GCSE

Methods in Mathematics (Pilot)

General Certificate of Secondary Education **J926**

Examiners' Reports

June 2011

J926/R/11

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Chief Examiner's report

For the first time all papers were available for these two specifications, Methods in Mathematics and Applications of Mathematics, which form the linked pair pilot GCSE. The largest entry was for Methods paper 1 with more candidates for Higher tier than Foundation tier. The entry for Methods paper 2 was higher than that for paper 1 in January, indicating that some centres entered candidates for both paper 1 and paper 2 this June. The entry for Applications paper 1 was significantly higher than in January whereas Applications paper 2 was only entered by candidates from 2 centres.

The papers proved to be accessible to all the candidates, although the Higher tier examiners felt that some candidates would have been more appropriately entered at Foundation level.

In general candidates performed less well on questions covering topics which are unique to the linked pair specification. In Methods 1, whilst candidates showed a greater understanding of Venn diagrams than had been demonstrated in January, they found set notation difficult to use. In Methods 2, tessellations and algebraic proofs were stumbling blocks. In Applications 2, candidates were not confident with finding the area under a curve and using AER to find total interest received.

The Methods 1 report draws Centres' attention to the fact that probability only occurs in this unit and, given the breadth of the probability statements, some aspect of this topic will almost invariably be assessed each series. In general, topics which are unique to a single unit are more likely to be assessed on a particular question paper than those which are repeated across several papers.

Centres will have noticed that, in the Applications papers, there are more questions set in context than there were in January – this should be expected in future papers.

In all papers there were a number of questions which expected candidates to be able to interpret and analyse problems and either to use mathematical reasoning to solve them (Methods) or to generate strategies to solve them (Applications). In general these questions did not have a greater omission rate than other questions, which is an indication that candidates were appropriately prepared to attempt these more novel questions. It was pleasing to see in a number of instances that these questions opened up an opportunity for candidates to select their own method to solve a problem. Unfortunately, all too frequently, candidates appear not to have considered a problem in sufficient depth, failing to consider all aspects or the different strategies that could be applied.

In those questions identified as QWC most candidates made an effort to show their methods clearly and to explain their results. Weaknesses in responses included a failure to use correct terminology including that for line segments (for example A to B used instead of AB) and for angles, and the use of incorrect mathematical language when, for example, describing shapes. Communication was always much clearer when candidates stated what their calculation referred to, for example 'area of semi circle, diameter BC, is ...', and when candidates avoided presenting their answers in continuous prose.

A number of centres failed to provide forecast grades for the units. These should always be provided.

Centres have adopted various entry policies for this pilot. Some are only entering a few groups within each cohort. Some are entering candidates for both Methods 1 and Applications 1 units in Y10 and then, presumably, the second units in year 11. Some are entering for all of Methods in Y10 and all of Applications in Y11. Some centres appear to be entering for all units for both qualifications in Y11. Almost all the candidates certificating the Methods qualification this summer were from Y10. Overall the results were encouraging. Although performance was slightly lower than forecast, examiners considered that this could largely be attributed to gaps in coverage of the specification. It is hoped that will be less of an issue in future years.

B391/01 Methods in Mathematics 1 (Foundation Tier)

General Comments

The first summer sitting of this new pilot specification paper produced a good spread of results covering virtually the whole range of possible marks and with average achievement close to half marks.

There were approximately 5% of candidates who were either under-prepared for this paper, or who would have been better suited to aim for some form of entry level certificate. However, amongst entries at the top end of the ability range there were no candidates who should obviously have been entered at the higher level instead.

Centres should be aware that questions 4, 5 and 7 are typical of the sort of AO2/3 problems that candidates will encounter in future series. The first two were relatively well answered, but question 7, which required both problem solving and spatial awareness, was not so well handled.

There appeared to be sufficient time for candidates to attempt the whole paper.

Comments on Individual Questions

1 This question was generally well answered, but did produce a good spread of marks amongst weaker candidates.
In part (a)(i), '6' was a common incorrect answer, possibly writing down the time rather than the temperature. The negative number with the smallest absolute value, '–2', was also fairly common. In (a)(ii) an answer of '–6' gained the mark as well as the correct '6'.
In part (b), common incorrect answers were 3 (from adding 10), 13 and (positive) 17.

2 This question was also well answered. Part (c)(ii) was the hardest part of the question for candidates and many methods of subtraction were seen. A common incorrect value here was 516. Errors in methods were seen when candidates rounded values but then failed to add or subtract the 'roundings' back correctly.

