

Mathematics B (MEI)

General Certificate of Secondary Education **J519**

Examiners' Reports

January 2011

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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

Although this was a January examination, all the papers produced a wide spread of marks indicating that the entry was by no means a totally re-sit entry. All the papers differentiated well. This was so even in unit B294 where the candidature was very low. There remained, however a small number of Higher Tier candidates who appeared better suited to the Foundation papers.

Presentation is improving but there are still a number of cases where the working is jumbled in no logical order and examiners being unable to award the part marks. This can prove the difference of a grade and candidates should be aware that, where there is more than one mark for a question, part marks are available if the method is clear.

Candidates continue to under-perform when clear written responses are required. For some of these, where the candidate is made to think clearly, this is understandable. However, some of these are standard responses which can be learnt. Examples of these are interpretation of statistical results and geometrical reasons.

At both Foundation and Higher Tiers, failure to do basic arithmetic causes candidates to lose far too many marks. Even Higher Tier candidates are often hindered by their inability to carry out the simple processes. Fractions particularly are a problem and many candidates simply omit fraction questions. Dividing by numbers like 0.5 is usually incorrectly done and many candidates struggle with basic fraction techniques. Non-calculator strategies are often carried over to the calculator papers and are often far less successful there where the numbers are more complicated and require calculator techniques.

B291 Paper 1 (Foundation – Modular)

General Comments

This was the modular paper for the Foundation Tier of MEI. Section A was non-calculator.

Candidates appeared to have plenty of time on both sections. Questions 8, 9, and 16 were common, all or in part, with questions 2, 5 and 10, respectively of Paper 3. There was a good range of marks, with more than 10% of candidates earning 80% or more of the total marks available. Only a quarter of the candidates earned less than half marks.

Some candidates' work was spoilt by careless arithmetic, with strategies for non-calculator work being poorly applied and basic addition and multiplication results (tables

Comments on Individual Questions

SECTION A

- 1 This question was well done. In part (a) suggested names were regular, equal or, creatively, "unequadrilateral" and in part (b) the coordinates were only occasionally reversed.
In parts (c) and (d) some candidates confused perimeter and area; others either miscounted, using lines rather than squares, or assumed that with a vertex (8, 4) the dimensions were 8 by 4.
- 2 This question was well done by all but the lowest quartile of candidates, and the following comments mainly address their errors.
(a)(i) It was disappointing to see how badly strategies for subtraction were applied, with candidates not knowing what to do with the "extra" 15, and getting 315 instead of 285 as their final answer.
(a)(ii) The correct result was sometimes achieved by repeated addition, and lack of confidence in multiplication was shown by the 6 times table being written out as far as 7×6 .
(a)(iii) This part was the least well done amongst all levels of candidate, with a higher level of No Response than the other parts.
(a)(iv) Candidates who set down their work in columns were usually successful in adding correctly.
(b) Most candidates chose the numbers correctly, but 60 and 500 were common wrong values for the product.
- 3 In part (a) a good level of accuracy was shown in drawing the line segment and the two angles. Where the angle was in the centre of the base line leading to possible ambiguity, most candidates indicated the correct angle.
In part (b) many candidates only gave one part of the definition of an obtuse angle, usually giving the lower limit.
- 4 The most common error in part (a) was to give the fractions as $\frac{1}{7}$ and $\frac{1}{127}$. Those who got part (i) correct often used 10 or 100 as their denominator in (ii), sometimes with 12.7 or 1.27 in the numerator.
Part (b) was well done, though some candidates listed the three smaller values in order of number of decimal places, ignoring the actual place value.

