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Examiners' Report June 2008

GCSE

GCSE Mathematics (Linear) 2540

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1.1. GENERAL COMMENTS

1.1.1. This was a fair and accessible paper that gave candidates ample opportunity to demonstrate their understanding. Candidates seemed to have had enough time to attempt all the questions and many made good attempts at the paper.

1.1.2. Questions 1, 2, 3, 4, 7, 8, 9 10(i) and 23(a) were answered with the most success. Full marks were gained most often for question 4(a).

1.1.3. It was pleasing that in both question 11(a) and question 15(a) many candidates were able to provide an appropriate reason for their answer.

1.1.4. It was apparent that most candidates had a ruler and protractor. Although many candidates did not use compasses in the construction of the triangle in question 27 it was not clear whether this was because they were not available or because the candidates did not think to use them. In question 29 the performance of many candidates might well have been better if they had used tracing paper for the rotation and the reflection.

1.1.5. In question 24 the drawing of a prism seemed to trigger many candidates into finding a volume and few were able to work out the surface area correctly. This is a topic requiring practice in centres.

1.1.6. It was pleasing that many candidates showed working out and were able to gain method marks when the final answer was incorrect. Too many candidates, though, displayed little, if any, working out which meant that method marks could not be awarded if the final answer was incorrect. This was highlighted by questions 5, 12(b), 15(b), 16(c), 17(b), 22(b) and 23(a). Centres must continue to encourage candidates to show all stages in their working.

1.1.7. Candidates need to be reminded to take care when writing their answers. It was often difficult for examiners to read candidates' numbers and in questions 5 and 19 it was sometimes difficult for examiners to decide whether or not the answer contained a decimal point. Rather than overwrite an incorrect answer candidates should cross it out and replace it.

1.2. INDIVIDUAL QUESTIONS

1.2.1. Question 1

For the majority of candidates this question provided a successful start to the paper. Mistakes were made most often in part (a) where a common error was to round to the nearest hundred rather than to the nearest thousand. Some candidates rounded 3187 up to 4000. Part (b) was answered extremely well and in part (c) most candidates could write the number 5060 in words. Here, incorrect answers often began with 'five hundred' or 'fifty thousand'.

1.2.2. Question 2

Measuring the length of the line *AB* in part (a) proved to be straight forward for most candidates with 8 cm the most common answer. More than 10% of the candidates, though, were unable to measure the line accurately or gave no units or incorrect units with their measurement. Part (b) was also answered very well but some candidates were unable to mark the midpoint of the line with sufficient accuracy and some did not mark it at all.

1.2.3. Question 3

Most candidates were able to demonstrate a good understanding of pictograms. Part (a) was answered extremely well with candidates using the key correctly to find the number of apples. Slightly fewer candidates gave the correct number of oranges in part (b), most likely because of the need to interpret the small square. Part (c) was also answered very well with the majority of candidates completing the pictogram correctly. The most common incorrect answers seen were one large square with one small square, rather than two, two large squares and three large squares.

1.2.4. Question 4

Very few candidates failed to answer part (a) correctly. It was not surprising that more mistakes were made in ordering the decimals in part (b). The two most common errors were ignoring the decimal point (so that 3.71 appeared at the end of the list) and ordering the numbers from largest to smallest.

1.2.5. Question 5

Many candidates gave the correct answer, often with little or no evidence of working out. The most common error was to use 60p as the price of one pen, leading to an answer of £3. Some candidates neglected to change the units and gave the answer as £150.

1.2.6. Question 6

The level of success in this question was both surprising and disappointing with many candidates unable to interpret the mileage chart correctly. Less than one third of the candidates found the correct distance between Hull and Manchester in part (a). Many assumed that the figures in the third row of the table related to Manchester so that the most common incorrect answers were 110 and 45 (from 110 – 65). Part (b)(i) was answered more successfully with just under half of the candidates identifying York as the city nearest to Hull. The most common incorrect answer was Leeds, which was next to Hull in the table. Most success was achieved in part (b)(ii) with almost three quarters of candidates giving the correct answer.

1.2.7. Question 7

This question was answered well with most candidates gaining at least two of the four marks and many achieving full marks. Errors were seen most often in (a)(ii) where (0, 4) was the most common incorrect answer and in (b)(ii) where the most common error was to plot (3, – 4) rather than (– 4, 3).

1.2.8. Question 8

Both parts of this question were answered very well indeed. Few marks were lost in the completion of the bar chart in part (a) and where they were it was more often because of incorrect widths or placement of the bars rather than the heights of the bars. A small number of candidates either gave the answer '8' rather than 'blue' in part (b) or gave no answer at all.

1.2.9. Question 9

Only a few candidates failed to reflect the shaded shape correctly in part (a) and most drew the correct line of symmetry in part (b). Occasionally this line was drawn very carelessly and the mark could not be awarded.

1.2.10. Question 10

It was not surprising that part (i) was answered with the most success. In part (ii) about three quarters of candidates were successful. The two most common incorrect answers were 0.5, from $10 \div 20$, and 10, from 20 – 10. Part (iii) was answered less well with only one third of candidates carrying out the two operations in the correct order. Most incorrect answers resulted from candidates doing the addition first and then attempting to divide 15 by 4.

1.2.11. Question 11

In part (a) most candidates identified 2/5 as the fraction not equal to 1/2 but giving a reason for their choice proved more difficult with some candidates having difficulty putting their thoughts into words. The most successful were those who used reasoning such as “the top number is not half of the bottom number” or “2 does not go into 5”. It was pleasing that the terms ‘numerator’ and ‘denominator’ were frequently used. Some candidates did choose an incorrect fraction, most notably 7/14. Part (b) was answered well. Most attempted it and about two thirds of candidates got the correct answer, often with no working shown. The most common error was for candidates to work out 1/4 of 20 as 5 and then give this as the final answer.

1.2.12. Question 12

About 60% of candidates were able to carry out the simple substitution in part (a) correctly. Common incorrect answers were 36, 9, 3 and $3n$. Some did not attempt this question. A similar proportion of candidates were successful in part (b). Those who were not frequently assumed that $2c = 23$ when $c = 3$, leading to an answer of 25. Another common incorrect answer was 7. Sometimes it could be seen that this resulted from candidates working out 2×3 as 5 and then adding 2 to make 7 and a method mark could be awarded. All too often, though, no working was shown and the mark could not be awarded.

1.2.13. Question 13

More than three quarters of the candidates gained at least two marks in part (a) and few failed to give at least one correct metric unit. The most common incorrect answers were ‘feet’ for the height of the tree, ‘kg’ for the weight of an egg and ‘gallons’ for the amount of petrol. In part (b) almost 70% of candidates were able to change 4 metres to centimetres but only half that number could change 1500 grams to kilograms in part (c) where 15 and 150 were the most common incorrect answers.

1.2.14. Question 14

In part (a) it was rather surprising that only half of the candidates could mark the probability correctly on the scale. Part (b) was generally answered well. Many candidates knew what was expected and weaker candidates were often able to gain one mark by identifying two correct pairs. Some used red as a colour and some did didn’t appear to know that tails is on the opposite side of a coin to heads.

1.2.15. Question 15

Both parts of this question were answered well. Almost two thirds of candidates gained both marks in part (a). Some lost the first mark because of inaccurate subtraction of 45 from 180. Many candidates were able to give a correct reason although some did simply describe the process they had used and did not mention that angles on a straight line add up 180°. Some candidates thought that there are 360° on a straight line and some simply measured the angle with a protractor even though the diagram was not drawn accurately. In part (b) many candidates were able to demonstrate their knowledge of the sum of the angles in a triangle by giving an answer of 40°, often with no working. Where working was shown it was evident that some incorrect answers were due to poor arithmetic and in these cases a method mark could be awarded. Some candidates added the two given angles together but did not subtract the result from 180°. Others thought that the angles in a triangle add up to 360° and worked out the missing angle as 220°.

1.2.16. Question 16

Part (a) was answered with the most success with two thirds of candidates able to write 92% as 0.92. The most common incorrect answer was 9.2. It was disappointing that in part (b) fewer than half of the candidates could write 3% as $\frac{3}{100}$. The most common incorrect answers were $\frac{1}{3}$ and $\frac{3}{10}$. Part (c) was answered quite well well and successful candidates often used the standard non-calculator method of finding 10% first. Some worked out 50% = 200 and 25% = 100 but then got stuck. Where the traditional method of $\frac{5}{100} \times 400$ was seen candidates usually struggled to proceed any further with the calculation. A common incorrect method was for 400 to be divided by 5. Unfortunately many candidates showed no method at all.

