OCR
RECOGNISING ACHIEVEMENT

GCSE

Methods in Mathematics (Pilot)

General Certificate of Secondary Education **J926**

OCR Report to Centres

June 2013

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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.

OCR will not enter into any discussion or correspondence in connection with this report.

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General Certificate of Secondary Education

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OCR REPORT TO CENTRES

Overview

This is the third June award for this pilot specification. Both the total number aggregating and the entries for individual units were lower than in June 2012. However it did appear that candidates were well prepared for the units. Similarly it was noticeable that there were few very low marks on the Higher papers and few very high marks on Foundation. Overall Centres appear to be entering candidates for the appropriate tier and at a suitable time. Candidates generally performed as expected on individual questions. The exceptions were questions involving area of composite shapes and finding dimensions of a cuboid given the volume. The use of Venn diagrams and set notation is unique to this specification and whilst the vast majority of candidates were prepared to tackle these questions many struggled with the more demanding aspects.

All papers included questions which expected candidates to be able to interpret and analyse problems and use mathematical reasoning to solve them. Examiners reported that candidates appeared to be prepared to tackle questions set in novel situations and thus achieved at least partial credit for their response.

The quality of written communication was addressed in a variety of ways. Many candidates produced good quality responses particularly for numerical problems, showing the stages in their working, indicating what their calculations represented and communicating their solution clearly. Questions requiring an explanation, particularly to justify a geometrical statement were generally less successful.

Overall results for Methods and Applications were broadly similar, although clearly many candidates were stronger in one specification than the other. For all papers performance was reasonably close to the forecasts at most thresholds although unfortunately there was a substantial reduction in the proportion of Centres submitting forecast grades.

To improve standards further Centres are encouraged to focus on the aspects raised in the detail of the reports. Centres are reminded that they are able to analyse the performance of individual candidates and of groups, comparing results to that achieved by all candidates, using the Active Results service.

B391/01 Foundation Tier

General Comments

A good spread of marks was seen for this paper and the paper differentiated quite well with marks across almost the whole range, but with fewer candidates at the lower end of the range.

Time was not an issue as most candidates answered all questions on the paper. The algebra questions were well attempted this session, particularly the substitution which often causes difficulties, with fewer candidates leaving letters next to the numbers, or substituting letters for digits rather than multiplying when evaluating expressions. Very few candidates thought to set up simple equations in Q12 to solve the number problem. Finding the area of the shape in Q10 by splitting it proved to be more difficult than expected. The negative numbers in Q9(d) also proved to be problematic for some candidates.

Question 2(b)(ii) was the QWC question as indicated by the asterisk on the question number. As such it was expected that candidates should set out the solution in a clearly explained way and many candidates achieved an acceptable level of detail in the explanation.

It was encouraging that attempts to show working out was seen more on the questions in this paper.

The omission rates for this paper seem to be lower than for previous papers suggesting that there were no questions that were inaccessible to candidates.

Comments on Individual Questions

1 This question was very well answered, with a very large majority of candidates earning the marks for parts (a), (c) and (d). Over half had the correct answer to part (b), but common errors were to put $\frac{1}{2}$ and $\frac{2}{3}$ the wrong way round, or to put $\frac{3}{7}$ as the highest fraction.

2 In part (a) the majority of candidates could write the number correctly in words, though with some poor spelling of "Forty", and could write the number to the nearest 100, although sometimes the answer was written as 43 900, 438 or just 800. Writing the number to 2 significant figures proved more difficult, with some candidates omitting part (a)(iii); giving 44 or 43000 and writing the number out again in full were common mistakes. In part (b)(i) a large majority of candidates were able to fill in the missing numbers in the fractions. A large majority of candidates scored at least 1 mark in part (b)(ii) for writing $\frac{30}{150}$, or equivalent, and attempting to cancel it down. Many got to $\frac{3}{15}$ or $\frac{15}{75}$ and stopped and so were unable to compare the fractions. Just under half the candidates earned three marks for part (b)(ii). Some candidates compared the figures, rather than the fractions, and then gave the incorrect family.

3 This question was very well answered with most candidates scoring 2 marks. There were a few candidates scoring 1 mark for two matchings correct.