3 Parts (a) (b) and (c) were all well answered. An occasional error in part (c) was to plot point B at (3, 2), forming a rectangle. Part (d), however, was very poorly answered. Candidates did not know how to describe a line, with 'A and D' and '4 and 2' being the most common wrong answers; the latter appearing to be a misunderstanding of the question – candidates erroneously saying in essence that the shape has 4 sides, 2 of which are perpendicular. Of those who used the correct notation for a line, many gave an answer which listed parallel lines rather than perpendicular ones.

4 This question produced a good spread of marks, differentiating well between weaker and stronger candidates. Part (a) was well attempted; even if full marks were not gained, most managed to give either the largest or smallest number and subtract correctly. Part (b) caused more problems although it was pleasing to see some candidates clearly handling the fractions well. One of the main problems in this part was that candidates failed to use the numbers given despite doing this correctly in part (a). Part (b)(v), finding the equivalent fraction, was the part that caused the most problems.

5 Except for the weakest candidates, scripts showed a good understanding of Venn diagrams and most candidates managed to earn at least one mark for placement of more correct than incorrect numbers. Marks were lost either because candidates only placed one number in each section or because the region outside of A and B was left empty.

6 This question was another good differentiator, with around a third of candidates gaining full marks. Part (a), which tested probability words, produced more correct answers than part (b) on probability fractions. Some candidates, incorrectly, in part (a)(iii) put one red in as well as several blues. Other candidates, throughout part (a), used more counters than were available; this was only penalised once. In part (b) some candidates erroneously continued to use probability words. Wrong notation was often seen, and penalised once. Another error seen in part (b)(ii) was to give 7/1 after the correct 1/7 for part (i).

7 This question, which assessed both AO3 and QWC (quality of written communication), was poorly answered by the majority of candidates. Even amongst strong candidates it was rare to see a mark higher than 3 out of 6.
Candidates who produced good answers appeared to have visualised solutions then drawn them, often showing both ways that a parallelogram could be formed. Experimental approaches were often handicapped by poor sketches which did not take sufficient account of the right angle in the triangle.
Almost a third of candidates scored no marks, either through being unable to start or by merely drawing the triangle already given or by using more than 2 triangles in each attempt. Amongst the other candidates, most were able to draw and name the rectangle although a common error here was to call it a square. Where attempts to show other quadrilaterals were seen, these were sometimes insufficiently clear sketches; if, even being generous, it was impossible to tell where the right angles were, the candidate could not be credited. A common wrong labelling for the parallelogram was to call it a rhombus. The kite was rarely found.

8 This question on straight line graphs, despite being beyond the abilities of weaker candidates, was a good differentiator for stronger ones. Parts (a) and (b) were found to be slightly harder than parts (c) and (d).
Part (b) required candidates to make explicit comparison between both the equation and the line. Good answers could refer to specific values of x, to the gradients or intercepts of both, or could even show the correct $y = 2x + 1$ line on the graph alongside the one already drawn.
The most common error throughout the question was to read the vertical scale incorrectly, using each small square as 0.1 rather than 0.2 so 4.2 was the most common error in part (a).
In part (c), candidates often answered part (i) correctly but then failed to plot this in part (ii), with lines drawn going from (0,1) to somewhere underneath (4,13). This gained one of the two possible marks. There were many $y = 1$ lines drawn.
In parts (a) and (c)(i), it was common to see equations as answers such as $y = 2.5x + 1$, $y = 2x + 2.5$, $y = 4x + 1$ etc.

9 This question was a good differentiator across the ability range, with successive parts being found to be slightly more difficult than the previous part.
Common errors were; in (a), 10, in (b), 30 or 300, and in (c), 10 or 64.

10 This probability question was common with the Higher level paper (question 2). Strong candidates usually found 0.55, for part (a), in their heads. Good answers to part (b) usually showed both the correct answer and the method used to find it.
A common error in part (a) was to fail to subtract from 1 resulting in an answer of 0.45. There were also some arithmetic errors made with the decimals but many candidates failed to show sufficient working and so could not gain marks. This was also the case for many in part (b) where they may have been trying to multiply the correct values but the working did not explicitly tell us this. Other errors here were to divide 190 by 0.4 or by 4 or simply by 2.

11 This transformations question was also common with the Higher level paper (question 3). In part (a) it was extremely rare to see the word 'translation' or the correct vector but many candidates did gain a mark for an accurate description of the movement. A common error was to describe the translation from B to A rather than from A to B.
In part (b) the most common answer was to draw a reflection of A in the *y* axis. This gained a single, special case, mark.