1.2.17. Question 17

In part (a) almost two thirds of candidates measured the size of the angle correctly. Many of the incorrect answers were less than 90°, suggesting that candidates had read from the wrong scale on the protractor. Part (b) was well answered with more than three quarters of candidates gaining both marks. Some of those who didn't gained one mark for showing the length *AB* to be 6 cm or for multiplying their length by 50. Quite a common incorrect response was 350, often with no working which meant that no mark could be awarded. Part (c) was poorly answered. Many candidates managed to mark a point 7 cm from *B* but relatively few managed to position it on a bearing of 060°. It was often positioned on a bearing of 030° as a result of the protractor being placed with the 90° line on the north line.

1.2.18. Question 18

Although a lot of fully correct tables were seen in part (a) there were many that contained errors. Candidates found calculating with negative numbers a problem and the *y*-value for *x* = –2 was frequently incorrect. Some candidates failed to work out any correct values and a commonly seen set of y-values was –8, –4, –2, 0, 2, 4. Many candidates who managed to calculate the entries in the table then either failed to plot the points or plotted the points but did not join them up. Some candidates were able to gain 1 mark in (b) by plotting their incorrect values from the table in (a).

1.2.19. Question 19

This multiplication was attempted by a wide variety of methods with just under half of the candidates gaining full marks. Those who broke the calculation up into $10 \times 5.40 + 10 \times 5.40 + 4 \times 5.40$ were often successful. For those using the traditional long multiplication method the most common mistake was in place value (omission of the 0). Partitioning methods were very popular but many candidates were confused by the £ and p. Often they worked with 5 and 40 and tried to incorporate place value at the end. A common wrong answer was £216, from working out 5×24 (= 120) and 4×24 (= 96) and then adding. Incorrect multiplication by zero ($2 \times 0 = 2$ and $4 \times 0 = 4$) was a mistake common to several methods. Some weaker candidates listed £5.40 24 times and attempted to add, usually unsuccessfully. A significant number of candidates seemed not to have considered the reasonableness of their answer and it was a shame that many candidates produced working that was very difficult for examiners to follow.

1.2.20. Question 20

The addition of fractions is a difficult topic for candidates at the Foundation tier and part (a) was answered poorly. Many candidates did not appreciate the need for a common denominator and the most common answer was $\frac{2}{15}$ from adding the numerators and adding the denominators. Even when candidates attempted to find a suitable common denominator, errors occurred in converting one or both of the fractions and some candidates, having correctly expressed both fractions with a common denominator, proceeded to add the denominators as well as the numerators. Candidates were more successful in part (b) with just under a half multiplying the two fractions correctly.

1.2.21. Question 21

As might be expected, part (a) was answered with the most success. The most common incorrect answer was d^5. By comparison, part (b) was answered poorly. Many candidates gave the answer as y^4, $2y^4$ or $4y$. Some, though, did not attempt it. Just over one quarter of candidates managed to expand 4(3a – 7) correctly in part (c). Some only multiplied one term inside the bracket by 4, most often resulting in $12a$ – 7. These candidates gained 1 mark as did the many who showed either $4 \times 3a$ or 4×7. There were some who, having got 12a – 28, then decided that this answer could be simplified. More than half of the candidates got either part (d) or part (e) correct but fewer than expected got both parts correct. A common incorrect answer in (d) was t^2. This could have arisen because candidates did not understand that t meant t^1 or because they did know this but multiplied the indices. Other common incorrect answers were $2t^2$ and $3t$. In (e) common incorrect answers were m^8 and $m^{\frac{5}{3}}$.

1.2.22. Question 22

Those candidates who were familiar with stem and leaf diagrams usually answered part (a) quite well although many did not understand how to complete the key. Some candidates made no attempt to order the leaves but many who did were careless and made one error in the ordering or omitted one or two leaves. A significant number of candidates did not know what was meant by a stem and leaf diagram and many tally charts and pictograms were seen. The probability in part (b) was often correct even when the diagram in part (a) was incorrect or not attempted and it was pleasing that most candidates expressed the probability in a correct form. Many candidates did not understand that to find the number of teachers over 40 years old they must include those over 50 as well so $\frac{5}{15}$ was a common incorrect answer. Some showed $\frac{5}{15}$ in their working, gaining one mark, and then simplified it to $\frac{1}{3}$ but those who gave an answer of $\frac{1}{3}$ with no working got no mark.

1.2.23. Question 23

Part (a) was answered very well. Many candidates worked out that 4 stamps could be bought for £1 so therefore 12 could be bought for £3 and some showed division of 300 by 25. Some made simple mistakes such as 5 stamps for £1, leading to an answer of 15, or 4 for £1, 8 for £2 so 16 for £3. Common incorrect methods were $25 \div 3$ and 25×3. Part (b) was answered less well but nevertheless more than half of the candidates were able to give the correct expression. A common incorrect answer was x^3. Some candidates, not appreciating that an expression was required, wrote $x = 3x$ which gained no credit. In part (c) the correct answer was seen less often. Many incorrect expressions had 5 being multiplied by x rather than added to it and some candidates added 5 to Barry's amount rather than to Adam's amount.

1.2.24. Question 24

Most candidates attempted this question but it was answered very poorly. Many candidates did not seem to understand what is meant by surface area and attempted to work out either the volume of the prism or the total length of some or all of the edges. Many of those who tried to find the surface area worked out the area of the triangle incorrectly as $3 \times 4 = 12$. Some candidates failed to appreciate that the prism has five faces and it was not uncommon to see just the area of the 5×7 rectangle added to the area of one triangle. Others assumed that two or even all three of the rectangular faces were congruent.

1.2.25. Question 25

Many candidates were successful in part (a). Slightly fewer gave the correct answer in part (b) and a common error was for 163.2, instead of 16.32, to be given. Part (c) was answered least well. Here, a very common incorrect answer was 34. A significant number of candidates did not use the information given at the start of the question and attempted to work out each calculation from scratch. These attempts almost invariably failed.

1.2.26. Question 26

Very few candidates gained full marks for this question. Many were able to round 302 and 9.96 to 300 and 10 respectively but the denominator of 0.51 was often rounded to 1 or somehow became 50. Sadly, the majority of those candidates who did get as far as 3000/0.5 were unable to evaluate this as 6000. Most chose to divide by 2 so that 1500 and 1510 were very common incorrect answers. Too many candidates failed to recognise the need to approximate and embarked on long multiplication and then division in the search for an answer.

1.2.27. Question 27

Most candidates attempted this question and many gained at least one mark for drawing a triangle within the required tolerance. This was often achieved by drawing the perpendicular bisector of the base (by sight rather than construction) and then measuring 6 cm from each end of the base or by measuring 60^{o} angles. Less than half of the triangles within tolerance were drawn using compasses. Those candidates who did use compasses to do a correct construction usually gained both marks.

1.2.28. Question 28

The term 'integer' appeared to be generally understood and many candidates gained at least one mark. The most common error made by those who understood the question was to omit –2 from the list.

1.2.29. Question 29

In part (a) most candidates were able to rotate triangle P but frequently this was not about the point (–1, 1). The triangle was often drawn in the correct orientation with one vertex at the centre of rotation. Many candidates rotated by 90^{o}, rather than 180^{o}. Part (b) was answered very poorly indeed. Many candidates could not cope with the vector and the triangle was often moved to the right with one vertex at (6, –1). A significant number of reflections were also seen. Almost half of the candidates reflected the triangle correctly in part (c). A few candidates achieved this by drawing lines perpendicular to the line $y = x$ but most did not show any such lines. Where just one mark was awarded this was usually for drawing the triangle in the correct orientation but in the wrong position. A common error was a reflection in a horizontal line.

2. PRINCIPAL EXAMINER'S REPORT – FOUNDATION PAPER 2

2.1. GENERAL COMMENTS

2.1.1. Presentation of answers was a concern on this paper. Candidates who work in pencil frequently rub out valuable working, and their work is far less legible than a candidate who works in black ink. Work presented in red or coloured ink is frequently illegible. The proportion of candidates who present only answers without working run the risk of no marks awarded (if the answer is incorrect). It is also worthy to note that candidates need to write their figures clearly enough to be read. For example, it is sometimes unclear as whether a digit is a 4 or a 9; 0 and 6 are also sometimes not clear.

2.1.2. Rounding is a problem for many, particularly when the calculator display shows many digits and candidates choose not to write down all the numbers. Essential advice for candidates in this context is to always write down the full version of the number and then round.

2.1.3. Most centres correctly advise candidates to have a calculator for a calculator paper, though the evidence is that a significant number did not have one for this paper. Candidates should be taught how to use calculators sensibly: always write down the numbers and operations they put on the calculator, and copy the full display; write the final answer with correct notation, ensuring it is a sensible answer.

2.1.4. The use of algebra continues to be a weakness. Whilst centres are clearly working with candidates to improve their manipulative skills, problems are still occurring with basic algebra. Those candidates who aspire to the higher grades on this paper need to use algebra confidently and correctly.