- 5 Most candidates understood what to do in this question, though some put the outcomes in the wrong sections of the table.
- 6 Perhaps not surprisingly, candidates were more successful in finding the square in part (a)(ii) than the square root in (a)(i). In part (a)(iii) a common wrong error was 40, and others gave the wrong number of zeros.
In part (b) many candidates found the explanation difficult; it was safest to accompany it with a demonstration with numbers. However, that did not rescue those who did not understand the concept.
- 7 In part (a), the most common error was to multiply 4 by 5 before squaring. In both parts, errors of the “when $a = 5$, $4a = 45$ ” type were seen. It was disappointing to see 4×25 producing results other than 100.
Very frequently 50 and -6 were found in part (b) but then added to give incorrect sums. Even so, this question was a good differentiator.
- 8 Only the top quartile of candidates performed well in this question. Even those candidates who understood the algebra found providing explanations difficult. They were more successful in part (a) where two counter examples sufficed than in (b) where numerical examples did not provide a complete explanation.
- 9 Many students ignored the instruction to “carry out a more accurate approximation” and simply commented on the example in the question. Those who approximated to 0.8 and 0.6 rarely achieved a correct product of these, and correct answers to the necessary division were extremely rare. Dividing by 0.5 was almost always replaced by division by 2.

SECTION B

- 10 This question raised few problems. Some candidates marked the vertical scale incorrectly, in the squares rather than opposite the lines.
- 11 There was a high rate of success in reading the scales in part (a). In (b) the most frequent errors were “miles” in part (i), metres in (ii) and kilograms or a measure of length in part (iii).
- 12 Part (a) was well done, though some candidates found the adult total, but failed to add it to the total for children’s tickets.
In part (b), many candidates read this as “reduced to a third” and/or “reduced to 60%”. More worrying was the number who stated that “ $\frac{1}{3} = 30\%$ ”, or who began their attempt to find a third with division by 2, usually ending up with $\frac{3}{4}$.
- 13 All but the lowest quartile made very good attempts at this statistics question. A few muddled their definitions, or were let down by their arithmetic, but there were many correct solutions.
- 14 This question was a good differentiator across all grades.
A common error in part (a) was to add only one 55° to two 90° s before subtracting from 360° . This result was usually halved correctly. Correct reasons were often not given.
In part (b), sometimes 180° was used instead of 360° .

- 15** In (a) part (i), the most common error was partial simplification, usually leaving the expression as $5a + 4a$.
In part (ii), $7w$ was often found correctly, though errors with signs sometimes led to $2w$ being subtracted rather than added, and $-4x$ was rarely correct.
The simple equations in part (b) were generally well done, though in (i) $10x$ was sometimes treated as $10 + x$.
- 16** This question was not well done. Only about a quarter of candidates found both medians correctly in part (a), a number giving single digit answers having presumably ignored the "stems". In part (b) many realised that Fred had more apples and/or more trees, but some talked about trees with no apples, or days when none were picked, or made unhelpful comments such as "Fred has more in the 70s".
- 17** Few earned part marks in this question. If they used Pythagoras' Theorem, they could generally calculate correctly.

B292 Paper 2 (Foundation – Terminal)

General Comments

This January sitting for the Foundation paper B292 has attracted mainly middle ability candidates, some of whom are presumably retake candidates trying to improve up to C grade standard. Candidates appeared to have sufficient time to complete each section of the paper.

Candidates' presentation has improved on previous occasions. There were, however, still cases where candidates overwrite to change an answer – this frequently leaves it unclear to the examiner as to which is the candidates final answer.

In preparation for the fact that quality of written communication will be assessed when centres switch to the new mathematics specifications commence, it is worth noting that questions 7, 17, 19 and especially 11b all require good communication. This communication can be partly, or in some cases fully, in the form of calculations or algebraic expressions.

There did appear to be a greater care shown by candidates to produce accurate work for this paper; more marks than in previous years were retained because sufficient attention had been given to accuracy of calculation, transcription or drawing.

