JustMaths

Countdown to your final Maths exam ... part 6 (2019)

"Working Above"
Markscheme & Examiners Report

Q1. Sometimes probability questions of this kind require the candidates to deduce that it is a case of non-replacement. In this question it was clearly stated that the counter taken first was kept before taking the second. But still many candidates ignored this detail and therefore both their tree diagrams and subsequent solutions were flawed. IN part (a) the probability tree diagram was incomplete, but nearly all candidates presented the remaining branches correctly to support their probabilities; only a small number failed to include any labels on their branches.
Part (b) was answered well; the only error in some was adding their probabilities rather than multiplying them. Those who made this error in part (b) did so also in part (c), but there the main error was in finding the probability for two counters with one letter A, rather than the probability for at least one counter with the letter A.

Q2. Once a scale factor had been established, many candidates used it for all of their calculations and so $BC = 7.5$ cm (5×1.5) with $EC = 8.7$ cm was a common error. Some gave $BC = 10$ cm (5×2). Some candidates found the perimeter of triangle ABC instead of the trapezium; some credit was given if a correct scale factor had been used. Some candidates assuming an isosceles triangle, gave EC as 4.2 A significant number of candidates used cosine and sine rules to work out angles DAE, ADE and AED, usually leading to none or at most one mark.

Q3. This was another question designed to assess the most able students. It did allow more students to score marks, often just by recognising that the second set of probabilities were conditional and writing down correctly. However, some students misinterpreted this and gave probabilities with denominators of 28. More successful students were able to pick up another mark by writing down one correct expression for a compound probability. Students who took the trouble to draw a tree diagram were generally more successful as they had the structure set out which made it more likely they would pick out all 6 possible expressions and then add them. Few students considered the complementary event approach; they were generally successful. Solving the corresponding problem with replacement could yield a maximum of two marks and there were a few students who did do this.

Q4. It should be clear from the context of the question that it is impossible to pick two people simultaneously, and that this is therefore a case of non-replacement. Too many candidates failed to spot this and assumed that denominators and numerators of fractions never changed. Some worked with just one combination rather than the two possible. Some felt the need to convert their fractions into decimals; in these cases premature rounding was common, leading to inaccuracy in final answers.

Q5. No Examiner's Report available for this question

Q6.Part (a) was poorly answered, the majority giving 80 × 2 = 160. One reason might have been that candidates did not associate paint with area. Greater success was found with part (b). Many used a scale factor 8 correctly to find the answer. Many also chose a circuitous route of working with volumes of cones to find the answer; a minority trying this route used prematurely rounded figures and therefore failed to reach an accurate final answer.

Q7. In part (a), most candidates gained at least one mark giving at least 4 of the correct integers. There were some errors interpreting the difference between the inequality symbols with confusion as to whether -2 and 3 should be included. Some candidates appeared to have misunderstood the question and gave a final answer of 5 to indicate how many integers met the inequality.

Candidate's answers for part (b) included both formal algebraic solutions and trial and improvement methods. Trial and improvement often yielded the correct integer answer from straightforward inspection whereas, many candidates who reached $^{11}/_{3}$ did not go on to give 4 as their final answer and so lost the final mark.

Q8. This was not well done. Students appeared confused by the context, and many chose not to attempt the question. There were some attempts at sample spaces, and lists of amounts where students were trying to make combinations leading to 40p, but frequently without stating probabilities. Some gained credit for deriving correct probabilities which they might have then gone on to use. Where probabilities were incorrect, some method marks were awarded if the work was clearly stated.

Q9. A high percentage of students completed this question on similar rectangles successfully They usually used a scale factor approach.

Q10.Few students were able to score full marks in this question but many scored 1 or 2 marks for writing down and adding at least two correct probabilities. Whereas a significant number of students recognised the need to combine the cards to obtain different totals for odd *T*, relatively few could relate these combinations to the actual process of selecting the cards at random. Most students considered specific odd and/or even totals for *T*, as shown by methods 1 and 2 in the mark scheme, rather than by considering odd and even numbers with odd/ even totals, as shown by methods 3 and 4 in the mark scheme.

