac{4}{10} \times \frac{4}{10}$ or $\frac{2}{10} \times \frac{3}{10}$ M1 for $\frac{3}{10} \times \frac{2}{10} + \frac{4}{10} \times \frac{4}{10} + \frac{2}{10} \times \frac{3}{10}$
				Total 9 marks

Question	Working	Answer	Mark	Notes
2. (a)	$\frac{4}{9} \times \frac{3}{8} (= \frac{12}{72})$	$\frac{12}{72}$ or $\frac{1}{6}$ oe	2	M1 A1 accept 0.167 or better
(b)	$\frac{2}{9} \times \frac{3}{8} (= \frac{6}{72})$ oe or $\frac{3}{9} \times \frac{2}{8} (= \frac{6}{72})$ oe or $\frac{4}{9} \times \frac{2}{8} (= \frac{8}{72})$ oe or $\frac{2}{9} \times \frac{4}{8} (= \frac{8}{72})$ oe $\frac{2}{9} \times \frac{3}{8} + \frac{3}{9} \times \frac{2}{8} + \frac{4}{9} \times \frac{2}{8} + \frac{2}{9} \times \frac{4}{8} (= \frac{28}{72})$ oe	$\frac{7}{18}$ oe	3	M1 1 correct branch M1 4 correct branches with intention to add A1 accept 0.389 or better.
	Alternative to (b) : with replacement $\frac{2}{9} \times \frac{3}{9} (= \frac{6}{81})$ oe or $\frac{3}{9} \times \frac{2}{9} (= \frac{6}{81})$ oe or $\frac{4}{9} \times \frac{2}{9} (= \frac{8}{81})$ oe or $\frac{2}{9} \times \frac{4}{9} (= \frac{8}{81})$ oe $\frac{2}{9} \times \frac{3}{9} + \frac{3}{9} \times \frac{2}{9} + \frac{4}{9} \times \frac{2}{9} + \frac{2}{9} \times \frac{4}{9} (= \frac{28}{81})$ oe)			NB: Use of this method can score all available M marks, but cannot score the Accuracy (A) mark. M1 M1
				Total 5 marks

Question	Working	Answer	Mark	Notes
3. (a)	$\frac{26}{40} \times \frac{25}{39}$		2	M1
	$\frac{650}{1560} = \frac{65}{156} = 0.41\dot{6}$	$\frac{5}{12}$		A1 Allow answer as decimal (0.4166..) or percentage (41.66..) rounded or truncated to 3 or more sig figs; only accept 0.42 (42%) if preceded by more accurate answer or M1 awarded.
(b)	$\frac{4}{40} \times \frac{13}{39} + \frac{3}{40} \times \frac{4}{39} + \frac{7}{40} \times \frac{4}{39}$ or $\frac{4}{40} \times \frac{13}{39} + \frac{10}{40} \times \frac{4}{39}$ or $2 \times \frac{4}{40} \times \frac{10}{39} + \frac{4}{40} \times \frac{3}{39}$ or $\frac{4}{40} \times \frac{7}{39} + \frac{4}{40} \times \frac{3}{39} + \frac{4}{40} \times \frac{3}{39} + \frac{3}{40} \times \frac{4}{39} + \frac{7}{40} \times \frac{4}{39}$		3	M2 Award M1 for any one correct product (shown or worked out). SC Award M2 for $\frac{4}{40} \times \frac{14}{40} + \frac{3}{40} \times \frac{4}{40} + \frac{7}{40} \times \frac{4}{50}$ or $\frac{4}{40} \times \frac{14}{40} + \frac{10}{40} \times \frac{4}{40}$ or $\frac{4}{40} \times \frac{7}{40} + \frac{4}{40} \times \frac{3}{40} + \frac{4}{40} \times \frac{4}{50}$ + $\frac{3}{40} \times \frac{4}{40} + \frac{7}{40} \times \frac{4}{50}$ or $\frac{96}{1600}$ or $\frac{6}{100}$ or 0.06 M1 for one product
	$\frac{92}{1560} = \frac{46}{780} = 0.05897\dots$	$\frac{23}{390}$		A1 Allow answer as decimal (0.05897..) or percentage (5.897..) rounded or truncated to 3 or more sig figs; only accept 0.059 (5.9%) if preceded by more accurate answer or M2 awarded.
Total 5 marks				