4 Most were able to give $x = 3$ in part (a)(i), with slightly fewer earning the two marks for part (a)(ii). Very few earned just the method mark in part (a)(ii). In part (b) a large majority earned the two marks, with some candidates earning one of the marks for 14 or 12 shown. The most common error was to substitute the number directly for the letter giving 27 + 34 = 61. Some added the numbers to give 9 + 7.

5 The reflection in part (a) was done correctly by almost all candidates. Just under half the candidates were successful at shading to achieve rotation symmetry of order 4 in part (b), with many different wrong answers being given, including the L shape being often translated on the grid.

6 Most candidates were able to give 25 as the number of bricks for part (a) and the volume was also well answered. Common mistakes were to multiply by 6 to give the surface area and some just counted the cubes or faces they could see in the diagram to give 75 as the answer. In part (b) it was rare for a candidate to just earn the method mark.

7 A large majority of the candidates earned the marks in parts (a) and (b)(i) for correct answers, and often, but not always, working out was shown. In part (b)(ii) a large majority of candidates earned two marks, but errors were quite often made in the subtraction by candidates using the “counting on” method. Those using the traditional subtraction sum seemed to fare better, but errors were sometimes made with one figure in this.

8 Part (a) was very well answered and it was pleasing that most of the candidates understood that the total probabilities needed to sum to 1. A majority of candidates also understood how to tackle expected frequency in part (b)(i), although common errors were 0.2, 1 and 0.1. Part (b)(ii) was answered correctly by very few candidates. Most said that probability was just luck and as the probability of gold was the lowest, so you were not likely to get one. Very few mentioned sample size or gave other acceptable answers.

9 The vast majority of candidates had the correct answer for the coordinates in part (a), and in part (b) most had the correct positions plotted, although some had the x and y values the wrong way round. In part (c) many thought that $0 \times 2 = 2$ and omitted the negative sign from the 8, although a majority of candidates earned two marks. There was much confusion with the negative signs in part (d) where 5 and 2 were often used, but with incorrect or omitted negative signs. Despite the example, a large number did not understand the term “product” and gave coordinates which summed to 10 or –10. Some candidates used coordinates that were not on the grid provided, but did have the correct product. It was only a minority of candidates that earned two marks in each of sub-parts (i) and (ii) of part (d).

10 In part (a) many candidates thought the shape had reflection symmetry or used words such as “parallel” or “line”. Only a small minority of candidates found the area of the triangle correctly in part (b)(i), with 12 being a common incorrect answer. It seemed that many were using the perimeter in both parts (b)(i) and (b)(ii) and some multiplied all the numbers on the diagram. Some used 4×5 as the area of the rectangle, failing to double the 4 to give the whole length. Another error by a number of candidates was to multiply the total length of each long side to give $8 \times 8 = 64$. Candidates with a correct answer of 6 for part (b)(i), usually followed this with the correct answer of 52 for part (b)(ii). However, some candidates gained two marks for part (b)(ii) by following through their (b)(i) answer plus 40.

11 Many candidates managed to gain some marks here, usually from the first entry and from following through the candidate's $3x+2y$ added to $3x$. $3x+2y$ proved to be the most difficult expression to find. Marks were lost through failing to simplify expressions, although this was only penalised once.

12 A significant minority found the correct numbers through trial and improvement but the majority gave answers which did not fulfil both criteria, although many gained a mark for fulfilling one of them. Very few candidates attempted to write down any algebra to help them solve this problem. There were just a few candidates who had the correct values but reversed - this earned the special case mark. A score of one mark was quite often earned for two values with a difference of 5. Some candidates presented answers where the second number was three times the first and scored no marks for this.

13 Few candidates scored full marks for correctly completing the Venn diagram, although many did put some values in the correct areas to earn one mark. There were few lists of numbers seen for primes up to 12 or factors of 12 which would have aided completion of the diagram. Part (a) was the part question with the biggest omission rate on the paper, with approximately a quarter of the candidates leaving the diagram blank. Fewer candidates omitted part (b), with a significant minority earning the mark in this part following on from their diagram. A common wrong answer in part (b) was to give the list of numbers in P U F.

