

Applications of Mathematics (Pilot)

General Certificate of Secondary Education **J925**

Examiners' Reports

January 2011

J925/R/11J

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This report on the Examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the Examination.

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Chief Examiner's Report

This was the first occasion when centres were able to enter candidates for this 'linked pair' GCSE and only paper 1 was available. Not surprisingly, only a few centres entered candidates, with the majority opting for Methods in mathematics rather than Applications of mathematics. One centre entered both. Performance on the papers varied from centre to centre and some candidates appeared not to have covered all of the topics in the relevant specification.

It is recognised that the methods papers were a little light on 'low demand' questions and the applications papers a little light on 'high demand' questions. This was taken into account when grade boundaries were set at the award.

All papers included at least one question assessing the quality of written communication. In this session, most of the QWC questions focused on presenting solutions in a clear, structured manner. A key reason for candidates not scoring full marks was their failure to state clearly what their calculations represented. (eg in 381/02 Q2d stating hardcore A alongside £111.15 and in 391/02 Q7 stating volume alongside 1200 (with units)). Candidates should not assume that the provision of lines (eg 391/01 Q5) implies that these lines need to be filled with words. The lines were provided in some of the QWC questions in order to help candidates present their work clearly.

All papers included questions which expected candidates to be able to interpret and analyse problems and either use mathematical reasoning to solve them (methods) or generate strategies to solve them (applications). Candidates did not find it easy to interpret problems and even questions where the content demand was relatively low, (eg 391/01 Q5 and 381/01 Q9bii) were not well answered. Questions involving solutions of number problems (eg 391/01 Q9 and 381/01 Q6) were generally more successfully answered.

Candidates will undoubtedly benefit from greater exposure to these new style questions and past papers from this and other specifications provide a rich source of examples. It may be profitable for students to work together and to assess their work using the marking guidelines.

The methods papers included questions which required candidates to understand and use Venn diagrams and set notation, topics which have not been included at GCSE level for a number of years. Candidates generally understood the use of Venn diagrams but they were less secure in using the associated set notation.

A381/01 Foundation Tier

General Comments

The number of candidates was small, about sixty, so any generalisations must be made with caution.

The majority of candidates gained more than half of the available marks, nobody gained less than 25%, but more than one in five gained 75% or more. There was no evidence to suggest that any candidate had been improperly entered.

This was the first offering of the specification and some initial problems might have been expected. This proved not to be the case although the newer "applications" items were noticeably less well answered than the more traditional GCSE items.

Candidates made a serious effort to show what they could achieve and there were only a few instances of questions not being attempted. There was no obvious indication that time was a concern for any of the candidates and the literacy demands of the paper did not appear to have a detrimental effect on their ability to answer questions. The legibility of writing and number work was at least satisfactory.

This was probably the first time these candidates had been assessed on their quality of written communication within a formal external mathematics examination. The unwillingness of many candidates to link or explain their numerical working with words was noticeable, despite bullet points and short headings being quite acceptable. For example in Question 3(a) subheadings such as "cost of buying 15 kg of seed potatoes" or "cost of buying 300 kg of bargain potatoes" would have gained credit. Similarly in Question 9(b) some very brief yet specific mention of the criteria for the best tower runner such as "metres per second climbing" or "step per second climbing" would have been a useful and valid response to the task "explain how you decided". Centres may also need reminding that quality of written communication may involve, on other occasions, clarity of algebraic working or geometrical reasoning.

A general point of which candidates need to be aware is the importance of showing working for all questions, and to take note of instructions such as "show how you arrived at your answer" or "justify your answer with working", where without justification full marks will not be earned.

Comments on Individual Questions

- 1 (a) A well answered starting question; there were very few obvious wild guesses such as "40 m" and most incorrect responses were only just outside the allowed limits.
- (b) Most candidates were able to gain at least partial credit as might have been expected. Rotation symmetry was found to be marginally more challenging than reflection symmetry.
- (c) As far as it was possible to ascertain all candidates had access to protractors and most errors involved carelessness reading the scale of the latter or (in very few cases) mistakenly giving the supplementary angle. Correct responses were generally well within the permissible range, suggesting careful and accurate measurement. Almost three quarters of candidates were successful.