2.1.5. Calculation of basic percentage is an essential skill for life. Where this was a simple percentage (10% Q15d) this was done well. Where the calculation required more manipulation of figures the success rate was lower than 1/3, with a significant number of candidates dividing rather than multiplying to find the percentage. There also remains a significant proportion who attempt non-calculator methods (on a calculator paper) in finding the percentage, but these are usually confused and rarely gain any marks as a result.

2.1.6. A significant weakness running through several questions relates to technical terms or key words. This includes naming shapes and angles (Q3), types of number (Q2, 15, 27), faces, vertices, edges (Q10), geometrical terms (Q14).

2.2. INDIVIDUAL QUESTIONS

2.2.1. Question 1

This was a well answered question with most candidates scoring full marks. Zero marks in any section were usually due to non-attempts.

2.2.2. Question 2

Most parts of this question were well attempted, but in part (ii) performance was poor, with many candidates unable to identify the "4" from the list as the square number.

2.2.3. Question 3

There were predictably many confused spellings associated with naming the shapes; examiners did not penalise incorrect spelling unless it led to ambiguity. Overall this question was not well answered, with many incorrect names given for the shapes. Part (b) was better answered, with about 2/3 of the candidates naming the angle correctly. The most common error was in naming it as an obtuse angle.

2.2.4. Question 4

The purpose of this question was to assess the candidate's ability to interpret a calculator answer (8.5) in the context of money notation. Most earned the mark, with 8.5 and 8.05 being given as the most common incorrect answers.

2.2.5. Question 5

The majority of candidates scored well on this question. Incorrect diagrams sometimes scored marks when used to obtain the numbers in the table. Frequently candidates ignored their diagrams and used the "+4" rule to obtain the numbers in the table, which was also credited.

2.2.6. Question 6

Candidates have some difficulty in working with time. For those who a calculator it is disaster. Those who "count on", showing clear evidence of this, experience far greater success. Part (a) was well answered, with 2/3 of candidates also gaining full marks in part (b). In part (c) the question required counting on into the next hour, and this inevitably caused problems for many candidates, highlighting a weakness that centres need to be aware of.

2.2.7. Question 7

It is disappointing to have to report that only slightly more than half of all candidates achieved the marks in any part of this question. Errors include confusion between area and perimeter, and errors in simple counting of lines, squares or cubes. Even more able candidates were found to have errors in this question.

2.2.8. Question 8

Parts (a) and (b) of this question were well answered. In part (c) the best candidates set out a product and answer with correct units also shown. There was evidence that some candidates arrived at the correct area but misread the graph, usually giving £160 as the answer. Some worked out the perimeter rather than the area, or gave the area (43) as the answer. It was encouraging to find that most candidates were willing to have a go at this multi-stage problem.

2.2.9. Question 9

The ability of candidates to work with directed numbers was a strength, with most candidates gaining the marks. Success in part (b) was less than in part (a).

2.2.10. Question 10

Many candidates were unable to understand the terms “face”, “edge” or “vertex”. About half of candidates gained the mark in (i), but answers given to (ii) were many and varied, almost arbitrary.

2.2.11. Question 11

Part (a) was well answered. In part (b) the frequent error was not to simplify the expression fully.

2.2.12. Question 12

This was a good discriminator. Candidates were expected to make a reasonable estimate of the normal height of a man in metres; a wide tolerance of 1.5 to 2.0 metres was accepted. The flagpole was exactly 4 times as high as the man in the diagram.

In part (a) it was disappointing to find totally unreasonable estimates being given, some quite absurd heights. In part (b) candidates were not careful enough to measure the scaling factor, and a significant number used 3 or 5 as the scale. Those who gave an incorrect estimate in part (a) but used this in part (b) were given some credit.

2.2.13. Question 13

This was a well answered question, with many candidates gaining full marks in both parts. The most common error in both parts was to perform the calculation in the wrong order. In part (b) a further error was to fail to account for the need to remove the fixed charge of £30 before dividing. Candidates who gave the answer embedded within an expression, but failed to extract the answer and put it on the answer line, were given some credit. It was clear in this question where a candidate did not have a calculator, usually evidence by computational errors.

2.2.14. Question 14

Part (a) was not well answered, with only half of the candidates gaining any marks. Incorrect answers given in part (a) included the supplementary angle, and answers arising out of measurement. Correct reasoning was rare, with confused references to parallel lines, angles on a straight line, or at a point. In part (b) the success rate was higher, with many good explanations relating to 360°, or the incorrect sum of 385°.

2.2.15. Question 15

The success rate in parts (a) & (b) in this question was related to that of question 2(ii), about half the candidates gaining the mark, with many lacking an understanding of square numbers or indices. In part (c) most were able to express the fraction as $\frac{80}{100}$, but of these half were then unable to cancel the fraction into its simplest form.

Candidates used a variety of methods in part (d), with many realising that a division by 10, or "10p in the £" would lead to the correct answer.

Candidates found part (e) far more challenging. The most successful method appeared to be conversion to decimals.

2.2.16. Question 16

Part (a) was well answered, but few candidates gained the mark in part (b). Many attempted to estimate the fraction of the diagram, hence many gave $\frac{1}{4}$ or $\frac{1}{3}$ as the answer. Of those who used the 100°, the error for many was in giving it out of a number other than 360°.

In part (c) most candidates gained some credit, sometimes by showing evidence of using inventive methods. Some found and used a scaling factor such as 4.5. Others found an association using the relationship of the angles, showing 8+16+20+28, or equivalent methods.

Part (d) was a discriminator, and it was encouraging to find half the candidates were able to distinguish between proportion and actual values, giving an acceptable explanation why Sean was wrong.

2.2.17. Question 17

Most candidates gained full marks in part (a), though those attempting the question by non-calculator methods rarely gained the full marks due to numerical errors in their calculations. Of those using calculators a common error was to write down and use £22.05 instead of £22.50. A significant number stopped after having found the total cost and failed to find the change.

In parts (b) and (c) about half the candidates gained the marks. It was usually a choice between dividing and multiplying, with many accepting answers which were numerical incorrect given the context. Some candidates lost marks due to their confusion over the units being used.

2.2.18. Question 18

This was a well answered question with most candidates gaining full marks. A significant minority gained only 1 mark since they gave their answer using incorrect probability notation, for example giving their answer as a ratio, or using words "5 out of 12". Centres are reminded that probability can only be accepted when written as a fraction, a decimal or a percentage. Some weaker candidates incorrectly added the 3, 4 and 5. The most common incorrect answer was $\frac{5}{7}$.

2.2.19. Question 19

The majority of candidates gave their answer as ratios, but the weaker candidates used fractions. Those candidates who gave their answer as a ratio often left their answer as 84:16 or made errors when cancelling. A significant number of candidates reversed the order of the ratios.

2.2.20. Question 20

This was the first question, in which the majority of the candidates were clearly out of their depth, unless they were working towards grade C standard. This was also the first question with a significant number of non-attempts. There was a preponderance of area formulae, and much confusion about whether to use 8 or 16 in either the area or circumference formula. Other problems occurred where candidates used an incorrect value for π, and rounded answers to the nearest whole number without working shown.

2.2.21. Question 21

There were some very good attempts to draw a sketch o the 3D shape, with more than half the candidates gaining full marks. A minority attempted to draw nets or 2D diagrammatic representations of the shape. In some cases the sketch showed a shape where the sloping edges failed to meet at a single point, which in most cases was given 1 mark.

2.2.22. Question 22

Many candidates found the number differences as "+3" but where then unable to use this to successfully write down a generalisation of even 3*n*. There were lots of 3, +3, *n*=3 and *n*+3, or common incorrect answers such as 2*n*+3. Overall a question that was beyond many candidates.

2.2.23. Question 23

There were some good attempts at this question, with many candidates gaining full marks. A significant number of candidates worked the numbers out using the wrong order (usually getting 122.27), or put the decimal point into their answer in the wrong place. Despite the direction to "write down all the figures…" some candidates still wrote their answers rounded or truncated. Those without calculators would have found this question difficult.

2.2.24. Question 24

There were many errors in this question, resulting in few candidates gaining full marks. Errors included plotting points at the end values of the class interval, rather than the midpoint, plotting points and not joining them, or attempts to join them with a curve. Many also joined the first to the last point with a straight line, which was inappropriate for a frequency polygon. It was clear some candidates were totally unfamiliar with frequency polygons.

2.2.25. Question 25

It was usual to award some method marks in some part of this question, but few answers both parts correctly. Lots of candidates wrote their answer as 10:35, misreading the question. Trial and improvement methods were also seen. It is a real concern that so many candidates had little idea with regard to calculating percentages. Many non-calculator methods were seen, which rarely attracted any marks due to the many numerical errors that accompanied them. Some candidates went as far as calculating the VAT, but then failed to add it on to find the total.