B391/02 Higher Tier

General Comments

The paper differentiated quite well with marks across the whole range. It also proved accessible to most, as omission rates were very low with only questions 7a(i), 9c, 9d and 10b having omission rates above 0.1. Very few candidates produced marks in single figures suggesting that there were smaller numbers for whom entry at Foundation level may have been a more rewarding experience.

Basic arithmetic continues to let many candidates down. The inability of candidates to do the basic four operations led to a fairly substantial loss of marks for some candidates.

Questions 3, 5 and 10 required candidates to interpret and analyse problems and use mathematical reasoning (AO3). Performance in these questions proved mixed with question Q3 having the highest facility and, possibly to be expected, Q10 having the lowest.

Question 5 was also the QWC question as indicated by the asterisk by the question number. As such it was expected that candidates should set out the solution clearly and provide working for the various calculations. A majority of the candidates did this quite well. It appears that candidates are much more comfortable when calculations are required in QWC questions, than when geometric reasons and logic are required.

One of the topics which distinguish this specification from other Mathematics specifications is Venn diagrams, yet it appeared that many candidates were insufficiently prepared for the demands they faced in question 7.

Comments on Individual Questions

1 This question provided a good start for candidates. Almost all completed the table correctly with only occasional errors. The probabilities were also usually obtained correctly with just a few miscounting the 6s or odd numbers or thinking the number of outcomes was 16 or 25 instead of 20. Just a few candidates wrongly thought that 2 in 20 or 2 : 20 is an acceptable way to give probabilities.

2 Part (a) was quite poorly done with 'none', 'reflective', 'asymmetric', 'opposite', 'isometric' and ‘reverse’ all being seen.
The area of the triangle was usually correct, although a few used length × width, while others stated the correct method but did not divide by 2. Some calculated the hypotenuse and used this as the height or simply gave 5 as the area.
The area of the complete shape was marked on a follow through basis and so most gained both marks in part (b)(ii), but a few thought the area of the rectangle was 4 × 5 = 20.

3 Most were able to reach the required values of 7.5 and 2.5 with a little or no working out, but the common error was to reverse the answers. Often values of 2 then 3 were trialled for Waqar’s number and then correct answers reached. Others trialled different random values and usually failed to find the solutions. Just a few used simultaneous equations (often $A = 3W$ and $A – W = 5$) and were usually successful in solving these equations.

4 In part (a) it was pleasing to note that most candidates were using algebraic equation solving techniques rather than trial and error and many were successful. The usual errors were sign errors, but where these were made, most candidates were able to gain a part mark. In part (i) the most common errors were $2x = -9$ or $2x = 15$. In part (ii) the common errors were to reach $4x = 12$, $4x = 10$ or $4x = -10$ or, having reached $4x = -12$, going on to $x = -4$.
Most who understood what was required in part (b) were successful. Most took out the factor $3x$, although a few took out only one of the factors 3 and x. Weaker candidates often did not appreciate what was required.

5 Considering this was marked as a QWC question, some candidates paid little attention to the setting out of their response. Many candidates correctly worked out the total cost as £3210, but a significant number lost one or two marks. The common reasons were omission of the £ sign in the answer, omission of working for the petrol or insurance (or both) and making incorrect statements such as 1500 × 1.4 = 2100 + 130 = 3400 + 500 etc. Candidates should realise that it is incorrect to state that things are equal when they are not and it is likely to be penalised on a QWC question. When calculation errors occurred it was often due to being unable to divide 12 000 by 8 and/or multiply 1500 by 1.4. Fewer errors were made in reducing 480 by $\frac{1}{5}$ though some just gave the insurance as 120 or even added 120. A significant number thought the whole costs were reduced by $\frac{1}{5}$. What was surprising was the number of candidates who worked out totally unreasonable costs for petrol, such as £210 000, and made no attempt being to rectify this.

6 In part (a)(i) most candidates recognised the transformation as reflection but a number omitted or made errors in the equation of the mirror line. The most common of these were giving the mirror line as $x = 1$ or $y1$ or as coordinates. In part (ii) most recognised that the transformation was a rotation, but many were unable to complete the description correctly. The description of a rotation requires the angle, the direction and the centre.
In both parts a considerable number of candidates ignored the instruction to describe the single transformation, instead giving a combination of transformations.