12 Parts of this question too were common with the Higher level paper (question 8 parts (a) and (b)); it was yet another good differentiator at the top end. Weaker candidates rarely scored anything.
In part (a), good answers usually came from efficient use of a factor tree; some candidates, however, were let down by poor multiplication skills (e.g. 5 × 5 = 10). Those candidates who used trial and improvement were generally unsuccessful. In part (b), although the correct answer was rarely seen, some candidates showed that they understood what was required by producing a common factor even if it was not the highest. There were hardly any correct answers in (c), where correct use of the prime factors was extremely rare and those that did reach the value tended to do so by listing multiples. Factors and multiples were frequently confused here.

B391/02 Methods in Mathematics 1 (Higher Tier)

General Comments

The paper differentiated quite well with marks across the whole range. There were a significant number of candidates with scores in single figures for whom entry at Foundation level may have been a more rewarding experience.

On this non-calculator paper, basic arithmetic let many candidates down. The inability of many candidates to do the basic 4 operations led to a fairly substantial loss of marks.
Parts of Questions 6, 8, 9 and 13 required candidates to interpret and analyse problems and use mathematical reasoning (AO3) and had the lowest facility with candidates. It is hoped that centres and candidates will become more used to these types of problems and candidates will become less thrown by novel contexts.

Question 11 was the QWC question as indicated by the asterisk on the question number. As such it was expected that candidates should identify which angles they were calculating with clear labels and give the correct geometric reasons as stated on the specification for each statement. Many candidates could obtain the correct answer but lost most of the marks for omission of either labels or reasons.

Probability is the only aspect of data handling covered by the Methods specification and hence some aspect is almost certainly going to be tested in each series. Since conditional probability is included and this is a non-calculator paper, practice in 'cancelling' fractions when multiplying the probabilities would make the arithmetic easier for candidates.

Comments on Individual Questions

1 It was envisaged that part (a) would be a fairly easy start to the paper. Most candidates used the correct figures, 27753 and 638, but the decimal point appeared in all possible positions. A few candidates did not realise they could use the given calculation and set about working out the question using long multiplication. In part (b) only a minority of candidates realised that it was necessary to divide the volume by the area of the base to get the depth. A similar number recognised that the emboldened 'Estimate' meant that rounding the figures was required. Many used the raw numbers and attempted long multiplication or division.

2 This question was well answered. In part (a) almost all candidates knew to add 0.4 to 0.55 with just a few not subtracting the answer from 1. A number of candidates made arithmetic errors in either the addition or the subtraction. Part (b) was also quite well answered. The most common errors were to multiply 190 by 0.55 or to divide 190 by 0.4.

3 In part (a), most appreciated that the quadrilateral was translated but many did not know the word. The generic 'transformation' was common as was 'move' and both 'transferred' and 'transported' were also seen. The column vector was seen from the better candidates but 5 to the left and 4 down was also accepted. Some candidates gave the wrong direction or omitted the direction in comments such as 'across 5'. It was quite common to see the description without the name of the transformation. In part (b) most candidates did a reflection but many used the wrong line with the *y*-axis being very common.

4 Most gave the correct coordinates. The most common error was to confuse a parallelogram with a trapezium and give D as (2,1), though some gave the *x* and *y* coordinates reversed. In part (b) most were able to give the correct area although some omitted the units or gave 'cm'. A few did not know the formula for the area of the parallelogram. In part (c), about half the candidates appreciated that the gradient was *y* increase divided by *x* increase but many of these omitted the negative sign or included '*x*' in their answer.

5 In part (a) many were unable to express their explanation well with many saying or implying that 4*x* was 4 notebooks and 5*y* was 5 pens rather than the cost of the same. A small minority of candidates were able to draw the correct line in part (b) usually those who knew the intercept method. Some of the candidates who calculated the intercepts plotted them at (4, 0) and (0, 5). Many obtained the answer £2.60 even with a wrong graph. Those reading from their graph were usually successful.

6 This was one of the AO3 questions. Those who realised that it was necessary to use equivalent fractions often recognised that the end points were $\frac{3}{9}$ and $\frac{6}{9}$ and obtained the correct answer. Others used, for example, 12ths and 24ths which did not lead to the correct answer. Many tried decimal approaches which were very rarely successful.