Question	Working	Answer	Mark	Notes
4. (a)	$\frac{4}{9} \times \frac{3}{8}$		2	M1
		$\frac{1}{6}$		A1 oe, eg $\frac{12}{72}$ Allow 0.16(666...) rounded or truncated to at least 2dp
(b)	$\frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{5}{8}$ or $\frac{20}{72} + \frac{20}{72}$ oe or $1 - \frac{4}{9} \times \frac{3}{8} - \frac{5}{9} \times \frac{4}{8}$ or $1 - \frac{1}{6} - \frac{5}{9} \times \frac{4}{8}$ oe		3	M2 M1 for $\frac{4}{9} \times \frac{5}{8}$ or $\frac{5}{9} \times \frac{4}{8}$ or $\frac{20}{72}$ oe Accept fractions evaluated $\frac{20}{72} = 0.27\dot{7}$, $\frac{12}{72} = 0.16\dot{6}$ rounded or truncated to at least 2dp.
		$\frac{5}{9}$		A1 oe, eg $\frac{40}{72}$ or $\frac{20}{36}$ Allow 0.55(5555...) rounded or truncated to at least 2dp
	Alternative: with replacement $\frac{5}{9} \times \frac{4}{9} + \frac{4}{9} \times \frac{5}{9}$ or $\frac{40}{81}$ oe			M2 M1 for $\frac{5}{9} \times \frac{4}{9}$ or $\frac{4}{9} \times \frac{5}{9}$ or $\frac{20}{81}$ oe Accept fractions evaluated $\frac{20}{81} = 0.24(691358...)$ $\frac{40}{81} = 0.49(382716...)$ rounded or truncated to at least 2dp
				Total 5 marks

Question	Working	Answer	Mark	Notes
5. (a)	$\frac{2}{7} \times \frac{1}{6}$ or $\frac{3}{7} \times \frac{2}{6}$ $\frac{2}{7} \times \frac{1}{6} + \frac{3}{7} \times \frac{2}{6}$	8 42	3	M1 Replacement - $\frac{2}{7} \times \frac{2}{7}$ or $\frac{3}{7} \times \frac{3}{7}$ M1 Replacement - $\frac{2}{7} \times \frac{2}{7} + \frac{3}{7} \times \frac{3}{7}$ A1 8 oe 42
(b)	$\frac{2}{7} \times \frac{3}{6}$ or $\frac{3}{7} \times \frac{2}{6}$ or $\frac{1}{7} \times \frac{1}{6}$ $\frac{2}{7} \times \frac{3}{6} + \frac{3}{7} \times \frac{2}{6} + \frac{1}{7} \times \frac{1}{6} + \frac{1}{7} \times \frac{1}{6}$	14 42	3	M1 Replacement – $\frac{2}{7} \times \frac{3}{7}$ or $\frac{3}{7} \times \frac{2}{7}$ or $\frac{1}{7} \times \frac{1}{7}$ M1 Replacement - $\frac{2}{7} \times \frac{3}{7} + \frac{3}{7} \times \frac{2}{7} + \frac{1}{7} \times \frac{1}{7} + \frac{1}{7} \times \frac{1}{7}$ A1 14 oe 42
				Total 6 marks

<p>6. (a)</p>	<p>Probabilities on branches correct.</p>	$\frac{6}{10}, \frac{4}{10}, \frac{5}{9}, \frac{4}{9}, \frac{6}{9}, \frac{3}{9}$	<p>3</p>	<p>B1 for $\frac{6}{10}, \frac{4}{10}$ oe on LH branches</p> <p>B1 for $\frac{5}{9}, \frac{4}{9}$ oe on top RH branches</p> <p>B1 for $\frac{6}{9}, \frac{3}{9}$ oe on bottom RH branches</p> <p>Decimals given on the 2nd set of branches to be to at least 2dp (truncated or rounded).</p>
<p>(b)</p>	<p>$\frac{6}{10} \times \frac{4}{9}$ or $\frac{4}{10} \times \frac{6}{9}$ or ft from their tree diagram</p> <p>$\frac{6}{10} \times \frac{4}{9} + \frac{4}{10} \times \frac{6}{9}$ or ft from their tree diagram</p>	$\frac{48}{90}$ oe	<p>3</p>	<p>M1 or $\frac{6}{10} \times \frac{5}{9} + \frac{4}{10} \times \frac{3}{9} \left(= \frac{42}{90} \right)$</p> <p>M1dep or 1 - "$\frac{42}{90}$"</p> <p>A1 Allow 0.53(33...)</p> <p>Note: If all 4 probability products are seen at the ends of the branches on the tree diagram or in lists in the working space for (b), marks can only be awarded in (b) if it is clear which product(s) they are intending to use.</p>
				<p>Total 6 marks</p>