7 Most candidates had at least partial success with the Venn diagram The most common errors were not considering 2 as prime or considering 9 as prime. Most also gained the marks in parts (ii) and (iii) although there was sometimes confusion between ∩ and U and a lack of understanding of the complement symbol. Some candidates omitted part (i) and it was unclear whether this was lack of understanding of Venn diagrams or the language of factors and primes. It may well have been the latter since some gained marks for parts (ii) and (iii) on a follow through basis. In part (b) most were able to place 'a' correctly but only the better candidates were able to place 'b' and 'c' correctly. Candidates should be aware that Sets is one of the topics which distinguishes this specification from others, so it will often be tested.

8 Most were able to convert from 12 litres to 12 000 cm^3, but many could make no further worthwhile progress. Many worked out the full volume of the container. One of the most common answers was 8000 from 20 000 – 12 000 and a few found the cube root of 8000 as 20. Others divided 20 000 by 12 000. The most common correct method was 12 000 ÷ 800. Others did 8000 ÷ 800 = 10 then subtracted this from 25. Some found the height for 1 litre (1.25 cm) and multiplied this by 12 and some found that 12 000 was 60% (or $\frac{3}{5}$) of 20 000 so 60% of 25 = 15.

9 This question proved very demanding and was only done well by the best candidates. Many started off by evaluating *a*, *b* and *c* and trying to work out the answers from there. Very few were successful in either working out the answers or converting back to prime factors. The very best candidates worked with the prime factors and gained most or all of the marks. In part (a) a common error was to subtract one from each power to give 2×3^3. Part (b) was the best answered part and those who knew the rules of indices were often successful. Some candidates gained more success with the HCF and LCM than with the first two parts. This may have been because they were used to the method for finding the HCF and LCM from prime factors. A common error, even from better candidates, was to give $2^8 \times 3^{11} \times 5 \times 7$ from working out $a \times b \times c$.

10 Many candidates knew the basic geometry to do this question, but often failed to appreciate that angle ABD was half the obtuse angle AOD, not half the reflex angle ABD. Hence $\frac{1}{2}x$ was a very common answer to part (a). Many of these candidates went on to gain the marks for part (b) on a follow through basis. Hence more marks were gained on part (b). A number of weaker candidates gave numerical answers, or answers that were not functions of *x*, eg 180 – ABD for part (b).

11 Part (a) was the best answered of the later questions with many gaining all or most of the marks. Perhaps surprisingly more errors came in working out the numerical coefficient than in the indices. $5a^6b^5$ and $3a^6 \times 2b^5$ were quite common in (i) as were $2x^6y^{12}$ and $6x^6y^{12}$ in (ii). Where errors did occur in the indices it was usually from multiplying the powers in (i) and/or adding the powers in (ii).
Part (b) proved much more difficult with only the better candidates reaching the correct answer. Many multiplied 9 by –3 and by 2 or squared the 9.

12 There were many correct answers to part (a), although $\frac{5}{18}$ was quite common.
A number of candidates identified the two correct fractions in part (b), but added these two fractions instead of multiplying them. Also many changed either the numerator or the denominator in the second fraction, but not both, and some simply gave the answer $\frac{4}{16}$. A few candidates made calculation mistakes, after having written down the correct multiplication.

B392/01 Foundation Tier

General Comments

Entry for this paper was lower than last year but almost all candidates appeared to be appropriately entered. Few very low or very high marks were seen.
Most candidates used a calculator and a ruler but examiners queried whether a few candidates lacked this basic equipment, particularly when Q2(c) was blank.
In general candidates made a good attempt at all questions with only the more challenging questions having a high 'no response' rate. Candidates were prepared to tackle more novel questions such as Q5(b), 9(c), 15(d) and 17. Candidates did well on money problems, proportion, calculator use, coordinates and basic sequences. Some candidates struggled with formal algebra, applying Pythagoras and using inverses to solve a volume problem.
Most candidates were prepared to attempt explanations, but sometimes they were too general and omitted clear mathematical statements.
Candidates generally showed their working, but too often it was presented in a rather muddled manner. This was particularly evident in Q14(b)(ii), one of the questions addressing QWC, where often a figure such as 750 was just written down rather than, for example, explaining that 70 m^2 was equivalent to 750 square feet, reading from the graph.