Q11.Very few attempts were made at this question. Sometimes one mark was awarded for identifying two pairs of equal sides. There were attempts to calculate angles *DAG* and *EAB* but these often incurred incorrect calculations and failed to reach the conclusion that they were equal. There was much evidence of misconceptions and misjudgement such as stating that two of the triangles were isosceles or incorrectly pairing sides.

Q12. No Examiner's Report available for this question

Q13. A significant number of students did not attempt this question. Of those that gained marks the majority were for stating that the two triangles both contained the same angle or for recognising that the opposite angles of a cyclic quadrilateral add up to 180. The difficulty for students was the recognition of an angle in the quadrilateral being the same as an angle on the straight line and how this linked with proving similarity. As with question 6, students were unaware that knowledge of three letter rule to denote angles makes life so much easier when it comes to describing what is going on. Some thought CB and CD were tangents and therefore of equal length.

Q14. No Examiner's Report available for this question

Mark Scheme

Q1.

5MB1H/01 June 2015				
Question	**Working**	**Answer**	**Mark**	**Notes**
(a)		Probability tree	3	B1 for $\frac{2}{8}$ in the correct place B1 for $\frac{5}{7},\frac{2}{7};\frac{6}{7},\frac{1}{7}$ in the correct place on a probability tree B1 complete probability tree with labelling eg A, B etc.
(b)		$\frac{30}{56}$	2	M1 $\frac{6}{8}\times\frac{5}{7}$ A1 oe eg 0.5357.... or $\frac{15}{28}$
(c)		$\frac{54}{56}$	3	M1 for $\frac{6}{8}\times\frac{5}{7}$ or $\frac{6}{8}\times\frac{2}{7}$ or $\frac{2}{8}\times\frac{6}{7}$ oe eg 0.5357... or 0.214... M1 for $\frac{6}{8}\times\frac{5}{7}+\frac{6}{8}\times\frac{2}{7}+\frac{2}{8}\times\frac{6}{7}$ or $1-\left(\frac{2}{8}\times\frac{1}{7}\right)$ A1 oe eg 0.964.... or $\frac{27}{28}$

Q2.

PAPER: 5MB3H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
		32.2	4	M1 for $BC=\frac{10}{4}\times 5$ (= 12.5) M1 for $EC=\frac{10}{4}\times 5.8-5.8$ (=8.7) M1(dep on at least M1) for '12.5' + '8.7' + 5 + 6 A1 cao OR M1 for $BC=\frac{5}{4}\times 10$ (= 12.5) M1 for $EC=\frac{5.8}{5}\times$ '12.5' − 5.8 (= 8.7) M1 (dep on at least M1) for '12.5' + '8.7' + 5 + 6 A1 cao OR M1 for $BC=\frac{5}{4}\times 10$ (= 12.5) M1 for $EC=\frac{6}{4}\times 5.8$ (= 8.7) M1 (dep on at least M1) for '12.5' + '8.7' + 5 + 6 A1 cao OR M1 for 4 + 5 + 5.8 (= 14.8) M1 for $\frac{10}{4}\times$ '14.8' (= 37) M1 (dep on at least M1) for '37' − 4 − 5.8 + 5 A1 cao

Q3.

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

Q4.

5MB1H_01				
Question	Working	Answer	Mark	Notes
		$\frac{83}{171}$	4	M1 for use of 18 as denominator of second probability M1 for $\frac{11}{19}\times\frac{10}{18}$ or $\frac{8}{19}\times\frac{7}{18}$ M1 for $\frac{11}{19}\times\frac{10}{18}+\frac{8}{19}\times\frac{7}{18}$ A1 for $\frac{83}{171}$ oe Special cases (with replacement) M1 for $\frac{11}{19}\times\frac{10}{19}$ or $\frac{8}{19}\times\frac{7}{19}$ M1 for $\frac{11}{19}\times\frac{10}{19}+\frac{8}{19}\times\frac{7}{19}$ OR M1 for $\frac{11}{19}\times\frac{11}{18}$ or $\frac{8}{19}\times\frac{8}{18}$ M1 for $\frac{11}{19}\times\frac{11}{18}+\frac{8}{19}\times\frac{8}{18}$ OR B2 for $\frac{185}{361}$ oe

Q5.