<p>7.</p> <p>eg. $\frac{3}{9} \times \frac{2}{8} \times \frac{1}{7} \left(= \frac{6}{504} = \frac{1}{84} \right)$</p> <p>eg. $\frac{2}{9} \times \frac{3}{8} \times \frac{4}{7} \left(= \frac{24}{504} = \frac{1}{21} \right)$</p>		5	<p>M1 (probabilities from selecting 2, 2, 2) allow $\frac{3}{9} \times \frac{2}{9} \times \frac{1}{9} \left(= \frac{6}{729} \right)$ or $\frac{3}{9} \times \frac{3}{9} \times \frac{3}{9} \left(= \frac{27}{729} \right)$</p> <p>M1 (probabilities from selecting 1, 2, 3) allow $\frac{2}{9} \times \frac{3}{9} \times \frac{4}{9} \left(= \frac{24}{729} \right)$</p>
<p>$6 \times \frac{24}{504} \left(= \frac{144}{504} = \frac{6}{21} = \frac{2}{7} \right)$</p>			<p>M1 (probabilities for all combinations of 1, 2, 3) allow $6 \times \frac{24}{729} \left(= \frac{144}{729} \right)$</p>
<p>$6 \times \frac{2}{9} \times \frac{3}{8} \times \frac{4}{7} + \frac{3}{9} \times \frac{2}{8} \times \frac{1}{7} \left(= \frac{6}{21} + \frac{1}{84} \right)$</p>			<p>M1 complete correct method</p>
	<p>150 504</p>		<p>A1 oe eg. $\frac{25}{84}$, 0.298, 0.297619...</p> <p>(NB. An answer of $\frac{150}{729} \left(= \frac{50}{243} \right)$ or $\frac{171}{729} \left(= \frac{19}{81} \right)$ scores M1M1M1M0A0)</p>
Total 5 marks			

8. (a)		$\frac{6}{20}, \frac{4}{20}$ $\frac{9}{19}, \frac{6}{19}, \frac{4}{19}, \frac{10}{19}, \frac{5}{19}, \frac{4}{19}, \frac{10}{19}, \frac{6}{19}, \frac{3}{19}$	2	<p>B1 For $\frac{6}{20}, \frac{4}{20}$ correct on LH branches</p> <p>B1 For all other branches correct</p>
(b)	$\frac{4}{20} \times \frac{3}{19}$	$\frac{12}{380} \text{ oe}$	2	<p>M1ft From their Tree diagram</p> <p>A1ft From their Tree diagram oe. Eg $\frac{3}{95}$ Accept 0.031(57...) rounded or truncated to at least 3 decimal places.</p>
(c)	$\frac{6}{20} \times \frac{5}{19} \text{ or } 0.078(947 \dots) \text{ or } \frac{6}{20} \times \frac{4}{19} \text{ or } 0.063(157 \dots) \text{ or } \frac{4}{20} \times \frac{3}{19} \text{ or } 0.031(578\dots)$ $\frac{6}{20} \times \frac{5}{19} + \frac{6}{20} \times \frac{4}{19} + \frac{4}{20} \times \frac{6}{19} + \frac{4}{20} \times \frac{3}{19}$	$\frac{90}{380} \text{ oe}$	3	<p>M1ft For one correct product from their Tree diagram</p> <p>M1ft For sum of all correct products from their Tree diagram</p> <p>A1 For $\frac{9}{38}$ oe or 0.236(842...) NB: Accept use of decimals if rounded or truncated to at least 3 decimal places.</p>

	<p style="text-align: center;">With Replacement</p> $\frac{6}{20} \times \frac{6}{20} \text{ or } 0.09 \text{ or } \frac{6}{20} \times \frac{4}{20} \text{ or } 0.06 \text{ or } \frac{4}{20} \times \frac{4}{20} \text{ or } 0.04$ $\frac{6}{20} \times \frac{6}{20} + \frac{6}{20} \times \frac{4}{20} + \frac{4}{20} \times \frac{6}{20} + \frac{4}{20} \times \frac{4}{20} \text{ or } \frac{100}{400} \text{ or } 0.25 \text{ oe}$			M1
	<p style="text-align: center;">Alternative method</p> <p>Eg 1 – $\left(\frac{10}{20} \times \frac{9}{19} + \frac{10}{20} \times \frac{6}{19} + \frac{10}{20} \times \frac{4}{19} + \frac{6}{20} \times \frac{10}{19} + \frac{4}{20} \times \frac{10}{19}\right)$ or $\frac{10}{20} \times \frac{9}{19} \text{ oe}$</p>			M2 For a complete method. Ft from their Tree diagram
				A1 For $\frac{9}{38}$ oe or 0.236(842...) NB: Accept use of decimals if rounded or truncated to at least 3 decimal places.
			3	
				Total 7 marks

9.	a	$\frac{7}{10} \times \frac{5}{8} + \frac{3}{10} \times \frac{3}{8}$	$\frac{44}{80}$	3	M1 for one correct product
					M1 for both correct products (and no others) added
	b	$\frac{12}{18} \times \frac{11}{17}$	$\frac{132}{306}$	2	M1 Correct product
					A1oe Accept 0.43(137...) rounded or truncated to at least 2SF
					Total 5 marks