7 About a third of candidates were successful with part (a) and a significant number of the remainder gained 1 mark for one term correct. Common errors were $2x^3$ for the first term and $-10x^2$ or $5x^3$ for the second term. In part (b) too about a third were completely successful. Here too a significant number gained part marks from partial factorisation.

8 In part (a) most candidates were successful. The most common method was using a 'factor tree' and some gained a part mark if they made a single error. In part (b) many correct responses were seen although the prime factor forms were not necessarily used. Many listed multiples of 180 and 140 and were often let down by arithmetic errors. Confusion with HCF was common with many answers of 20 seen. Part (c) was omitted by a significant number of candidates.

9 In part (a) many candidates seemed to know the rules of indices and trialled values to find the solution. Some realised that $\div 2^3$ would be $\times 2^3$, when the equation was manipulated, giving $2^{x+2} = 2^6 \times 2^3$ then $2^{x+2} = 2^9$ but a number could go no further. Some changed 2^3 and 2^6 into 8 and 64 and followed this with the equation $2^{x+2} \div 8 = 64$ or $2^{x+2} = 512$ but few could proceed from this point. Very few extracted the indices to use the equation $x + 2 - 3 = 6$. A few gave the final answer as $x = 2^7$, others saw the index equation as $(x + 2)/3 = 6$ leading to $x + 2 = 18$ and then $x = 16$.
In part (b) the major difficulty was presented by the left side of the equation. Many thought $(3^{2y})^2 = 9^{4y}$. Those, who reached $3^{4y} = 3^{y+6}$, were often successful in reaching the final answer, usually by choosing a value that worked rather than by solving an equation. Some used a formal solution of $4y = y + 6$ etc and a few retained the index notation in their method: $3^{4y} = 3^y \times 3^6$ then $3^{3y} = 3^6$ then $3^y = 3^2$ and finally $y = 2$, or sometimes $y = {}^2$.

10 In part (a), very often the error was that 1 was regarded as a prime number leading to an incorrect placement in A ∩ B. The value 2 was also regularly misplaced. A few used values greater than 15, for example 30, as it was a factor of 30 and a few used all the integers up to 30. Very few candidates missed out values but a few repeated values. Most gained at least 1 mark, often for the intersection correct, but a minority gained full marks. In part (b), which was marked on a follow through basis, most gained one or two marks but very few gained all three. The majority gained the mark for the intersection. Part (ii) was the most successful, probably due to it being in words rather than using set notation. Only a small minority were successful with part (iii) with many reading it as (A ∩ B)' and others B'.

11 As stated in the general comments, this was the QWC question and clear labelling of angles with reasons for statements made was expected. The two methods listed on the mark scheme were used regularly with the method using angle BDF being slightly more popular. Many only gained 2 marks for the first part of the solution. Many gave correct values for the required angles but were confused regarding the reasons. Some confused 'alternate segment' with 'alternate angle' or 'opposite segment' and also 'opposite angles in a cyclic quadrilateral' with 'opposite angles in a quadrilateral'. A number of wrong assumptions were made. Among these were that angle BDF was 90° as it was between a tangent and a radius, AB being parallel to EF and ABD being isosceles. A few started by wrongly thinking that ADF was 110°. Some simply gave the final answer of 110° without any working or reasons. A very uncommon, but valid, solution was to join OD and OB to form ∆BOD. Then ODB = 20° (tangent and radius meet at 90° so ODB = 90 – BDE) and BOD = 140° (isosceles triangle), reflex BOD = 220° (angles round a point) followed by BCD = 110° (angle subtended at centre is twice the angle subtended at the circumference).

12 Many reached 20/100 and 19/99 but a significant number added these fractions and those who multiplied often failed to reach the correct answer. Common errors were 20/100 × 20/100, 20/100 × 18/99 or 21/100 × 20/99. Tree diagrams were often used.

13 Just a few candidates gave an excellent vector proof. A large majority made no progress in the formal proof that was required. Very few found the vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ Many indicated that it was due to a 3 : 2 ratio. Some gave correct vectors for AB and CD but could not give a reason for them being parallel. Many thought that it was an equilateral or isosceles triangle and that a vector of 5a was equal to a vector of 5b. Some simply gave corresponding angles as their reason or gave reasons about the lengths of lines rather than vectors. A few stated that ∆OAB was an enlargement of ∆OCD but gave no further evidence. In part (b) most common errors were 3 : 2 or 2 : 3 but other ratios also occurred. A few gave 5 : 3 or 3/5. Those who realised it was 3 : 5 sometimes gave their answer in an equivalent form like 6 : 10 or 1 : 1 2/3.