2.2.26. Question 26

In part (a) many candidates were able to combine one of the letters, but rarely both. Weaker candidates frequently spoilt their answer by incorrect simplification, for example $4a+2a=6a$, and $2a+4c=6ac$. In part (b) there was little understand of formulae. Many added the three pats of the formulae, whilst squaring was almost arbitrary. Weaker candidates did not know what to do with the $\frac{1}{2}$. Even with an answer as short as 1.125 there were instances of candidates rounding off this answer to 1 d.p. Part (c) was done well by those candidates who understood what was meant by "factorise". A few candidates gained a mark for multiplying out the bracket in part (d), but most failed to gain any marks. Algebraic methods were very confused, with few manipulating the terms correctly.

2.2.27. Question 27

It was disappointing to see that so many candidates did not know what was expected of them in this question. There were some attempts using factor trees or continued division that usually resulted in some credit. Fully correct factor trees were sometimes spoiled by incorrect statements on the answer line eg 2+2+3+3+7 or 2,2,3,3,7. It was not uncommon for 9 or 63 to be left as prime factors.

2.2.28. Question 28

It was evident that few candidates understood Pythagoras, as attempts to square and add were rare. Common incorrect attempts included finding the area of the triangle, adding sides and then finding the square root, doubling rather than squaring, and again rounding of answers, this time incorrectly.

3. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 3

3.1. GENERAL COMMENTS

3.1.1. This paper was accessible to the majority of candidates. There was no evidence to suggest that candidates had difficulty completing the paper in the given time.

3.1.2. As expected, some of the weaker candidates made little progress with the more demanding questions, but most candidates were able to gain marks here and there throughout the paper.

3.1.3. The presentation of work was generally very good, but poor arithmetic impaired the performance of many candidates.

3.1.4. The vast majority of candidates did all their calculations and checks within the space provided for each question, but written responses often went beyond the answer region.

3.1.5. Candidates should be advised to:

- round all numbers to one significant figure when doing an approximation
- draw all their construction lines clearly
- quote circle theorems accurately

3.1.6. Candidates should be encouraged to take care when using vector notation.

3.2. INDIVIDUAL QUESTIONS

3.2.1. Question 1

This question was done well by the vast majority of the candidates. In part (a), most candidates were able to find the amount of milk required to make 24 pancakes, but a few thought that the recipe was used to make only one pancake and consequently worked out 24×300. In part (b), most candidates realised that they needed to find the amount of flour to make 4 pancakes and then add this to 120 for a total of 12 pancakes. A popular alternative approach was to find the amount of flour needed to make 1 pancake, $120 \div 8$, and then multiply this by 12 for the total amount. As with part (a) a common incorrect method was to work out 12×120

3.2.2. Question 2

This question was done well by most candidates. Partitioning and grid methods were as popular as the traditional approach to multiplying numbers. If a candidate lost a mark on this question it was more likely to be as a result of arithmetic error than an incorrect placement of the decimal point. A small number of candidates treated a multiplication by 0 as a multiplication by 1.

3.2.3. Question 3

This question was done well by the majority of the candidates. Most were able to draw an ordered stem and leaf diagram. Typical errors included omitting a number, usually the 0 in 50 or the 5 in the repeated 45s; or drawing an incorrect key. A surprising number of candidates gave more than one example for the key.

3.2.4. Question 4

This question was done well by the vast majority of the candidates. A small number of candidates tried to do the various calculations rather than use the information provided, but few of these attempts resulted a correct answer. Common incorrect answers in part (c) were 34 and (more rarely) 340.

3.2.5. Question 5

About three quarters of the candidates were able to gain at least one mark on this question. In part (a), a common incorrect answer for the point with coordinates (2, 1, 0) was *R*, and in part (b), a common incorrect answer for the coordinates of *P* was (2, 3, 1).

3.2.6. Question 6

This question was done well by most of the candidates. In part (a), the vast majority of candidates were able to find the number of days hire of the carpet cleaner. Usually by the reverse process 18 – 6 = 12 and then dividing this by 4, but some by setting up and solving the equation $4n + 6 = 18$. In part (b), most of the candidates were able to write down a suitable expression for the total cost of hire for *n* days, but some wrote this incorrectly as $n = 4n + 6$ or in the rearranged form as $n = (C - 6)/4$.

3.2.7. Question 7

Only a minority of candidates were able to score full marks on this question but most were able to get a mark for finding the area of at least one face and a mark for giving the correct units cm^2. Common errors included finding and adding the areas of only the two visible faces, i.e. 6 + 35; finding and adding the areas of only four faces; adding the areas of repeated faces, typically $6 + 6 + 3 \times 35$; incorrectly working out the area of the triangle as 3×4. A significant number of candidates calculated the volume of the prism, but some of these, perhaps fortuitously in some cases, were able to score the independent mark for units.

3.2.8. Question 8

The vast majority of candidates were able to score at least one mark in this question but less than half managed to get full marks. Common errors were to round 0.51 to 1 (leading to an answer of 3000) and to calculate 3000/0.5 as 1500 (common) or 4500. A significant number of candidates did not round 302 to 300, but were still able to gain full marks for 6040. Candidates should be advised to round all numbers to one significant figure when doing an approximation.

3.2.9. Question 9

This question was done well by the vast majority of the candidates. Most knew that the sum of the probabilities in the table should equal 1 and were able to work out the missing value 0.4. Answers of 4/10 or 2/5 were not uncommon.

3.2.10. Question 10

This question was done well by the majority of the candidates. In part (a), most candidates were able to write down the answer $20pq$. Common incorrect answers here were $4p5q$, $9pq$, $20p^2$ and $20q^2$. In part (b), the vast majority of candidates were able to write down the answer d^4. A very common incorrect answer here was $4d$. In part (c), about half the candidates were able to gain both marks. Common incorrect answers here were $12a - 7$, $7a - 28$ and $12a - 21$. In part (d), about three quarters of the candidates were able to score both marks and many that didn't were able to score a mark for either $4n + 6$ or $3n + 3$. Common incorrect answers here were $(4n + 6) + (3n + 1) = 7n + 7$ and $(4n + 3) + (3n + 3) = 7n + 6$ (each gaining 1 mark); and $(4n + 3) + (3n + 1) = 7n + 4$ (for 0 marks). A surprising number of candidates multiplied the expressions $(4n + 3)\times(3n + 3)$ instead of adding them. Parts (e) and (f) were generally done well. Common incorrect answers here were $(t \times t^2 =)\ t^2$ and $(m^5 \div m^3 =)\ m^{5/3}$ or m^{15}.

3.2.11. Question 11

This question was generally done with most candidates showing their construction arcs and drawing an accurate triangle. Some constructed a 60° angle at both ends of the line. Candidates should be advised to draw their construction lines clearly. A small but significant number of candidates constructed the perpendicular bisector of the line and apparently used a protractor to complete the triangle. Those candidates not showing construction arcs were still able to score 1 mark for an accurate triangle within tolerance.

3.2.12. Question 12

This question was done well. Most candidates were able to give the integer values of x within the range. Common errors were to either to omit an integer (usually 0 or -2) or to add an extra integer (usually 3).

3.2.13. Question 13

In part (a), an increasing number of candidates are able to write down the reciprocal of a number. Common incorrect answers here were 2, 16 and 4/1. In part (b), most candidates were able to score at least 1 mark for writing the fractions with a common denominator (generally 20), but poor arithmetic often hindered candidates from gaining full marks, $\frac{14}{5}-\frac{7}{4}=\frac{46}{20}-\frac{35}{20}$ was a typical error. Those candidates who dealt with the integers and fractions separately, i.e. $(2-1)+\left(\frac{4}{5}-\frac{3}{4}\right)$, where a little more successful than those who converted the mixed numbers to improper fractions. In part (c), about half the candidates were able to write down a suitable reason for why Sundas was wrong. Most reasons were based either on 1/3 = 0.33…or on 3/10 not being the same as 1/3.

3.2.14. Question 14

In part (a), about half the candidates were able to score both marks for this question. Common incorrect answers here were based on rotating the triangle about the wrong point, typically (–1, –1) or (0, 0). A smaller number of candidates reflected the triangle in the *x*-axis or rotated it by only ±90°. In part (b), a significant number of candidates did not understand how to interpret the translation vector $\begin{pmatrix}6\\-1\end{pmatrix}$. Common errors here were based on incorrect translations, typically $\begin{pmatrix}6\\0\end{pmatrix}$ or $\begin{pmatrix}-1\\6\end{pmatrix}$. A small number of candidates reflected the triangle in the *y*-axis.