Question	Working	Answer	Mark	Notes
		7.47	P1	for process to find volume scale factor, e.g. $1:\frac{500}{150}$, $\left(\frac{500}{150}\right)^{\frac{1}{3}}\times 5$
			A1	7.46 – 7.47

Q6.

Question		Working	Answer	Mark	Notes
	(a)	$1:2^2$ or $2^2:1$ $80 \times 2^2 = 80 \times 4 =$	320	2	M1 for sight of $1:2^2$ or $2^2:1$ or 2^2 or ¼ for ratio of area or 80×4 or identification of 4 as the scale factor A1 cao
	(b)	$1:2^3$ or $2^3:1$ 171700×2^3 $= 171700 \times 8 =$ OR $h_a = \frac{171700 \times 3}{\pi \times 40^2}$ $=102.47589$ $h_b = h_a \times 2 = 204.95..$ $vol_b = \frac{1}{3}\pi \times 80^2 \times 204.95..$	1 373 600	3	M1 for sight of $1:2^3$ or $2^3:1$ or 2^3 or ⅛ for ratio of volumes or identification of 8 as the scale factor M1 for $2^3 \times 171700$ A1 cao OR M1 for complete calculation to find the height of A (=102.47589..) M1 (dep) for $h_a \times 2$ and used to find vol_b A1 cao

Q7.

Question		Working	Answer	Mark	Notes
		SF = $(x^2 - 1) \div 2(x - 1)$ $= (x - 1) \times (x + 1) \div 2(x - 1)$ $= ½(x + 1)$ Area *DEF* = $4 \times \left[\frac{1}{2}(x+1)\right]^2$ $= (x + 1)^2$ $= x^2 + 2x + 1$		4	M1 $(x^2 - 1) \div 2(x - 1)$ or SF $\times 2(x - 1) = (x^2 - 1)$ M1 $½(x + 1)$ or $(x - 1) \times (x + 1) \div 2(x - 1)$ M1 $4 \times \left(\frac{x+1}{2}\right)^2$ or $4 \times \left(\frac{x^2-1}{4(x-1)}\right)^2$ C1 fully correct convincing process OR M1 $(x^2 + 2x + 1) \div 4$ M1 $\sqrt{(x^2 + 2x + 1) \div 4}$ or $\sqrt{(x+1)(x+1) \div 4}$ or $(x + 1) \div 2$ M1 $2(x - 1) \times (x + 1) \div 2$ C1 fully correct convincing process

Q8.

Paper_5MB1H_01				
Question	**Working**	**Answer**	**Mark**	**Notes**
	(50,10) (10,50) (20,20) (20,50) (50,20)	$\frac{12}{30}$	4	M1 for method to identify all correct pairs eg sample space or tree diagram (may be implied by correct products) M1 for all correct products $\frac{1}{6}\times\frac{3}{5}, \frac{3}{6}\times\frac{1}{5}, \frac{2}{6}\times\frac{1}{5}, \frac{1}{6}\times\frac{2}{5}, \frac{2}{6}\times\frac{1}{5}$ M1 for finding sum of correct products $\frac{1}{6}\times\frac{3}{5}+\frac{3}{6}\times\frac{1}{5}+\frac{2}{6}\times\frac{1}{5}+\frac{1}{6}\times\frac{2}{5}+\frac{2}{6}\times\frac{1}{5}$ A1 for $\frac{12}{30}$ oe OR M1 for method to identify all correct pairs < 40p eg sample space or tree diagram (may be implied by correct products) M1 for all correct products $\frac{3}{6}\times\frac{2}{5}, \frac{3}{6}\times\frac{2}{5}, \frac{2}{6}\times\frac{3}{5}$ M1 for completing working $1-(\frac{3}{6}\times\frac{2}{5}+\frac{3}{6}\times\frac{2}{5}+\frac{2}{6}\times\frac{3}{5})$ A1 for $\frac{12}{30}$ oe

Q9.

PAPER: 5MB3H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
			21	2	M1 for $120 \div 30$ (= 4) or $30 \div 120$ (= 0.25) or w/30 = 84/120 oe A1 cao

Q10.