B392/01 Methods in Mathematics 2 (Foundation Tier)

General Comments

A full spread of attainment was seen on this paper with most candidates having been appropriately entered. Questions on basic sequences, number operations and coordinates were particularly well answered. Most candidates showed the stages in their working clearly when solving a linear equation, which was one of the questions designated as assessing the quality of written communication. Questions on the two topics unique to the methods specification, tessellations and algebraic proof, were not well answered. Performance was varied on the questions addressing AO3. For some questions candidates failed to consider the whole problem. For example in Q3 many did not use a total of 9 tiles and in Q5 they did not comment on the equal ratios. Working in Q11 and Q18 tended to be unstructured and many candidates failed to gain partial credit for the methods used as they tended to be 'ad-hoc' jottings with no structure.

Comments on Individual Questions

1 This question proved to be a very positive start to the paper. Errors occurred in the second sequence when candidates added 5 to the previous term and in the third sequence when, although generally the third term was correct, arithmetical errors occurred when evaluating the fourth and fifth terms.

2 In part (a), most candidates were able to perform this decimal calculation. The common error was to evaluate 13.8 + 7.7/2.5 through incorrect calculator use and reach 16.88. Some candidates gave an answer in fraction mode, 43/8. If a question is set using decimals the answers would generally be expected as a decimal.
In part (b), almost all candidates were able to find the square root of 289.
In part (c), finding the cube of 16 proved slightly more difficult with some candidates evaluating 16 × 3 = 48. A few answers included a decimal point, possibly in place of a comma.
In part (d), the majority of candidates were able to find three quarters of 860 generally by first finding a quarter and then three quarters.

3 A full range of responses was seen in this question. Many candidates missed that they needed to use nine tiles in total; with some avoiding the nine completely and with others thinking that each shape had to be made from nine tiles. Others made shapes that were not quadrilaterals and some used part tiles. The rhombus was often named as a kite and this was accepted but diamond was not acceptable. Many candidates drew both an oblique and a horizontal rhombus with the first being labelled kite and the second rhombus. Candidates were generally able to name a trapezium if drawn but they were less successful with the parallelogram.

4 In part (a), the majority of candidates found the correct perimeter. The common error was to give the area of the rectangle.
In part (b)(i), candidates were then generally able to use their answer to part (a) to draw a rectangle with the same perimeter but a larger area. Some drew a rectangle with a smaller area and a few drew another rectangle measuring 9cm by 2cm.
In part (b)(ii), the majority of candidates were able to give the correct area for their rectangle and most included the units in their answer. Those candidates who found the area in part (a) generally found the perimeter in this part.

5 In part (a), few candidates were able to give a satisfactory explanation for the sum of the angles of a quadrilateral. Most made an attempt but generally described a square or a rectangle and then explained that 4 x 90° = 360°.
Part (b), was well answered with many fully correct answers. Some candidates lost marks through transposing 55 and 125. Some errors arose through calculation mistakes but most candidates realised that angles C and D were equal.

6 In part (a), almost all candidates correctly plotted the two points.
In part (b), the majority of candidates recognised the midpoint but some attempted to record both coordinates as integers and others misread their plotted point. Other errors included (3,1.5) from subtracting rather than adding the coordinates of A and B, and (5, 4) from drawing a horizontal line from A and a vertical line from B and then giving the coordinates of the point of intersection.

7 In part (a)(i), the sum of the corner numbers was invariably correct.
In part (a)(ii), almost all candidates were able to complete a square and then find the sum.
In part (a)(iii), many clear concise descriptions of the connection were seen. Some referred to the sum being a multiple of the middle number rather than 4 times the middle number. Use of 'the answer' rather than the sum of the corner numbers was condoned but 'it' or similar being used for both the sum and the middle number was not accepted for both marks.
In part (b)(i),more able candidates wrote correct algebraic expressions in the squares. Others recorded $x + 4$, $x + 6$ and x +.6 and weaker candidates tended to just give numerical values.
In part (b)(ii), only the most able candidates were able to find the expression for the sum in terms of x. Errors included x^4 rather than $4x$, finding the sum of all five terms and ignoring the coefficient of x (giving $x + 44$).
Part (b)(iii), was only really accessible to those who had been successful in the previous part but few recognised that they needed to relate their expression for the sum to that for the middle term. Most candidates who attempted this part simply substituted new numbers.