3.2.15. Question 15

In part (a), many candidates were able to score at least 1 mark on this question. Common incorrect answers were $3x^2-5y$ and $4x-5xy$ (each scoring 1 mark). A small number of candidates expanded the expression to, e.g. $3x\times x-5x\times y$, then did not go on to simplify it. In part (b), about half the candidates were able to factorise the expression correctly. Common incorrect answers here were $(x-6)^2$, $x(x-36)$ and $(x-6)$.

3.2.16. Question 16

In part (a), most candidates were able to draw a correct whisker on the box plot, but many either did not know how to draw the median or did not realise that the median was missing from the diagram and therefore needed to be included. A common mistake for some candidates was to draw more than one vertical line in the box plot. In part (b), most candidates were able to write down the value 10 for the lower quartile, but some, presumably dividing the scale into quarters, gave 15 (or 20) as this value.

3.2.17. Question 17

In part (a), many candidates were able to write the number in standard form as 64 000. Common incorrect answers here were 640 000 (mostly) and 6400. In part (b), many candidates were able to write the number in standard as 3.9×10^{-3}. Common incorrect answers here were 3.9×10^{-4} (mostly) and 3.9×10^{3}. Candidates were less successful in part (c) where the most popular incorrect answer was 2.5×10^{8}.

3.2.18. Question 18

Part (a)(i) was generally done well. Most candidates realised that they needed to double the angle at the circumference to get the angle at the centre, but in part (a)(ii), only the best candidates were able to quote the circle theorem accurately. A typical answer here was 'the angle in the middle is double the angle at the edge'. A common unacceptable answer was *BOD* = 2 × *BAD*. In part (b)(i), only about a quarter of the candidates were able to work out the correct value for *y*. many thought that *x* and *y* were equal and said as much in part (b)(ii), e.g. 'opposite angles in cyclic quadrilateral are equal'. Again, only the best candidates were able to quote the circle theorem accurately. A common unacceptable answer was 'circle in a quadrilateral, opposite angle add to 180°'. A significant number of candidates thought that *BODC* was the cyclic quadrilateral and gave the angle as 40°. Candidates should be advised to learn the circle theorems accurately.

3.2.19. Question 19

A surprising number of candidates did not just simply add the equations to eliminate the terms in *y*. Many chose the much harder route of multiplying the second equation by 2 and then subtracting the equations. This method often produced an error in either the multiplication, e.g. $2x-6y=9$, and/or the subtraction, e.g. $3y-\left(-6y\right)=-3y$. Most of the candidates who were able to find a value in either *x* or *y* and were then able to substitute this value into an equation to find the value of the other variable. Only the best candidates showed any evidence of checking their answer.

3.2.20. Question 20

This question was generally done well. In part (a), most candidates were able to gain at least 1 mark for a correct value in the table. A common error here was to find the value of *y* at *x* = –1 as 6 or 5 or –7. Despite possibly having made an error in the table, many candidates were able score 2 marks in part (b) for plotting their points correctly and drawing a smooth curve through their points. A very common error here was to join the points with straight lines. A surprising number of candidates, having drawn a completely correct graph but having made an error in the table, did not go back and correct the value in the table.

3.2.21. Question 21

Part (a) was done well by the vast majority of the candidates. In part (b), many candidates knew that they needed to multiply the probabilities but a significant number of these were unable to do the calculation accurately, e.g. $0.8 \times 0.6 = 4.8$ or 0.42. Common incorrect methods were 0.8 + 0.6 = 1.4 and $\frac{0.8+0.6}{2} = 0.7$. In part (c), only the best candidates were able to score full marks for this question, but many were able to score 1 mark for either 0.8 × 0.4 or 0.2 × 0.6. Common errors here were similar to those in part (b), e.g. those involving poor arithmetic, e.g. $0.8 \times 0.4 = 3.2$, 0.24 or 2.4, or those involving confusion as to when to multiply the probabilities or when to add the probabilities, e.g. $(0.8+0.4)\times(0.2+0.6)$.

3.2.22. Question 22

Only the best candidates were able to score full marks in this question, but many were able to score 1 mark for clearing the fraction. A common error here was *ab* – 5. Of those who were able to clear the fraction successfully, few realized that they needed to rearrange the equation to isolate the terms in *b* (many of those who did made errors in signs, e.g. *ab* – 7*b*). Having got to '*ab* + 7*b*' few candidates went on to factorise the *b*, many simply divided 'selectively' by *a*, e.g. $ab + 7b = 2 + 5a$ to get $b + 7b = \frac{2+5a}{a}$. A small number of candidates simply interchanged the letters and sometimes the signs to get $b = \frac{2-7a}{a-5}$ or $b = \frac{2+7a}{a+5}$ (each scoring 0 marks).

3.2.23. Question 23

Many candidates were able to score at least 1 mark in this question. In part (a), only the best candidates realized that they had to multiply both the numerator and the denominator by $\sqrt{3}$. Common incorrect answers here were $\frac{1}{3}$ and $\frac{1}{9}$. A large number of candidates attempted to expand the brackets in part (b), and most were able to score a mark for three correct terms. Common errors here were $(2+\sqrt{3})(1+\sqrt{3}) = 2+\sqrt{6}+\sqrt{3}+\sqrt{9}$ or $3+2\sqrt{3}+\sqrt{3}+\sqrt{9}$ or $2+2\sqrt{3}+\sqrt{3}+\sqrt{3}$

3.2.24. Question 24

Only the best candidates were able to score full marks in this question. For the surface area in part (a), the vast majority of candidates simply multiplied 80 by 2 (the linear scale of the enlargement). Similarly for the volume in part (b), the vast majority of candidates simply divided 600 by 2.

3.2.25. Question 25

The use of vector notation in this question was generally poor. In part (a)(i), about half the candidates were able to score 1 mark for $\frac{1}{2}\mathbf{a}$. A common incorrect answer in part (a)(ii) was $\frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{c}$. In part (b), about a quarter of the candidates were able to write down a correct vector for $\overrightarrow{CA}$ and show that *CA* is parallel to *MN*. Common correct answers here were $\overrightarrow{CA} = 2\overrightarrow{MN}$ and $\overrightarrow{MN} = \frac{1}{2}(\mathbf{a} - \mathbf{c})$.

3.2.26. Question 26

Many candidates were able to score one mark for writing a correct formula for the volume of the cone or the volume of the cylinder in terms of *x*, and some were able to equate two correct formulae, but few could rearrange the equation accurately to find *h* in terms of *x*. A common error here was $\frac{2x}{\left(\frac{1}{3}\right)} = \frac{2}{3}x$. A small number of candidates were able to compare the two volume formulae and simply write down the answer without working.

3.2.27. Question 27

More than a fifth of the candidates were able to get each part of this question correct. In part (a), common incorrect answers were (0, 3) and (2, 3), and in part (b), common incorrect answers were (4, 6) and (4, 3).

3.2.28. Question 28

About a fifth of the candidates were able to score full marks on this question. A significant number of candidates reached the expression $\frac{(x+3)(x-2)}{(x-2)(x-5)}$ but then did not go on to simply this further, and some, having obtained the correct answer $\frac{x+3}{x-5}$, went on to incorrectly simplify this to $-\frac{3}{5}$. The most popular incorrect approach was to start by cancelling the x^2 terms from the expression.

4. PRINCIPAL EXAMINER'S REPORT – HIGHER PAPER 4

4.1. GENERAL COMMENTS

4.1.1. Although many candidates were able to demonstrate a good knowledge of mathematical technique, it was disappointing to see many non attempts and many poor attempts at questions.

4.1.2. Algebraic manipulation at medium demand was good, but often failed on the more demanding questions at the end of the paper.

4.1.3. The gradient of difficulty on the paper seemed to work well with most candidates being successful at the start, but of course, less so towards the end.

4.1.4. Question 8, the frequency polygon seemed to come as a surprise to many candidates and was often where some of the most able candidates lost marks.

4.2. INDIVIDUAL QUESTIONS

4.2.1. Question 1

Overwhelmingly correct although there were some careless answers involving 3+4+5 = 11 or 13. A few candidates gave answers as ratios so could not score full marks and a few lost marks in premature approximation when they converted their fraction to a decimal or to a percentage.

4.2.2. Question 2

Most candidates knew that they had to work out the numerator and the denominator separately or that they had to use brackets when dividing by the expression in the denominator. The vast majority of candidates gave enough figures in their answer to earn full marks for the question. The most common incorrect answer started with 122.2…and was awarded no marks if no interim working had been shown.

4.2.3. Question 3

There was a lot of careless plotting where the point at x = 22 was plotted wrongly at x = 21. Most candidates knew this was negative correlation although a few tried to give a description. The line of best fit was generally well drawn although in some cases it was too short. Most candidates knew and could apply the technique of reading off values from the diagram.