Comments on Individual Questions

Section A

- 1 Almost all candidates were able to gain good marks on this question, with over half of them scoring full marks. The weakest candidates found part (c) challenging, sometimes giving attempted answers as ratios or in word form.
- 2 This question, typical of AO3 on the incoming specifications, was well attempted. Most candidates were able to gain marks here, and it was rare that a candidate did not try each part. Part (c) was best answered and part (d) worst.
- 3 Part (a) caused few problems, but the addition and subtraction of fractions with common denominator did trouble some candidates. Common, erroneous, answers involved adding or subtracting denominators. Some candidates insisted on using cross-multiplication methods to gain a solution of $\frac{35}{49}$ for part (b)(i).
- 4 This question was generally very well answered. A few candidates clearly did not understand the situation, trying to give probabilities rather than names.
- 5 This question was particularly good at differentiating between candidates, with a good spread of marks achieved. Too many candidates are unable to do the basic 'multiplication before addition' type of sum given in part (a)(i) with less than half getting this right. The rest of (a) was generally well answered. Part (b), which overlapped with the higher paper, was only done well by the best candidates. Some weaker ones rounded the initial figures without making further progress; others tried to add the decimal places in the question.
- 6 This question was very well answered except for part (e), although even this was answered better than in previous years.

- 7 This was another overlap question. Strong candidates could find the solution – which did not require formal algebraic methods to gain credit – but even they were unable to form the initial equation.
- 8 Part (a) of this overlap question was a source of part-marks for candidates, but it was rare to see proper use of compasses. In part (b), there was usually an understanding of the need for an arc centre A, and often some attempt to construct a perpendicular bisector. However, this attempt usually foundered after arcs centre B and D had been drawn.
- 9 The final question in section A was another overlap question. Strong candidates could often attempt a translation, but very few were able to deal with the fractional enlargement.

Section B

- 10 This question on reflection and coordinates was well answered by almost all candidates.
- 11 Part (a) was well answered; part (b) produced a good spread of results. Good answers, which 40% of candidates could produce, were characterised by clearly displayed calculations and conversion of unit. Several candidates did not see (or ignored) the fact that there were three class sets, but were credited for dealing with their reduced problem.
- 12 Sequences for odd numbers and doubling were well answered. The sequence of square numbers was not so familiar to candidates, some of whom tried squaring from term-to-term producing the sequence 1, 1, 1, 1 rather than the correct 1, 4, 9, 16.
- 13 Candidates were, on the whole, able to tackle each part of this problem. A few were penalised once for wrong notation such as 2 in 9.
- 14 This question distinguished the weaker from the stronger candidates. The fact that part (a) was better answered may reflect the fact that some students continue to use non-calculator methods even when a more efficient method is available with a calculator. A common error was to find the total after percentage change rather than the change itself.
- 15 This was another question that produced a good spread of results. Occasionally the weakest candidates gave 2D names as answers.
- 16 It was pleasing to see a significant number of candidates showing confidence in multiplying out a bracket. A few spoilt initial answers by trying to oversimplify or to solve the correct expression.
- 17 This was another question which acted as a good differentiator, although few candidates were lucid enough to gain full marks. The mark that caused the most problems was gained by explaining that angles B and C were equal because it was an isosceles triangle. For y , candidates preferred to use the phrase F-angle, and although they were not penalised for this, centres should encourage use of good mathematical vocabulary by using 'corresponding'.
- 18 Very few candidates were aware of negative square roots, but other parts of this question were a good source of marks for the stronger candidates.

- 19** This multi-step question produced a good spread of marks. Many candidates could discover that Joseph would have £632 to spend on NZD, but it was quite common to see them trying to multiply this figure by 0.38 instead of dividing.
- 20** Most candidates can plot points, so it was pleasing to see how many took the necessary care required to ensure that all six points were accurate. Lines of best fit were generally well done, the most common error being to insist on including the origin as a point on the line. Candidates also showed a good understanding of the limitations of extrapolation for part (c). There was some good contextualisation of this part, with candidates talking about teenage growth spurts and the reaching of adult height.
- 21** This final question again contained elements of overlap with the higher paper. Answers were generally good considering the level of question, and none of the parts was beyond the ability of stronger candidates.

B293 Paper 3 (Higher – Modular)

General Comments

The work seen was very variable. The paper discriminated well with marks across the whole range and, whilst it was pleasing to give full marks to some scripts, it was worrying that a few candidates were able to score only in single figures. Possibly the Foundation paper would have been a much more rewarding experience for these candidates.