8 A full range of responses was seen for this question. Answers of 0.25 and 5% were generally seen. Common errors were 1/5 for 0.05 and 0.2 and 20% for 2/5. Some forgot to simplify their fractions.

9 In part (a), most were able to solve the simple equation. Errors were 2 and -1.
Part (b), was designated as a QWC (quality of written communication) question. The majority of candidates presented their work clearly, step by step and usually describing the inverse operation they were using. Some candidates reached $15x = 40$ and then recorded 2.6 or 2.7 without showing 40/15 or 2.666 or stating that 2.7 was the solution correct to 1dp. A common error was 15x + 10 = 50 then 5x = 50 with −10 shown against each term. Some candidates used flow diagrams but errors tended to occur.

10 In part (a), the majority of candidates found the correct volume. Some found the surface area for 3 or 6 faces and some simply added the three lengths.
In part (b), the correct volume was found by more able candidates. Others gained some credit for finding the volume of two cuboids (4 by 5 by 5 and 4 by 3 by 5), missing the fact that the left hand cuboid had height 8m. As in the previous part some found the surface area or added the given lengths. Other wrong answers commonly seen were 6000 from multiplying all given lengths and 320 from 8 x 8 x 5.

11 In part (a), most candidates realised that they needed to plot the points and draw a straight line for this conversion graph. Some, having plotted points, then drew a bar chart.
In part (b), many candidates were able to interpret this problem and find a strategy to reach a solution. Some simply used 50 miles = 80 km to write 550 miles = 880 km and then found the difference of 40 km. Others performed basically the same calculation for converting 550 miles to kilometres or 840 km to miles but in stages. Some used the graph and although this resulted in a less accurate answer full marks were scored. Weaker candidates multiplied or divided both distances by the same number and then subtracted or simply subtracted 550 from 880.

12 A range of misunderstandings and misconceptions were exposed in the responses to this question. They included:

< means greater than
⅓ = 0.3 (and 'so the statement is false because they are the same'.)
Squaring makes something bigger
$(1/5)^2 = 2/10$

Many candidates did however recognise that 1/3 = 0.3 recurring and $(1/5)^2 = 1/25$ or 0.04.

13 In part (b)(i), the number was generally correctly written in words but errors were seen including thirteen million and thirteen thousand.
In part (b)(ii), many acceptable answers were seen. A common error was to simply subtract 130400 from 825400 –often with an answer of 695000. A common response was '7 times' presumably from interpreting this subtraction.
Part (c) required candidates to analyse the problem, use an appropriate method and interpret the results. The majority of candidates failed to relate the capital to the country and many just wrote descriptions comparing England and Namibia. Some did find each capital's population as a percentage of the country's or found a multiplication factor or a unitary ratio. Those who used percentages generally reached the correct conclusion but those who recorded 6.7... for England and 7.8... for Namibia generally misinterpreted their calculation.

14 To solve this problem, candidates were required to interpret the ratios in terms of the relative strength of the drinks. Many correct solutions were seen but few explicitly stated that A and E were the same strength although this could be implied from the working. Some candidates misinterpreted the strength and wrote the ratios in the reverse order. Appropriate working was seen with candidates simplifying ratios for B and E or writing all ratios in equivalent form. Weaker candidates added the numbers in each ratio then ordered these totals.

15 In part (a), some candidates found the exterior angle but generally they failed to then find the interior angle. A few found the sum of the angles of the pentagon and then worked out the interior angle.
Over half the candidates omitted part (b). Those who attempted an explanation generally gave very vague reasons such as 'they won't fit together'. A few used a diagram combined with the interior angle to give an acceptable explanation.

16 Rearranging a formula is one of the harder topics within this unit. Many of the more able candidates used an appropriate method and gained at least one mark. Weaker candidates tended to just swop the letters y and x.

17 A reasonable proportion of candidates recognised that they needed to use Pythagoras' rule but it was more common to see $\sqrt{(9^2 + 3^2)}$ rather than the correct $\sqrt{(9^2 - 3^2)}$.

18 Questions of this form have previously been presented in a more structured format. Few candidates adopted this approach for themselves and it was rare to see the pattern number and the number of sticks tabulated for the given patterns. A reasonable proportion of candidates gave the correct number of sticks generally from using $2n + 1$ but sometimes from adding on 2 with or without a diagram. Many who used a less sophisticated method failed to reach the answer 101. Common errors were to find the number of sticks in the 5^{th} pattern (11) and then multiply by 10 (110 sticks) or to simply multiply 50 by 3 (150 sticks).