Comments on Individual Questions

1 Almost all candidates correctly answered the first part but generally were less successful in the other parts. In part (b) many missed that they were required to find the largest even number that could be made. A large majority were successful in part (c), finding the subtraction with the largest answer, but in part (d) only just over half realised the significance of arranging the 7 and 6 in the 'tens' boxes.

2 The vast majority of candidates were able to perform these calculations. The only common errors were 83. ... in part (a) and 54 (from 18×3) in part (c) but even these were not often seen. A few candidates gave an answer of 47/5 rather than 9.4 in part (a), presumably as their calculator was set in fraction mode.

3 Most candidates gained full marks for this simple proportion question. Almost all realised that they had to use the multiplier 3 and just a few made calculation errors, particularly with the half.

4 In part (a) about a half of the candidates were able to interpret the angle notation and the right angle symbol, whilst others thought that they were required to find the sum of three angles. Similarly in part (b) although over half the candidates were able to find the correct angle a significant number then gave a final answer of 270, the sum of three angles. In both parts a common incorrect method seen was to split the quadrilateral into two triangles and assume symmetry. Most candidates were able to find the perimeters in parts (c) and (d).

5 In part (a) most candidates were able to find the correct two sets of values of coins, although some failed to use units and so lost a mark. Part (b) proved more challenging, but half the candidates did manage to find the two correct costs. Generally a trial and improvement method was used rather than identifying the cost of 2 bars.

6 Almost all correctly completed the table and most were able to find the value of the 10th term. A few simply found the 5th term and then doubled the answer but this error appeared less often than in previous papers. Candidates found part (b) more challenging and, while over half scored some marks, only a small minority provided full explanations. A common error was to assume a term to term rule ‘add 3’ as in the first part.

7 About three quarters of candidates were able to convert the first two fractions to decimal form, but only a third of candidates were able to deal with the recurring decimal. In part (a) the common error was 0.7 rather than 0.07 and in part (c) many gave truncated or rounded answers.

8 Most candidates were able to find percentages of amounts but a significant number recorded their answer to part (b) as £43.4 rather than £43.40. Some candidates chose to use a ‘non-calculator’ method and, particularly in part (b), errors arose. A small, but significant, number of candidates interpreted ‘of’ as ‘off’.

9 Almost all candidates correctly plotted the points in part (a). About half identified the triangle as isosceles but, whilst scalene and equilateral were expected errors, it was surprising that many described quadrilaterals. In part (c) about a third of candidates were able to interpret the ratio and work out the coordinates. The common errors were (5, 2) and (5, 3).

10 In part (a) about half the candidates gained full marks. Others were more successful using angles of a triangle than angles on a straight line. Some decided that x and 40° were equal angles. In part (b) the majority of candidates were able to find the size of angle z. Not surprisingly the common error was 72.

11 Over half the candidates were able to find the correct number of cubes. Various other answers were seen, with the most common being finding full or partial surface areas. Only about a quarter of candidates were able to find a set of dimensions in part (b). Most ignored the square base but still could not find a different cuboid.

12 Almost all candidates solved the equation in part (a)(i) and the majority part (a)(ii). Only the more able candidates scored full marks in part (iii). Some expanded the brackets but could not proceed further, others produced a different equation and some just tried a trial and improvement approach. In part (b) the most common choice was ‘always true’ but only the most able candidates were able to provide an adequate explanation. The most successful were those that referred to ‘working out $5x$ before squaring’ and providing an example. A very common error was ‘never true, because they are the same’.

13 Over half the candidates gained full marks in this question. The common error was 720, 1200, 900 from dividing 3600 by 5, 3 and 4.

14 The majority of candidates realised that they needed to plot the points and draw a straight line in part (a). Most could then find the area of the floor but the perimeter 34 was a common incorrect answer. Two thirds of candidates were then able to make some progress towards finding the rental cost, but few provided sufficient evidence of their method to gain full marks. Many ignored the need to convert from square metres to square feet.

15 About half demonstrated that they understood congruency in part (a), with the others generally answering 7 or 11. Whilst most understood the need to find the area of the shaded shapes and the whole grid, generally inefficient counting methods were often employed and errors arose. Only the most able were able to then find the percentage. In part (c) most simply estimated a length rather than using Pythagoras. About two thirds of candidates made a good attempt at this part and about half of these gained full marks. Common errors usually involved the omission of the square or an inability to fit in the small triangles.