All candidates appeared to have sufficient time. Essential working was usually shown but sometimes was not well set out.

Comments on Individual Questions

SECTION A

- 1 In part (a) most managed $\frac{51}{300}$ but some then did not know what to do with this to turn it into a percentage.
In part (b), the expected number divided 300 by 5 to give £60.
- 2 The majority chose the correct description but some could not explain why. Some embarked on a lengthy explanation, others said that $5n$ ended 0 or 5 and so adding one continued to result in odd or even. The simplest in this case, chosen by many, was to choose two values of n to give an odd and an even number.
In part (b), some candidates took $2(n + 1) = 2n + 1$ and so chose the incorrect description. In this case, of course, it was not acceptable to choose two values of n , one odd and one even, to fully justify the description.
- 3 The vast majority scored full marks for this question. No candidate gave a choice without some attempt at an explanation. A few calculated £35, but then made no choice.
- 4 There were the usual spurious answers from incorrect working, mainly a failure to get the decimal place in the correct position. Usually this was because both 0.8 and 0.6 were multiplied by 10, but then 96 was also multiplied by 10 instead of 100.
- 5 This question was intended to test the property that the exterior angle of a triangle is equal to the sum of the two interior opposite angles. While most candidates obtained the correct angle for x , not one used this property. Consequently it was necessary to give two reasons, the angles on a straight line and the angle sum of the triangle; a significant majority failed to give both. For y , it was not sufficient to say that the lines were parallel and so many lost the explanation mark here also.
- 6 The equation in part (a) was solved by the vast majority of candidates.
It was pleasing to note that the simultaneous equations in part (b) were also solved by the majority of candidates, though the manner in which they set out their work often left a little to be desired.
- 7 This question was not done well and few realised that the similarity of triangles occurred at the top of the roof. The question was rendered a little easier than it might have been by the fact that the length of the beam was double the distance to the top of the roof giving the answer immediately as 1.1×2 , and a number of candidates realised this.

- 8 This question was done well by most candidates.
- 9 A number of candidates did not realise that all was required in (a) was to extract the common factor x .
A number of candidates failed to factorise the numerator properly in (b), preferring instead to cancel the x^2 .

SECTION B

- 10 The median for each distribution was usually correct.
In part (b), the two comparisons were often the same, such as "Fred picked more apples" and "Jo picked fewer apples". Sometimes the statements were not comparisons.
- 11 In the first part many candidates had the right idea, even if the addition of the groups was not done correctly.
In the second part a significant majority obtained the correct answer.
- 12 Some candidates did not read the question and placed their cross where the curve cut the x -axis.
There were a number of difficulties in part (b). Decimal search was not at all well understood by the majority of candidates and the working was mainly by trial. Coupled with the very poor layout of the working made it hard to see what was being trialled. Additionally, part (a) was usually ignored and so the trials started almost everywhere except $x = 1.3$. Finally, candidates who got as far as showing that the root lay in the range $[1.32, 1.33]$ usually chose $x = 1.33$ as $|f(1.32)| > |f(1.33)|$. This is incorrect and in order to determine which it is, the value of $f(1.325)$ was needed.
- 13 Many candidates took the formula for the area of a trapezium and solved it to find DC. Others constructed a rectangle within the trapezium and calculated the "extra" length of DC over AB. This caused some difficulties as the rectangle did not, according to the diagram, sit symmetrically on DC, though some ignored this and treated it as if it did. This, of course, was perfectly valid.
- 14 Most candidates used the correct trigonometrical ratio. It was surprising how many candidates used Pythagoras to find the third side and then used the cosine ratio. A number of candidates had little or no understanding of how to find the angle given the information given in the diagram.
- 15 Some candidates wrote down the coordinates in the wrong order. This did not affect their answer in (a)(ii) for the distance. Most candidates used 2 dimensional Pythagoras twice rather than 3-D Pythagoras. Candidates often then either approximated to give an intermediate answer and then squared their approximation, or forgot which pair had already been used (working out, for instance, $\sqrt{8^2 + 2^2 + 2^2}$ or even forgetting to do it twice).
Candidates who demonstrated their confusion over the axes in part (a)(i) might be expected to get part (b) incorrect as well. Many of the points given, however, were correct after an incorrect first answer or inconsistent with it.