19 In part (a), most candidates attempted to find the values of y by substituting values of x in the expression and about half obtained correct values, at least for $x = 1$ and $x = 2$. Some candidates continued a linear sequence, entering 4 and 2, then either 2 and 4 or -2 and -4.

In part (b), those candidates who had completed a table in part (a) generally scored a mark for plotting the points. More able candidates drew the correct quadratic graph with few losing a mark for excessive lines or a flat 'bottom'.

In part (c), many more able candidates gave a correct solution to the equation by taking one reading from the graph but very few gave two solutions.

B392/02 Methods in Mathematics 2 (Higher Tier)

General Comments

A wide spread of attainment was seen in this paper. A few candidates scored above 80 marks but there were some candidates who scored very few marks and they would probably have been more appropriately entered at Foundation level. Most candidates showed working which meant that method marks could be awarded. However the setting out of the work was often rather disorganised and not in a clear order. Errors arose in some final answers as a result of premature rounding, sometimes midway through a calculation and sometimes at the start, for example writing 4/3 as 1.3 and π as 3. Other candidates used excessive degrees of accuracy, writing all the figures shown on the calculator as the answer.

Candidates answered questions involving converting between fractions, decimals and percentages, ratio, quadratic graphs, explaining errors in calculations and converting recurring decimals well. Errors in the recall of basic facts and a failure to correctly identify angles and lengths led to incorrect solutions to the geometry questions. For example using the incorrect dimensions when calculating volume, incorrect recall of facts in the tessellation question, using the wrong formula for area of a circle and misinterpreting bearings. Algebraic skills were weaker than expected and candidates were clearly not ready to write an algebraic proof or to set up an equation. Using decimal places and significant figures was also weaker than expected and clearly candidates were not familiar with proportion other than the simplest case. Two topics unique to this paper, tessellations and algebraic proof, were not well answered.

Five questions, 5(b)(iii), 8, 13(b), 15(b) and 16 included an assessment of candidates' ability to interpret and analyse problems and use mathematical reasoning to solve them. In general candidates performed less well on these questions. Candidates were uncertain on occasion how to start the question, particularly in Q13(b), but once they had embarked a wide range of strategies were used.

The quality of written communication was assessed in questions 5(b)(iii) and 15(b) and most candidates made a good effort to communicate effectively by using the correct terms and showing their working. However, there was a tendency to present the work in continuous prose when writing clear statements step by step would have been more effective.

Comments on Individual Questions

1 In part (a), almost all candidates performed the correct calculation but writing the answer correct to 3 significant figures was often incorrect. Some truncated their answer to 6.70 and others rounded to 3 decimal places.
Again, in part (b), candidates performed the correct calculation, sometimes in two stages and they were more successful than in part (a) with writing to the required degree of accuracy. Some truncated the answer or wrote the solution correct to 3, rather than 4, decimal places.

2 Most candidates solved the equation correctly. Errors arose in expanding the bracket and rearranging the equation. It was surprising that a few candidates appeared totally unfamiliar with this topic.

3 In part (a), about half the candidates found the correct volume and most stated the correct units. Others appreciated that the prism should be split into two cuboids but an answer of 44cm^3 was common as candidates used the incorrect dimensions. Various other errors were seen, including finding the surface area of all, or some of, the faces, multiplying all the dimensions together and multiplying 'their cross section' by 5.
In part (b), the majority of candidates found the correct volume. Most errors arose by candidates substituting the diameter, rather than the radius, or using the square of the radius, rather than the cube. Some failed to show the expression they were evaluating and so when errors arose in the calculation, sometimes from very premature rounding, no marks were earned.

4 Most candidates were confident in converting between fractions, decimals and percentages. Marks were lost through not writing the fractions in their simplest form or truncating the two percentages, 37% and 16%.

5 In part (a)(i), candidates either found the interior angle and then subtracted from 180 or found the sum of the angles of a pentagon and divided by 5. Errors arose when candidates forgot to subtract from 180, used the wrong angle sum or the wrong number of sides.
In part (a)(ii), some of the candidates who had reached 108° in the previous part were able to use this fact to explain that regular pentagons would not tessellate as 108 was not a factor of 360. Some used a diagram to support their explanation. Other explanations were rarely adequate. Descriptions referred to gaps and then the diagram showed pentagons meeting at one point but not another. Assumptions were made about tessellations having to lie along a straight line. Other candidates referred to different length sides not meeting or to the exterior angles.
In part (b)(i), those candidates who used the tessellation generally provided an adequate explanation. Others referred to the diagram ABCDE, stated that triangle CDE was equilateral, without any justification, and therefore D was 60°. Others used the information in the next part to work out angle D.
In part (b)(ii), the common error was to use the sum of angles of a quadrilateral, rather than a pentagon, leading to an answer of 75°.
In part (b)(iii), some candidates identified equal angles rather than sides. Others used poor notation for the sides. A to E was condoned on this occasion but not A + E nor A, E. Full explanations were extremely rare. Some referred to the two pairs of equal sides DE and DC, EA and BC, explaining that they were equal because of the line of symmetry from D. Others referred to EA, AB and BC being equal because the sides met in the tessellation.