16 About half the candidates demonstrated some competence when substituting in the quadratic formula but errors arose with $y = -1$ often seen when $x = -1$. Some candidates appeared to attempt to produce a set of values for a linear formula. Many gained one mark for plotting in part (b) but few fully correct graphs were seen. Very few candidates were able to find even one solution to the equation.

17 Almost all candidates were able to tackle this question although some appeared a little rushed, possibly having spent time using inefficient methods earlier in the paper. About a third scored full marks for 18 and most others reached 16.

B392/02 Higher Tier

General Comments

This specification has now become more established and it is evident that centres have considered their levels of entry carefully. Candidates entered for this paper scored across the whole range from 0 to 90. Responses showed a high level of understanding and the number of candidates scoring below 20 marks was less than 2% of the entry. Very few seemed to be entered at an inappropriate level and the number of questions where no response was offered has declined. Mathematical instruments were generally not required and there was no evidence that anyone completed the examination without an appropriate calculator.

It is obvious that students are being told to write down more of their working and fewer are losing marks as a result of this. It would benefit many more if some attention could be given to achieving higher levels of presentation. Untidy work can often conceal the fact that the candidate has ideas that may deserve credit. In particular, the space allocated to questions such as question 13 is often covered with work that has been scattered around and sometimes written at various angles across the page. A variety of methods can be started, abandoned and then replaced with no real indication of what is intended to be considered or which part is meant to lead to the final answer. Weaker candidates should be encouraged to form letters and numbers properly and to communicate their ideas in a more logical sequence. The stronger candidates seem to have a decent grasp of this skill and are more likely to score valuable marks for method. Differentiation on this basis was most apparent in questions 6, 10, 12, 13 and 16.

Questions 10 and 12(a) required candidates to show good quality of written communication and there is evidence that more of them are developing an understanding for what is needed to score marks here. Many ran out of space on Q12(a) in an attempt to cover all aspects of the explanation and did not always give concise, relevant information. Others failed to understand that they needed to arrive at a final conclusion to prove the stated hypothesis rather than start with the assumption that the triangle was definitely equilateral and, therefore, contained angles of 60°. Conversely, failure to gain full marks in question 10 was more likely to occur as a result of a simple mathematical error at an early stage of the working.

It is clear that many of the issues mentioned above are being addressed to some extent and centres should be encouraged to continue to work in this direction.

Comments on Individual Questions

1 This question enabled most candidates to achieve a good start to the paper. Part (a)(i) was invariably answered correctly with only a very small number rounding unnecessarily. A majority scored full marks in part (a)(ii) with the most common errors coming from inaccurate rounding of the final answer or incorrect order of operations inside the square root usually leading to an answer of 2.72... Both parts of (b) scored well with 66/100 seen as a misconception in (i) and the recurring decimal in (ii) frequently terminated by rounding (usually to 0.951951952 or similar).

2 This was another question with many successful candidates scoring full marks in both parts. However, many responses in part (a), although correct, showed no working at all. Quite a few gave an answer of 6 from simply adding 1 kg to the weight of fruit and others applied the "rule" for fruit (2 x 2 kg + 1) to sugar hence getting 2 x 3 kg + 1 = 7 kg. In part (b), by far the most common error was a misread of the question giving Dave's share as £27.

3 Probably the most accessible question on the paper with an extremely low number of incorrect responses. The only error worth noting was the incorrect 9 and 27 in part (b).

4 The substitution of negative numbers caused some difficulty in part (a) and a value of $y = -1$ was often seen when $x = -1$. Other entries, from positive values of x, were usually correct. Plotting of their points in part (b) usually guaranteed a mark and stronger candidates seemed to be aware that the curve needed to be symmetrical and scored the other mark for drawing a smooth curve that extended below the x-axis. Weaker students continued to join incorrect points even though it "skewed" the graph and created a horizontal line through three points for which $y = -1$. Most realised that solutions to part (c) were found at the intersections of the curve with the x-axis and scored at least one mark for an attempt to obtain them within the allowed tolerance. Responses were split fairly evenly between those who found correct values, values obtained from an incorrect curve or a single value only. In the last case, it was usually the negative value that was missed. There were far more instances where candidates failed to offer a response here than any other question on the paper.