4.2.4. Question 4

A surprising number of students could not identify the angle as being 58°, but gave either 65° , the other angle in the diagram, or 122°, the supplement of the 58°. Attempts at a reason varied from the technical ' alternate angles', the casual 'Z angles', the wrong 'corresponding angles', to the vague ' opposite angles on parallel lines'. Just quoting 'parallel lines' was insufficient to score the mark.

4.2.5. Question 5

This question was answered very well. The majority of candidates gave a sort of isometric view of a square based tetrahedron surmounting a cuboid and gained their marks. A few candidates seemed to misunderstand the task and gave a repeat of the front or the side view. Some candidates took the cross sign on the plan literally (figuratively?) and drew a diagonalcross on the base of the cuboid part.

4.2.6. Question 6

Very good answers at this level. There were few errors – mainly of the $n + 3$ variety or $n = 3n + 2$. A few candidates had not learned the rule carefully enough and wrote $2n + 3$, which, of course, gives the first term.

4.2.7. Question 7

This was a standard trial and improvement question. Most candidates scored marks on it. Responses tended to come in 4 groups:

- An answer of 2.7 , including a trial at 2.75 – scoring 4 marks
- An answer of 2.7, without a trial at 2.75 or equivalent – 3 marks
- An answer of 2.8 with some correct working – 1/2 marks
- A bizarre or incomplete answer

Many candidates still test the value of the function at $x = 2.7$ and at $x = 2.8$ and compare these values with 26. This is mathematically unsound and is worth a demonstration to students why.

On the positive side, nearly all candidates could work out the value of the cubic correctly for several values of x and many of these candidates worked fairly sytematically recording values in a table. The most common error was to forget to change the value of the x term as x changed or to give the value of x as 2.74 or 2.73.

Some candidates still choose to ignore the instructions and do not write down the values of the cubic – they score no marks.

4.2.8. Question 8

Frequency polygons have made a comeback after a few years' absence. This might go some way to explain the indifferent response. Many candidates plotted the points at the upper end of the interval rather than the middle. There were many cases of inconsistent plotting where not enough care had been taken in the positioning of the points. Commonly, candidates joined the first point directly to the last point to produce a pentagon.

A successful teaching approach adopted by many centres is to draw essntially a histogram based on the (almost) equal class intervals and mark then join the midpoints of the top of the bars.

4.2.9. Question 9

This was a linked question in which in part (a) candidates had to derive an equation and then solve the equation in part (b). Many candidates did in fact produce the equation $5x + 60 = 360$ as their answer. These candidates usually went on to solve the equation correctly. A few candidates did simplify the expression x + 2x + 2x + 10 + 50 as $4x^3 + 60$

Of those candidates who could not do part (a), a sizable number were still able to find the value of x in part (b) by judicious use of the calculator. They earned the marks available for part (b). Many candidness put down an incomplete answer to part (a) by just writing the expression 5x + 60. Many of them went on to find the value of x as 60 in part (b) but sadly a minority then made up and solved the equation $5x + 60 = 0$

4.2.10. Question 10

Part (a) was very well done. A few candidates wrote down both 10 and 35 without identifying which value answered the question. They got one of the two marks.

Part (b) was also very well done with a majority of answers involving multiplying by $\frac{117.5}{100}$ to get the answer directly. Of course, there were a considerable number who worked out $80 \times \frac{17.5}{100}$ and added the answer to 80.

A few took the 8 + 4 + 2 route to get to the £94.

The main errors were a failure to add the £14 to £80 and a miscalculation on the £8 + £4 + £2, usually at the $2\frac{1}{2}$% stage.

Part (c) was a standard depreciation question. It was pleasing to see so many students using the efficient 12000×0.8^2 although many who used a careful step by step approach also gained full marks. A common misread was 1200 for 12000, which resulted in the loss of 1 mark. A few candidates added on the 20%.

Of course, there were many candidates who worked out 20% of £12000 and then subtracted 2×2400 to get the wrong answer £7200

4.2.11. Question 11

This question gave students the opportunity to display their skills of algebraic manipulation and of algebraic substitution.
Usually candidates were successful on part (a), although there were many wrong answers, mainly from a misunderstanding of the relationship of the sign in a term with the term it acted on.

Part (b) had many cases of poor substitution, where, for example, $\frac{1}{4} \times 3^2$ was evaluated as $\left(\frac{1}{4} \times 3\right)^2$

Parts (c), (d) and (e) were all well done. The most common error in (c) was the difference of 2 squares misunderstanding as $(x-5)(x+5)$ or $(x-2.5)(x+2.5)$. The clumsy, but correct $(x \pm 0)(x-5)$ was awarded both marks.

On (d), the characteristic $x^2 + 7x + 7$ was occasionally seen and on (e) the 'factorisation' $y(y+8)+15$

4.2.12. Question 12

Part (a) was a percentage change question made a little more challenging by the relevant numbers being in a table. It was extremely rare for anything other than the 85 and 91 to be chosen. However, apart from that the remaining working was not good. Many candidates had little idea how to proceed and wrote 6% presumably from 91 -85. Others knew they had to convert a fraction to a percentage, but used a denominator of 91. Another common error was to calculate either $\frac{91}{85}$ or $\frac{91}{85} \times 100$ and then omit the subtraction of either unity or 100. Some candidates adopted a trial and improvement approach but rarely got to within the demanded level of accuracy.

Part (b) was a standard moving average question. There were many correct answers, but also many candidates did not know where to start and left a blank or worked out the average of all the figures.

4.2.13. Question 13

For a standard volume question this was poorly answered. Common errors included circumference × height, $k\pi r^2$ where k was usually 2 (from 2 ends?) , 0.5 or 4 . Some candidates evaluated $\pi \times 4^2$ as $(\pi \times 4)^2$.

Part (b) was generally well done with the vast majority of candidates multiplying their answer to part (a) by 0.6.

4.2.14. Question 14

Part (a) was answered correctly by the overwhelming proportion of the candidature. There were a few 56s to be seen and some candidates took advantage of the formula sheet to use $\frac{1}{2}ab\sin C$.

Part (b) was a standard Pythagoras question . Most candidates knew that they had to square and add. Some did not notice that the answer had to be given to correct to 2 decimal places, so 10.6 was not acceptable for full marks, unless a more accurate value were given in the working.

Part (c) caused more problems. A sizable proportion of candidates did not know where to start and tended to guess at an angle or to misuse the idea of tangent and write such things as $\tan = \frac{32}{46}$ or $\tan 32 \times 46$

Some candidates evaluated the fraction $\frac{32}{46}$ as 0.7 and thus were not able to pick up the final accuracy mark for the size of the angle.

A minority of candidates took advantage of the formula page and used Pythagoras to calculate the hypotenuse and then use the sin rule to calculate the angle. This can get full marks, but candidates tend to lose out through a lack of accuracy.

4.2.15. Question 15

Many candidates could not carry out the transformations correctly. The main error was to reflect the triangle in the *y* axis followed by a reflection in the line *x* = 1. A different error was to identify the correct axis but to carry out the reflection incorrectly with the image being 2 squares below the *x* axis instead of the correct 1 unit. A few candidates gave two transformations and consequently gained no marks for the description. Some gave the centre as (0, 1) rather than the correct (1, 0)

4.2.16. Question 16

Most candidates had a clear idea what to do on part (a) this question. Factor trees or repeated division were much in evidence. These were mostly correct as candidates could use a calculator. Most went on to write their answer as a product although there were a few who wrote them as a comma separated list or as a sum.

Part (b) proved to be more of a challenge as the candidates were faced with a demand that was unusual. The answer 9 and 15 was seen much more often than 3 and 45. However, just as common was 3 and 15, possibly coming from 3 ×15 = 45, identifying a correct HCF of 3 but failing to spot that the LCM was 15. Many candidates were confused over LCM in particular and gave values in the answer as multiples of 45, so 45 and 90 was a common pair as was 90 and 135.

4.2.17. Question 17

Candidates who understand standard form were successful as the task was straightforward. A number of candidates changed the number of atoms to an ordinary number and then multiplied by 20, but generally miscounted the number of zeros either when converting or in their answer. An answer of 1.51×10^{520}, or 3.02×10^{520} coming from 26×10 was often seen.

4.2.18. Question 18

Many candidates knew that they had to draw lines but were unable to interpret the inequality signs as meaning just 1 line, so rectangles as the required region were common. There was some confusion between the line $x = 2$ and the line $y = 2$, but sadly the line $x + y = 6$ was often drawn as the two lines $x = 6$ and $y = 6$. Candidates who drew the correct lines often had no difficulty in identifying the correct region.