6 Most candidates recognised that they needed to use Pythagoras' rule but a significant proportion worked out $\sqrt{(9^2 + 3^2)}$ rather than the correct $\sqrt{(9^2 - 3^2)}$.
Some tried, without success, to use trigonometry.

7 Many correct answers were seen to this question but a significant proportion of candidates shared £28 in the ratio 3:2 so an answer of £16.80 was common.

8 Again many correct answers were seen but methods were often not clear. Some found the 5th term and then simply multiplied by 10 and others even used $2n + 1$ to find an early term in the sequence and then multiplied. $3n + 2$ was often stated as the *n*th term.

9 In part (a), evaluation of the expression for $x = 1$ and $x = 2$ was generally correct but various errors arose when substituting $x = -1$ and $x = -2$.
In part (b), those candidates who had completed a table in part (a) generally scored a mark for plotting the points. Those candidates who gained full marks in part (a) then drew the correct quadratic graph in part (b) with few losing a mark for excessive lines or a flat 'bottom'.
In part (c), many candidates gave one correct solution to the equation by taking one reading from the graph but only the more able candidates gave two solutions.

10 In part (a), candidates explained, in various ways, why the multiplication of the two numbers was incorrect. There was a tendency to use 'decimal' when referring to a number less than one but this was condoned in this instance. A common response which was not accepted was 'there is a missing 0 because 0.*n* x 0.*n* always gives 0.0...' although, clearly, a response in which the numbers were rounded to 1 decimal place and then correctly multiplied did score.
In part (b), to explain why the addition of the fractions was incorrect, candidates either referred to the 5 not being a possible common denominator or to the answer (3/5) being less than one of the fractions (2/3). There was a lack of clarity in some explanations, particularly those referring to cross multiplying the two fractions.

11 In part (a), most candidates were successful. Some failed to select a window of adjacent numbers and some added rather than multiplied.
In part (b), a minority of candidates were successful. Many failed to appreciate that they needed to write expressions which applied for all windows in the table and so responses such as 2*e*, 8*e* and 9*e* or 1.5*e*, 4.5*e*, 5*e* or three numbers were common.
In part (c), candidates failed to appreciate that they needed to multiply their expressions from part (b) to prove that $fg - eh$ was always 7. Most gave very wordy explanations often referring to 7 days in a week but these did not score.

12 In part (a), about half the candidates selected the correct equation for this cubic graph. It was surprising that many chose the linear equation.
In part (b), candidates were slightly less successful, often choosing the other quadratic equation.
In part (c), many recognised that this was the graph of a trigonometric function but only about a half identified it as $y = \sin x$.

13 In part (a), about half the candidates realised that this was a reverse percentage question and so divided 100 by 0.8 to reach £125. Most other candidates simply multiplied 100 by 1.2, in one or two stages. Other incorrect calculations seen on several occasions were 100 ÷ 0.2 = 500 and 100 x 1.8 = 180.
In part (b), a reasonable proportion of more able candidates were able to solve the problem. Most started by choosing a starting price, usually £100 or £125, then working out the special offer price and then finding the percentage increase. At the final stage, calculations such as 40/60 or 125/75 or trial and improvement were seen. Some weaker candidates found the special offer price for their normal price but often it was not clear whether candidates were referring to £60 or 60%. The most common answer seen was 60%.

14 In part (a), some candidates had a clear method for solving proportionality problems. This usually involved writing $y = kx^3$ at the start, substituting to find k, writing the equation and then substituting for x to find y. In general these candidates reached the correct answer. However, these good solutions were in the minority. Many just found the cube of 8 or assumed that y was proportional to x, divided 20 by 2 and then answered 8 x 10 = 80.

In part (b), those candidates who had reached 1280 in part (a) generally reached at least 400. Many candidates simply found the cube root of 1000.

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