5 The concept of congruence was understood by the majority who gained the mark in part (a), but some confused the idea with similarity and stated 7 or 11 triangles. Most also gained full marks for correctly calculating the percentage in part (b), many others also managed to show a reasonable understanding of the process and only lost marks by failing to identify the correct area of the shaded sections. In part (c) there was a fairly even split between those who used Pythagoras or trigonometry correctly and those who really didn't know how to proceed. The former usually arrived at a correct answer with the required degree of accuracy, but the latter often showed no working at all before giving an answer of 2 or 2.8. A small number scored one mark for a Pythagoras statement or for correctly rounding their incorrect answer. Part (d) was answered really well with evidence of good spatial awareness. There was a large variety of different correct arrangements and where, errors occurred, they usually involved the omission of the square or an inability to fit in the small triangles.

6 A large majority of the candidates scored maximum marks for the algebraic manipulation required in part (a) and very few failed to score at all. Candidates who scored only part marks invariably knew how to expand the bracket to $3x - 6$ and usually managed to collect the x terms correctly. The most frequent errors occurred when collecting the numbers with the negative values causing problems leading to occasional answers of ±21. Part (b) proved to be a little more complex for many, and some failed at the first stage of the re-arrangement by giving $3x - 6 = 2y$ instead of $2y = 6 - 3x$ or $3x - 6 = -2y$. Others tried to divide by 2 as a first step but failed to halve the x term. The two-term quadratic in part (c) confused many and single answers (often 5) were common with only a minority arriving at two correct values for x. Most scored by a system of trial and improvement and many offered no method at all. Few used the factors of $x(x - 5) = 0$, although $(x + 0)(x - 5)$ appeared quite regularly. Many opted for a more complex use of the formula or even completing the square with varying degrees of success.

7 Most candidates could obtain the correct value, many with very little working. Weaker candidates frequently only got to 16 and a small number only gave one additional set of numbers. It was surprising to see some using negative numbers.

8 The solution in part (a) could be obtained by using "routine" trigonometry in a right-angled triangle and many of those who scored full marks correctly used the cosine function and its inverse. However, with so many different ways of navigating this problem, it was not surprising that many methods were complex and failed to reach a correct conclusion. Alternative methods often involved finding the missing length (RQ) by Pythagoras and then using sine, tangent, or more often, sine and cosine rules. Inevitably these methods offered more scope for errors to occur and further inaccuracies were caused by premature rounding leading to an answer that was out of the accepted range. Occasionally, angle R was found but without any intention to use it to find P. Part (b) was less complex but, surprisingly, less successful. Basically, the majority did not realise that, having found the volume of the appropriate cuboid, they were then required to divide by 3. Most either divided by 2 leading to an answer of 112.5 or didn't divide at all and obtained 225 (probably by simply multiplying the three numbers given on the diagram). There were a few who incorrectly treated the shape as a cone with a base radius of 5 cm.

9 There was almost universal understanding of the need for a whole number of females here, and many mentioned this, although a small minority stated 2 using the general rules of rounding. As most of these showed a correct method there were very few candidates who failed to score at all. In part (b) only around a half understood that 3.99 equated to 30% of the original price and some of these lost a mark as they had not used the required accuracy for answers involving money (2dp). Additionally, premature rounding of 10/3 to 3.3 usually resulted in an incorrect answer of 13.17. A few obtained 5.70 from working on a 30% reduction but the most common error was to increase 3.99 by 70% leading to an incorrect answer of 6.78.

10 This was the first of two questions requiring good quality of written communication in order to score full marks and only a very small number managed to achieve this level. Many candidates had a good idea about finding the two areas and adding them together, with only a few confusing the formulae for area and circumference. The majority scored at least one mark for correctly stating the area of the semi-circle. However, the quadrant caused real problems due to the fact that, in most cases, the radius of $2r$ was not fully squared due to a missing bracket. Hence, most scored a maximum of two marks for using $\frac{\pi r^2}{2}+\frac{2\pi r^2}{4}$ instead of $\frac{\pi r^2}{2}+\frac{\pi (2r)^2}{4}$, as a correct simplification was impossible from this point. Those who did use the correct expression often failed to correctly combine the areas mathematically as they couldn't cope with the algebraic fractions.