PAPER: 1MA0_1H					
Question		**Working**	**Answer**	**Mark**	**Notes**
			$\frac{156}{336}$	4	**Method 1 (Combinations for odd T)** M1 for one probability for odd T, eg $P(2,3,4)=\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or $P(2,4,5)=\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}$ or $P(3,3,5)=\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}$ or $P(3,5,5)=\frac{2}{8}\times\frac{4}{7}\times\frac{3}{6}$ or $P(5,5,5)=\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}$ M1 for adding at least two probabilities for odd T, eg $\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}+\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}$ or $3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)$ M1 for completely correct method, ie $6\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)+6\left(\frac{1}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{2}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+\left(\frac{4}{8}\times\frac{3}{7}\times\frac{2}{6}\right)$ oe A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **OR** **Method 2 (Combinations for even T)** M1 for one probability for even T, eg $P(3,4,5)=\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}$ or $P(2,3,3)=\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or $P(2,5,5)=\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}$ or $P(2,3,5)=\frac{1}{8}\times\frac{2}{7}\times\frac{4}{6}$ or $P(4,5,5)=\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}$ or $P(3,3,4)=\frac{2}{8}\times\frac{1}{7}\times\frac{1}{6}$ M1 for adding at least two probabilities for even T, eg $\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}+\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}$ or $3\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)$ M1 for completely correct method, ie $1-[6\left(\frac{2}{8}\times\frac{1}{7}\times\frac{4}{6}\right)+3\left(\frac{1}{8}\times\frac{2}{7}\times\frac{1}{6}\right)+3\left(\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+6\left(\frac{1}{8}\times\frac{2}{7}\times\frac{4}{6}\right)+3\left(\frac{1}{8}\times\frac{4}{7}\times\frac{3}{6}\right)+3\left(\frac{2}{8}\times\frac{1}{7}\times\frac{1}{6}\right)$ oe A1 for $\frac{156}{336}$ oe, eg $\frac{13}{28}$ or 0.46(4…) **PTO**

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

Q11.

		Working	Answer	Mark	Notes
			proof	3	B1 for *AD* = *AB* and *AE* = *AG* B1 for angle *EAB* = angle *DAG* (= 90 + angle *DAE*) B1 (dep on previous B marks) for 2 sides and included angle (SAS) oe

Q12.

Question	Working	Answer	Mark	Notes
		$\frac{8}{56}$	P1	for process to start e.g. $\frac{1}{8}\times\frac{2}{7}$ or $\frac{2}{8}\times\frac{3}{7}$
			P1	for complete process e.g. $\frac{1}{8}\times\frac{2}{7}+\frac{2}{8}\times\frac{3}{7}$
			A1	$\frac{8}{56}$ oe

Q13.

Question		Working	Answer	Mark	Notes
*			Similarity and proof	5	B1 for method matching a pair of opposite angles, e.g. if $EAB = x$, $BDE = 180-x$, $EAB + BDE = 180$ B1 for linking angles between quad and triangle, e.g. if $BDE = 180-x$ then $BDC = x$ B1 for stating or implying $ACE = BCD$ (same angle) C1 for Opposite angles of a cyclic quadrilateral add up to 180° or statement linking three angles for similarity C1 for complete proof

Q14.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
		$\frac{10x-x^2}{45}$	P1 for $\frac{x}{10}$ or $\frac{10-x}{10}$ or $\frac{x-1}{9}$ or $\frac{10-x}{9}$ or $\frac{x}{9}$ or $\frac{9-x}{9}$ seen on diagram or in a calculation P1 for $\frac{x}{10}\times\frac{10-x}{9}$ or $\frac{10-x}{10}\times\frac{x}{9}$ | for $\frac{x}{10}\times\frac{x-1}{9}+\frac{10-x}{10}\times\frac{9-x}{9}$ P1 for $\frac{x}{10}\times\frac{10-x}{9}+\frac{10-x}{10}\times\frac{x}{9}$ | for $1-(\frac{x}{10}\times\frac{x-1}{9}+\frac{10-x}{10}\times\frac{9-x}{9})$ P1 for beginning to process the algebra A1 $\frac{10x-x^2}{45}$ oe