- 16** Although the construction of histograms is not in the syllabus for the Modular paper, frequency density is and candidates are expected to know how to deal with bars of different widths in a histogram and determine the scales. The most common error in part (a) was to ignore this and to give as the outside group frequencies as 2 and 3. In part (b), some candidates did not complete the labelling, some did not have a linear scale and some wrote things in the label space that indicated that they were not aware that it was supposed to be for a specific length.
- 17** Many candidates did not understand what was required in this question; and too many could not complete the square for the left hand side or expand the brackets of the right hand side in order to make a comparison. In the following part many, who got part (a) correct, failed to realise how their manipulation would enable them to answer this question directly. It was very rare for the value of d given in part (a) to be given as the answer to part (b).
- 18** Only the best candidates understood that the safe maximum was found by dividing the minimum safe lift by the maximum pallet weight. Most divided the numbers given in the question to give 12.5 and then truncated to give 12.

B294 Paper 4 (Higher – Terminal)

General Comments

The candidature for the paper was very small and therefore it is difficult to generalise over many of the questions. It seemed that most of the candidates were not resitting to gain a grade C as there was a large proportion who got high marks. Most candidates appeared to be entered at the correct level as there were very few low marks. At the top end there were some extremely impressive scripts with scores in the high 90s.

The algebra from the better students was very good as was the vector work.

All candidates appeared to have sufficient time. Working was usually present though sometimes rather poorly laid out.

Comments on Individual Questions

SECTION A

- 1 This question was done quite well. Most rounded the numbers to a suitable accuracy although a few tried to do it with the original numbers despite the clear instruction and some used 2 significant figures instead of 1. Some were out by a factor of 10 or even a hundred when doing either the multiplication or division. Just a few, having estimated correctly, forgot to write down the correct answer.
In part (b) most were correct but a substantial number used 3 decimal places or 4 significant figures.
- 2 Part (a) was done very well indeed with almost all using the correct construction arcs. Part (b) was less well done but nevertheless the majority were successful.
There were more arcs omitted here and some candidates failed to make the final locus clear.
- 3 In part (a) there were many correct solutions. The usual errors were to enlarge with a scale factor 2 or to use an incorrect centre.
Part (b) was better done with almost all carrying out a translation and most of these were with the correct vector.
- 4 Parts (a) and (b) were both well done. Almost all were successful with (a). In (b) there were a variety of wrong answers such as $\frac{1}{2}$ and $\frac{1}{5}^1$. As expected part (c) was less well done but nevertheless produced a fair number of good responses.
- 5 About $\frac{3}{4}$ of the candidates were successful with this question. There were some errors in writing down the equation, usually missing an x or for example $2x + 6(x + 2) = 126$ or omitting the brackets. There were also a few sign errors and division errors in solving the equation. Just a few candidates got the answers without an equation and this got partial credit.
- 6 Fewer than 50% were successful with part (a). There were a number who did not recognise that the probabilities changed for the second card and a few, who did, still making errors. The method marks for (b) were awarded on a follow through basis and so many gained credit even with an incorrect tree diagram. Most did part (b) by the long method rather than calculating $1 - P(\text{two vowels})$. Some weaker candidates added the probabilities or just found $P(\text{one consonant})$.