- (d)** Rather unexpectedly only about half of all candidates were successful. Some responses appeared to be guesses.
- 2** **(a)** Almost all candidates gained credit here.
- (b)** A very well answered question although it was disappointing to see a relatively large number of candidates giving "30" as their response to part (iii).
- 3** **(a)(i)** Quite well answered but not by all candidates.
- (ii)** Better answered than part (i) which appeared to suggest that the actual context was accessible.
- (iii)** This was found challenging by the majority of candidates and in fact several did not attempt this part question. A significant proportion of candidates had difficulty making clear their route to the answer as alluded to in the General Comments. Very few candidates gained full credit for this part question.
- (b)(i)** A fairly well answered part question with three quarters of candidates gaining full credit.
- (ii)** This was found very challenging by the least capable.
- (c)(i)** About a third of candidates gained full credit; most "logical" errors involved assuming that two thirds of seeds did germinate. Where this was clearly the case partial credit was available.
- (ii)** This was found difficult by all but a third of candidates.
- (d)(i)** A very well answered part question: almost all candidates gained full credit.
- (ii)** Less capable candidates found this a challenge. The most common error was to assume there to be 100g in a kilogram – a classic mistake.
- (iii)** Despite the follow through mark from part (ii) only just over half of candidates were successful. Most errors appeared to originate from poor pencil and paper subtraction skills.
- (e)** Most candidates could confidently perform the percentage calculation required. It was pleasing to note this as evidence that candidates appear not to have been adversely effected by the number of parts to this question on a single theme.
- 4** **(a)** Well answered by many candidates but the number of incorrect answers of "24 cm" suggested that in a small number of cases candidates were using their rulers improperly and reading from the "1 cm" mark.
- (b)** A difficult question; the least capable rarely gained any credit and overall only about 1 in four candidates were completely successful. Partial credit was available for candidates who had clearly given their calculation correct to 2 decimal places.
- 5** **(a)** Found accessible by the great majority of candidates. Follow through marks were available throughout the question.

- (b)** This question was not well answered by the majority of candidates. Most errors involved considering the wrong time period (giving £20, which was a quarter of the bag's value in 2008) or calculating $\frac{3}{4}$ of the drop in value from 2008 to 2009 (giving £15).
- (c)** Most candidates gained full credit – due in many instances to follow through marking.
- 6** Well over two-thirds of candidates gained full credit.
- 7** No candidate succeeded in gaining full credit for this question but the vast majority managed to obtain at least partial credit; there were several opportunities for gaining follow through credit. Those candidates who used the diagram to work out and record angles tended to be more successful. There was no evidence of any candidates assuming the lines ST and XY not to be parallel.
- 8** **(a)** As a whole this question attracted rather meagre credit. This was well illustrated by the number of candidates who straight away attempted, invariably incorrectly, to find the numbers in each coach and bus – almost as a “knee jerk reaction”. Wrong responses did not show any pattern although $5x - 5$ (perhaps from $(2x) + (3x - 5)$) was observed several times.
- (b)(i)** Some follow through credit was available for solving an equation derived in the previous part nevertheless most candidates failed to gain any credit.
- (ii)** Only the more able candidates attempted this question.
- 9** **(a)(i)** A popular wrong answer was “200” – a response with no obvious rationalisation.
- (ii)** A large proportion of candidates tended to write verbose justifications seemingly missing in the rubric the instruction to “support your answer with some working”.
- (b)(i)** This simple lead-in to the succeeding part was well answered with most gaining full credit.
- (ii)** This part required candidates to interpret and analyse a problem and generate a strategy to solve it. Several approaches were possible, as outlined in the mark scheme. Partial credit was available at several points. There were several instances of candidates correctly calculating the vertical climb speed or stepping rate (for which due credit was awarded) but then choosing the smallest value as being indicative of the best tower runner. Some small credit was available to those candidates employing purely qualitative arguments.

A381/02 Higher Tier

General Comments

The questions allowed candidates the opportunity to demonstrate their knowledge and understanding of the topics. A small number of candidates appeared to be out of their depth on some questions. There was no evidence to suggest that candidates had insufficient time to complete the paper with the majority attempting all questions. Presentation and layout was generally satisfactory, but for some candidates the working was hard to follow and led to the loss of marks. In general, good scripts were characterised by the presence of some working, allowing examiners to award method marks even when the final answer was incorrect. Three questions, 2d, 10b and 11 required candidates to interpret and analyse a problem and generate a strategy to solve it. In Q2d candidates were generally successful but lost marks through poor communication. In Q10b candidates were usually successful but many did not use the most efficient strategy. In Q11, whilst recognising that the concepts are difficult for many candidates, there was little evidence of the problem being interpreted using for example sketches, diagrams or tables.

Comments on Individual Questions

- 1 (a) Many correct answers were seen with almost all candidates working out the amount of flour required for 1 cake and multiplying by 15. Others worked out the amount for 8 cakes and added this on.
- (b) Again many correct answers were seen with candidates using a method similar to (a). Some slipped up by subtracting from 1000 grams of sugar.
- 2 (a) Some mistakenly evaluated $\sqrt{(2 \times 3.15)^2}$ leading to 6.3 but for some the answer was incorrect with no working shown at all. Overall a majority of candidates scored full marks.
- (b) It was expected that candidates would add the four given sides to their answer from (a). Some ignored their answer and recalculated the missing side again. Some calculated it correctly in this part having worked it out incorrectly or made no attempt in (a). Some simply took the missing side to be 3.15 even when (a) was correct. In a small number of cases candidates calculated areas.
- (c) It was expected that candidates would calculate the area by splitting the shape into a rectangle and trapezium or by subtracting a triangle from a square. This allowed them to earn two marks for a correct method for both parts and a third for a correct final answer. Some, however, split the shape into three or four parts which usually involved errors with the dimensions of one or more parts resulting in a loss of marks.