11 This question provided excellent differentiation with a good majority scoring full marks in part (a), most scoring one mark out of two in (b) and only the stronger candidates scoring at all in part (c). Part (a) was a fairly straightforward expansion of two brackets although the inclusion of a negative term caused the usual problems with multiplying and combining the x terms (often finishing with either $-5x$ or $+7x$). The multiplication of $2x$ and x was sometimes written as $3x$ and included in the x terms. Partial factorisation was the norm in part (b) with $3(x^2 - 4)$ being the most common response, closely followed by $(3x - 6)(x + 2)$ or $(3x + 6)(x - 2)$. It was quite obvious that many were testing their factors by multiplying their brackets. Only a handful scored full marks in part (c) with a few scoring one for a correct denominator seen. This was one of the least accessible questions on the paper.

12 Part (a) was the second QWC question and, again, full marks were quite rare due to incomplete explanations or statements. Full marks required students to fully justify how each angle in their calculation was obtained and to issue a final statement regarding all the angles in the equilateral triangle being equal. Too often students used the statement that both BAC and BCA were 60° to justify the size of other angles. Equally, angles in the quadrilateral were assumed to be the same, and AB = BC given, without any mention of the shape being a kite or symmetrical. Many, quite correctly, gave DAC = DCA = 45° followed by DAB = DCB = 105° and BAC = BCA = 60° but with no explanation about how they had arrived at these conclusions. Most commonly, one mark was awarded for stating a relevant fact. Part (b) could be answered without the same amount of detail and was consequently more successful. Most candidates managed to find the area of triangle ACD using $\frac{1}{2} \times 8 \times 8 = 32$ and to find the length of AC as $\sqrt{128}$ but many failed to get any further. Those who knew the formula for the area of a triangle using trigonometry, or had looked at the formulae sheet, were generally able to get to a correct answer. Those who chose to find the perpendicular height of ABC and then use $\frac{1}{2}bh$ were generally less successful due to the increased chance of making errors in the working.

13 This was one of three questions with a particularly low facility (below 0.3). Presentation is an important skill and the strongest candidates demonstrated an ability to show their method in a clear, concise manner. Unfortunately, many managed to fill the considerable space available with a variety of incorrect and incomplete attempts at obtaining the required values. Work was often disconnected and scattered at various points and angles. A good proportion resorted to trial and error, sometimes successful enough to score two or three marks, and the method mark for an attempt at substitution was awarded with some regularity. Those who started by trying to eliminate y using subtraction frequently made sign errors while those who rearranged and equated equivalents of y were marginally more successful. Even those who managed to obtain a quadratic equation often didn't know what to do with it, despite the correct expression factorising nicely.

14 Although some candidates in part (a) sketched a correct image in the knowledge that it was a translation of one unit in the negative direction there were many others who clearly needed to plot points. Quite a few moved the curve in the positive direction while others translated vertically or attempted a stretch. Part (b) was answered more successfully than part (a) with the majority sketching a curve good enough to score both marks. Common errors included vertical translations and stretches with a scale factor of a half.

15 A large majority scored all three marks here and there were no obvious common errors, although some failed to understand that the y coordinates had to sum to 4.

16 This question proved to have the lowest facility of all even among stronger candidates. There was a general failure to relate the scale factor of 6 for area to √6 for length. The small minority that used the appropriate scale factor to reach correct values for height and width often lost the final mark for failing to round to the nearest centimetre. Without the use of a common multiple for 20 and 25 the only mark available was for rounding a measurement to the nearest centimetre. Unfortunately, as most used some form of trial and improvement to get close to an area of 3000 (20 × 25 × 6) they rarely arrived at an answer of sufficient accuracy to allow rounding to be considered. Those that may have scored this mark rarely rounded at all and certainly not to the nearest centimetre. Some tried to apply a ratio of 4 : 5 when splitting 3000 but this rarely constituted a complete, correct method. The most common incorrect answers were either 120 and 150 (by using scale factor of 6 for the lengths) or 50 and 60 (the most obvious values for an area of 3000) although 49 did appear with some regularity.

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