- 7 This question was generally very well done. Most candidates produced a good cumulative frequency graph with just a few repeating the frequencies in the second table or plotted at the middle of the interval. The median was usually correct but the inter quartile range less commonly correct. A few did $60 - 20 = 40$ and read off at 40 producing the same answer as the median.
The comments were slightly better than usual in part (c) possibly because they were lead more to the correct answers. Some merely said the median was higher for Mr Badly and the inter quartile range was greater for Mr Gill without making any attempt to interpret these in the context of the question. This was not awarded full marks.
- 8 The better candidates did the congruent triangles proof well. Many of the weaker candidates made fairly vague statements or thought they could state all 3 sides or other angles were equal. Some failed to give the reason for the angles being equal or that the reason for congruence was SAS.
Part (b) was less well done with, again, many vague statements. A significant number did, however, identify the alternate angles that were equal giving the evidence for parallel lines.
- 9 Part (b) was the least well done part in this question. The usual common errors occurred such as stretching with scale factor $\frac{1}{2}$ in (a) and 2 in (b) and translating the wrong way in (c).
- 10 Almost all candidates plotted the scatter diagram correctly and read off correctly from their line of best fit. A number lost the line of best fit mark with curves or poor lines for example a line going through (0, 80) For the final mark, most recognised that it was not sensible to extrapolate that far outside of the range of the data, with just a few thinking it was sensible or giving an unsatisfactory reason.

SECTION B

- 11 Most candidates did part (a) well although weaker candidates sometimes confused d and n . Part (b) was usually correct, often after a wrong part (a). Straight lines, series of points and step functions were all accepted. About two-thirds of the candidates gained the mark in part (c) where anywhere in the range $12 < d \leq 13$ was accepted.
- 12 There were very few errors in using the formula with $C = -35$ or filling in the table. Although there were more errors here, most were also able to plot an accurate graph and read off where the lines crossed. Due to the closeness of the gradients of the graph a larger than usual tolerance was given for the point of intersection. A few candidates gave the °F value instead of the °C value.
- 13 Both parts of this question were well done. In part (a) the usual error was the inability to deal with $5x = 9$. In part (b) there were just a few with wrong powers of x or 3 not being multiplied by 5.
- 14 The calculations here were fairly successful. The usual method in (a) was to add the 17.5% to £720 then add the 15% to the £720 and then subtract. Very few recognised that the quick method was to multiply 720 by 0.0025. There remain a few candidates who use non-calculator 'mathematical practice' techniques on the calculator section. The most common error was to assume the £320 included VAT at 17.5% despite the clear statement to the contrary in the question.
Part (b) was also quite well done although contrary to part (a) shorter methods could not be used here and also the reverse percentage to find the price without VAT proved a problem for many.

- 15** Parts (b)(ii) and (iv) proved the most difficult on the paper. Parts (a) and (b)(i) were well done with just a few who gave $n + 3$. Disappointingly few candidates recognised that it was necessary to replace n by $n + 1$ in the expression for part (ii) to make $2(n + 1) + 1 = 2n + 3$. The better candidates did part (iii) well although, of course, weaker candidates struggle with algebraic fractions. The main problem with part (iv) was the inability to multiply 51×53 whether in their answer to part (iii) or the original expression.
- 16** Many candidates coped with this long structure question well. Most recognised the need for cosine rule in part (a) although a few thought the Sine Rule fitted the bill. The usual common error of working out $11^2 + 13^2 - 2 \times 11 \times 13$ before multiplying by $\cos 63$ was seen fairly often as were misquotes of the cosine rule. Over half the candidates coped with the explanation in part (b). A number of candidates used the wrong ratio in part (c). Some successful candidates used sine rule rather than the rather easier right angle triangle technique. Part (d) was marked on a follow through basis so some were able to get the marks following a wrong radius, the most common errors were to use length of arc formula or to use 63° .
- 17** The equation was often produced by just starting with $6x + 2y$ with no justification. Others tried to use $3x^2 + 2xy = 75$. The best candidates answered part (b) extremely well with pleasing accuracy in algebra. Many candidates failed to justify why they rejected the solution $x = 25/3$. Others made sign errors in reducing the equation to $ax^2 + bx + c = 0$ or made errors in multiplying out the bracket. Those attempting to make x the subject of the linear equation were usually less successful but a few did it well. Some candidates tried equalising and eliminating in mirroring the linear equation technique. Those who equalised the xy terms could reach the same quadratic equation but equalising the x^2 terms did not work.

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