4.2.19. Question 19

The most common successful approach was to multiply πR^2 by $\frac{150}{360}$, although a few candidates did the equivalent by dividing by 2.4. Common errors included assuming the sector was one third of a circle or just working out the area of a circle. Some candidates halved the given `13 and thought that the radius was 6.5 cm.

4.2.20. Question 20

Proportionality laws are ubiquitous in science so it is not surprising that they get tested frequently at the higher level. Many candidates had the correct idea of writing the relationship as a formula involving a constant of proportionality k and then using the given information to find the value of k. After that, completing the question was straightforward, There were a few candidates who overlooked the word ‘inverse’ and changed the problem substantially. There were also many who answered the question for q directly proportional to t^2

or inversely proportional to *t*, or √*t*. Common wrong answers were 2t+0.5, 2.125t and q=34/t

4.2.21. Question 21

Many candidates were well prepared for this histogram question and were able to score full marks. Both frequency density methods and area methods were in evidence, but often there was little sign of any working. Some otherwise competent candidates lost a mark on part (b) by drawing their rectangle to the right hand end of the given axis.

4.2.22. Question 22

As with Question 20, another important technique with applications in science. Many candidates could identify at least one upper or lower bound correctly, but then used commonly $\frac{238.5}{27.35}$. Many candidates simply used $\frac{238}{27.3}$ and then rounded off or $\frac{238.4}{27.25}$. Most candidates sensibly avoided recurring decimals saving themselves a problem when using their calculator.

4.2.23. Question 23

Responses to this question usually scored either full marks or zero marks. The usual correct methods seen were to multiply through directly by $(x-1)(x+2)$, cancel, expand and collect terms. The equivalent cross multiplication was also seen correctly carried out. A few candidates collected terms on the left hand side and then lost track of the signs or never got round to dealing with the denominator. An all too common error was to write 4 - 3*x*(*x* + 2) before expanding the brackets. Sometimes this was expanded correctly and other times as $4-3x^2-6x$.

Part (b) was a standard quadratic equation solution by formula. The most common errors included the detachment of the -7 term from the denominator to give the equivalent of $-b\pm\frac{\sqrt{b^2-4ac}}{2a}$ and the incorrect evaluation of the discriminant to give a value of -107 instead of the correct 205.

Some candidates got through to $\frac{-7\pm\sqrt{205}}{6}$ but then misused their calculator and worked out the answers to $-7\pm\frac{\sqrt{205}}{6}$.

A few enterprising students attempted the solution by completing the square. Even if carried through to a conclusion these candidates often lost marks through premature approximation.

4.2.24. Question 24

Candidates who had put in some preparation were rewarded on this question by a task which involved a straight substitution and it was very telling that this approach yielded much more success than that of using the given formula at the front of the paper and then manipulating to isolate cos*A*. Of the candidates who did adopt this latter approach, many forgot about operator precedence and ended up with 225 = 4 cos*A* from which they concluded that *A* was 56.25 degrees.

4.2.25. Question 25

Exponential growth is generally found to be a hard topic at GCSE and this question was no different. Many candidates started sensibly and substituted the values of *x* and *y* to get the pair of equations $7 = ka^1$ and $175 = ka^3$. However, things then went badly wrong, mainly through poor use of index laws. For example, a^1 was evaluated as 1, leading to *k* = 7 and ignoring the second equation, or, the 2 equations were combined to eliminate *k* giving $a^3 = \frac{175}{7}$, followed by a cube root. There appeared to be little evidence of candidates checking the value of *a* and the value of *k* in both equations.

5. PRINCIPAL EXAMINER'S REPORT – PAPER 5507 / 7A

5.1. GENERAL POINTS

It is somewhat disappointing that in the final year of this component that the administration of centres was not up to the previous high standards of the other years. It was necessary in 25-30% of the centres moderated this summer for the moderator to contact the centre regarding some matter regarding administration.

I must, however, offer my sincere thanks to those centres that did everything correctly and according to the regulations, sent the documentation, coursework in correct numerical order and with authentication complete, on time to the moderator.

The areas where the administration was lacking usually fell into one of the following categories:

- A failure to have the necessary authentication for the candidate's work. This is a QCA regulation but many candidates had not signed the necessary forms.

- Incorrect addition by the teacher-assessors of the individual strand values which meant that the marks were then incorrect on the Optems forms.

- Centres failing to include the highest and lowest scoring candidates work if these were no already a part of the original sample.

- A lack of annotation on the candidate's work. Often there were just strand values recorded on the front page of the work and nothing on the rest of the script.

- Incorrect transfer of marks from the Candidate's Record Form on to the Optems. Where this was recognised by the moderator then the centre was informed. However, this would automatically mean that the centre's mark and the moderators marks would differ even where the initial moderation at the centre was agreed.

- Errors in the candidate's work that had no been recognised by the centre. In AO1 this was often incorrect algebra and in AO4 it was often incorrectly drawn diagrams and statistically incorrect comments that the candidates had made. In all cases these caused differences in the marks awarded by the centre and the moderator.

There also appeared to be an increase in the number of cases where the centre had given too much help to the candidates in the form of 'help sheets'. Some of these offered too much undue help to the candidates and these were always referred to the Compliance Section of Edexcel for possible further action.

In coursework the candidates are supposed to be 'making decisions of their own' which enhances their work. This element has been removed from the candidates where the centre tells them what to do. Some 'help sheets' actually gave the candidates the answers, which is certainly beyond the help permitted by the regulations.

5.2. REPORT ON ASSESMENT

5.2.1. A01: COURSEWORK

In the vast majority of cases these tasks were well assessed but it was reported by the moderators that the number of cases where the assessments in the centres was too generous had increased. It was not just the work at the higher awards where this generosity occurred but right across the whole spectrum of marks.

One of the main areas is the candidate's apparent inability to justify their results, other than numerical substitution. Numerical substitution is a mark 4 award in strand 3 and not in the higher awards. This results in the candidates not being able to guarantee that any results obtained will hold true in all cases and not just those that they have tested.

The areas where inaccuracies occurred were:

- Incorrect work marked as correct. There was evidence that this was more apparent this year. If this happens then the centres marks have to be adjusted, as errors cannot be allowed to gain credit. More details relating to certain tasks will be highlighted later in the report.

- Inconsistent, undefined symbolism. This has been mentioned every year but the work submitted still has variables undefined and candidates using different letters to represent the same variable. It is in the General Criteria that all symbolism must be defined and consistently used at mark 6 and above.

- Insufficient rigour in certain tasks where generalisations just appear without any derivation of justification. Candidates then perform a numerical check and this process is given undue credit.

- Inconsistencies relating to internal standardisation particularly where the centre does several different tasks. There were cases where the centres assessments of a particular task were too generous within the several different tasks submitted and this affected the whole centre's marks irrespective of the other tasks. There is no mechanism to take individual tasks or teachers into account.

- Candidate's failure to use the structure of the task to help justify any generalisations given in the work. This is particularly important in the higher awards but also at mark 5 in strand 3.

AO1 Tasks.

There are a considerable number of tasks that centres could submit. I have concentrated, in my report, on the popular tasks submitted by centres.

THE FENCING PROBLEM

This is another very popular task with centres. Most centres are assessing this task well but there are more and more cases where candidates are omitting a very important part of the process. The essence of this task is the establishment of the regular case. Without this then it is not possible to 'provide a reasoned convincing argument' as required at mark 7. Candidates cannot bypass the earlier work and hope to gain full credit at the higher awards. We have emphasised this point in past reports to centres but there is increasing evidence that centres are not heeding the warnings given and the marks awarded by the moderator's differ from those awarded by the centres. This means that the justification for the general formula is flawed as the basic criteria for its justification has not been fulfilled. It is the justification for the triangular case that was often omitted by the candidates. They often just draw a few triangles and state the equilateral has the largest area. Where is the justification? This cannot be done graphically as the graph is not symmetrical as in the case for the square. It is amazing how many candidates can use their graph to show that the maximum occurs at 333.333 when their horizontal scale goes up in increments of 50/100.

The award of mark 7 in strand 2 is for the candidates deriving the general formula. There were cases this year where the formula just appeared. This is not a convincing reasoned argument. Mark 7 in strand 3 requires the candidates to give a commentary in support of their graph. A graph on its own is not sufficient for this award. There also has to be a sufficient range of polygons before this graph/ commentary has any meaning.

The work, at mark 8, in this task requires the candidates to discuss 'limits'. It is not sufficient for them to simply do a numerical approach demonstrating the circle area is always just larger than the polygons. They have to demonstrate, in general not numerical terms, that the formula for an n-sided polygon approaches that of the circle in the limiting case.

GRADIENT FUNCTION

This task maintains its popularity with many centres as an introduction to Calculus for their higher-level candidates.