- (d)** This question was also testing QWC. To earn full marks candidates were expected to decide which merchant to use for each item and work out the total cost as their justification. Correct solutions were seen but some candidates lost marks by working out the total incorrectly, not giving a total but listing the individual costs only or by giving the total but failing to say where the items were purchased. Others simply calculated the total cost for A and for B (sometimes incorrectly) and made their choice based on their totals. Others made an incorrect choice but earned some credit for partial working.
- 3 (a)** There were many correct solutions seen with a majority of candidates scoring full marks. Some set up a formal algebra solution as $2x + 3(3x - 5)$ and went on to obtain the correct solution. Others set out their solution less formally, working out minibuses and coaches separately before giving a final answer. Common errors included $2 \times x$ given as x^2 and $3(3x - 5)$ given as $6x - 15$ or $9x - 5$. Some got as far as $2x + 9x - 15$ and gave this as their final answer.
- (b)(i)** Many of those who were able to obtain a correct expression in (a) went on to set up and solve the equation. Others were able to obtain a solution by using trial and improvement rather than formal algebra. Some were able to earn follow through marks for equating their answer in (a) to 150. Common errors included incorrect collection of terms such as $11x = 135$ rather than 165.
- (b)(ii)** Only the correct answer scored here and that was achieved by just under half of all candidates, usually those who had solved the equation in (i) correctly.
- 4** A majority of the candidates earned all three marks for this question. Some worked with fractions throughout, others converted to decimals and obtained 3.85 before converting back to a fraction. Some simply gave the answer, probably after using a calculator. Others lost the final mark for leaving their answer as 3.85, as $\frac{77}{20}$ or as $4 - \frac{3}{20}$. Some struggled to change the fractions to a common denominator. A common wrong answer was $\frac{9}{4}$.
- 5** Many found this question straightforward and obtained the correct answer of 60 seconds. Others picked up a mark for a multiple of 60 seconds or for listing multiples of 10 and 12. Only a handful of candidates earned no marks.
- 6 (a)** Many candidates coped well with the expansion of the bracket and went on to collect terms correctly and obtain a final solution. A few struggled with the expansion with $6x - 6$ and $6x - 3$ seen but candidates were able to pick up some marks if they followed through correctly from these errors. Some attempted trial and improvement but usually got nowhere.
- (b)** Candidates fared better on this question, only those who made slips when multiplying the equations or in addition or subtraction tended to pick up part marks. A few did not read the question carefully enough and simply gave the total cost of one tea and one cake. Solution by substitution was extremely rare.
- 7 (a)** Two methods dominated the solutions. Division of 20664 by 1.12 and decreasing 20664 by 12%. Sadly the majority chose the latter method.

- (b) Repeated percentage change proved less of a challenge and a majority of candidates scored full marks. Slightly more opted for multiplication by 1.16 with others preferring to find 16% and add it on. In both cases candidates generally went on to obtain full marks. A small number lost the final mark by working out four separate increases instead of three. A small number treated each increase as the same and effectively worked out a single increase of 48%.
- 8 (a) Common incorrect answers were usually 0 or 6.
- (b) Several candidates used a calculator and a decimal answer was accepted provided it was written rounded or truncated to three decimal places. Some candidates had little understanding of the meaning of the power and their answers tended to be 24.5, – 24.5 or 48.5.
- (c) Candidates coped well with positive integer powers and it was rare to mark an answer that was incorrect. Where errors were seen it usually involved a slip with answers such as 5^2 , 5×5 , 5 or 50. A few candidates evaluated 5^7 and 5^6 rather than use the rules of indices.
- 9 Candidates could have solved the problem by calculating the area of a trapezium and doubling it or by calculating the area of the rectangle and subtracting the area of the four triangles. The latter method was more common but other methods of splitting the shape were seen. About a half of all candidates obtained the correct answer. For some of the others part marks were earned for a correct method for calculating an appropriate area. Some lost marks due to arithmetic slips and others for using incorrect formulae for triangles and a trapezium.
- 10 (a) A minority of candidates picked up all three marks for the position of the lighthouse (L). Some candidates picked up two marks for one correct bearing and a follow through mark for the position of L. Others had both bearings incorrect but earned a follow through mark for the position of L.
- (b) Some marks could be earned following an incorrect position of the lighthouse in (a). Overall candidates were more successful in this part of the question. Many coped well in working out the actual distance to the lighthouse but for some, calculating the time was more of a challenge. Surprisingly not all candidates who attempted this part divided the distance by the speed. Some subtracted 25 from the distance before dividing by 25 and then added on 1 hour (although some forgot to do so). Some worked out the distance travelled in one minute and divided their distance by this value while others worked out the time needed to travel one kilometre and multiplied by this.
- 11 This proved a challenge too far for the majority of candidates. It was common to see working involving cubes with assumed dimensions. Unfortunately, despite the reference to volume many simply used cubes whose sides were doubled. It was extremely rare to see a solution laid out with volume scale factor leading to length scale factor followed by area scale factor. A small number picked up some marks for working with two cubes with assumed measurements and evaluating the smaller area as a percentage of the larger area rather than the other way round.

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