However, it does not mean that the process of deriving the generalisations can be side stepped. Initially, the candidates use the method of drawing tangents to curves. They then need to introduce another approach to support and enhance the results already obtained. This is normally using 'small increments' to establish the generalisation.

Some candidates assumed the generalisation and then used small increments to test the generalisation worked. This task is not a predict and test mentality. Where did the candidates obtain the generalisation that they tested? The initial part of the task is to establish this.

At mark 7 the candidates did not always use negative/fractional values with small increments and so the 'convincing argument' was lacking.

At mark 8 many of the better candidates adopted a totally algebraic approach to the task to produce a very good piece of work. Again this has to be for other values than just positive values of the power.

It was pleasing to note that, this year, fewer candidates stated that *' ∂x equals 0'* in the limiting case. Where this did occur the candidates were penalised. Some centres did award mark 8 in all strands where this did happen, even when the candidates actually divided by nought.

HIDDEN FACES

This task was very popular with candidates at the Foundation Tier of entry. Most of them were able to systematically draw the shapes and correctly tabulate the results and obtain the generalisations. It was the awarding of mark 5 in strand 3 where centres were generous as the candidates could not really explain why it was '*3n and –2*', by reference to the structure of the task.

Some of the better candidates were then able to progress the task into the general cuboids case and obtain the correct generalisations.

NUMBER STAIRS

This task has increased in popularity with the centres. Again the assessments are very good up to awards of mark 6/7. The awards at mark 8 are then, often, generous.

Most candidates are able to generate formulae of the type:*' T= an +bg +c'*, where *'n'* is the stair number and *'g'* is the grid size. For the award of mark 6 in strand 2 the candidates need two of these formulae, or three of the type '*T=an +b*' where the coefficient of '*n*' changes. The candidates do often fail to clearly define 'g' and hence the award of mark 6 in strand 2 is not warranted. Candidates should also be warned that the use is IT can cause problems with ‘consistent’ symbolism. They often end up using *‘N and n’* for the same variable

At mark 7 the candidates should be looking for an overall generalisation. Many of the candidates now use the differencing technique. Whilst this is an appropriate technique it can never be used to provide ‘a concise reasoned argument’, or used as justification. This approach would have a limit the marks to 7-7-6. Some centres are still awarding marks of 8 for the differencing technique in spite of the comments in past reports and advise given at any Inset /Feedback meetings. A concise argument cannot be produced using this technique as the approach is based upon a finite set of numbers unless the candidates can guarantee that the sequence of numbers would continue.

The more able candidates attempt to use Sigma Notation. However, they base their use of this notation upon a pattern spot of the coefficients of *‘n and g’* this is not concise. Can they ‘guarantee’ that their sequences will continue? Without this then the argument does not hold true. Often the work shows that the candidates do not understand the notation, particularly in correctly writing the limits.

T-TOTALS

This is still a very popular task and the assessments, by centres, are very good up to a mark of 6. Beyond this mark there is often generosity in the awards.

At mark 7 and above the candidates have to be considering any investigation in total general terms and not just looking at specific instances. The vast majority of the candidates move on to consider transformations at this level. When they do so they must be considering all possibilities and in general terms. For rotations, this means rotating the general T-shape’*5n – 7g’* about a general point *(a,b*) on the grid. For reflections, looking at reflecting the general T-shape in lines parallel to the axis and at an angle of 45 degrees. Again the line of reflection has to be a general distance away and not just on the shape itself. For Translations, looking at the effect of translating the general T-shape, using a general vector. And for enlargements, looking at enlarging the general T-shape by a ratio for the whole T-shape and not just the stem or the crosspiece.

For the award of mark 7 in strand 3 the candidates have to consider the constraints placed upon their variables so that the T-shape will remain on the grid following their chosen transformation.

For an award of mark 8 the candidates must consider the relationship between all of their variables for their shapes to remain on the grid. Without this, any argument put forward is flawed as they have situations where their shapes would not fit on to the grid. This also applies to the situation where candidates attempt to explain how their combination of transformations can be represented by a single transformation.

One of the major errors in this task and not recognised by the centres is where the candidates incorrectly label the cells in the general grid case. This is a conceptual error and cannot gain any credit. The result cannot gain credit either as this is only correct, as the two errors made by the candidates have cancelled each other out.

Many centres failed to spot this when marking the work and awarded marks of 6 in all three strands. This was incorrect as the candidates should not be awarded any credit.

BEYOND PYTHAGORAS

This task maintains its popularity but the work does not often address the needs of the task. This task is all about families of Pythagorean Triples based upon the relationships between the sides of the triangle. Candidates were often just treating the task as a process of repeated differencing techniques to derive generalisations.

The better work looked at the relationship between the sides 'a b and c' and what happens as the relationship between 'b and c' changes. Which family derives when *'c = b + 1; c = b + 2' etc*.

Finally looking at the generalisations $2ax$, $a^2 - x^2$, *and* $a^2 + x^2$, and the different families that are derived dependent upon the value of 'x'

Again the assessments up to mark 6/7 were generally fine but generous at the higher awards. Mark 7 requires the candidates to consider different families of triples and not just multiples of the original set given in the task. Mark 7 in strand requires the candidates to justify that their generalisations fulfil Pythagoras's Theorem for their two new families.

BORDERS

This is another popular task with centres. As with the Numbers Stairs task the assessments are generally accurate up to marks of 6/7. Candidates were capable of producing a systematic list of results, tabulated and pattern spot for the marks in the 4/5 regions. However, mark 5 in strand 3 cannot be awarded for this approach. Many were able to demonstrate an understanding of the structure of the task as they show the manipulation of the squares to generate two other larger square of sides '*n and (n+1)*. If the candidates clearly define their variables as a physical feature of the shape and not the pattern number then mark 6 in all three strands could be awarded. This is not the same as candidates who 'spot' that the number of squares is ' $a^2 + b^2$ '.

There is still a reliance on the differencing technique to obtain the quadratic. Where ti is the case awards of 6-6-4 are made but, as above, only with a correct definition of the variables. No higher awards in strand 3 can be made for this approach, as differencing is not justification.

Moving the task into mark 7 and above requires the candidates to show a clear understanding about the structure of the task and to demonstrate that the 3-D case is made by building up 'layers' of the 2-D cases. This is necessary for the award of mark 7 in strand 1, not just drawing 3-D shapes and counting cubes. As with Number Stairs many candidates now applied the differencing technique to generate the cubic result. As with Number Stairs this approach has a ceiling of 7-7-6.

Candidates need to carefully define their variables in this task. They have to define their variable as a physical feature of the shape and NOT as the pattern number. They have to be able to demonstrate, that given any shape, they could quickly and efficient know the value of the variable without recourse to drawing previous shapes. This point has been highlighted in many previous reports to centres but it is still one of the causes for work being marked down by the moderators. There cannot be a 'convincing reasoned argument', which is the requirement at mark 7 without this careful definition of variables. Mark 8 requires the candidates to consider in general terms the summation of these various layers leading to the 3-D case. There was some very good work where the candidates had considered the algebraic sequences based upon the initial 2-D case.

THE OPEN BOX PROBLEM

This task is primarily about investigating the maximum 'cut-off' from a rectangular piece of card so that the resulting box would have the maximum area. It is not an exercise in calculus to obtain a formula for the volume of a box. Calculus can be used in the task but as a 'tool' to help the investigation.

The best pieces of work in this task were where the candidates considered the ratio of the sides as always being in the form '*1: n*'. The candidates then varied the value of *'n'* and used a spreadsheet to show that the optimum 'cut-off' was a sixth for the square case up to the maximum of a quarter for the rectangular case.

OPPOSITE CORNERS

Centres were generally very good in their assessments of this task up to marks of 5-5-5, where candidates were able to label a grid algebraically and then correctly expand brackets of the type '*n(n+a) and (n+a)(n+b)*' to show the difference for various sizes of rectangles. At mark 6 there is a need to introduce another features as an alternative approach to the work, which moves into the situation of a general sized grid. It is not awarded for repeating the previous skills. Some centres did the square case on the grid first and then moved to the rectangular case. The techniques used are the same and so there is no alternative approach. Candidates should have realised that the square case was a special case for the rectangular situation.

EMMA'S DILEMMA

This task continues to be popular with centres but the same pitfalls in the candidates work are still evident and the marks awarded were not justified. Previous reports have made it very clear that there has to be justification at every stage of the tasks development. Once the justification is flawed then any further progress is just not possible as the task develops stage by stage. The candidates have to be able to guarantee that their results will hold true in all situations and not just those that the candidates have 'tested'. Far too many candidates adopt a 'listing and pattern spotting approach' towards this task and this has limiting marks in the region of 6-6-5.

At mark 7 and above there should not be any need for the candidates to do any listings, as they should be working in purely general terms.

As with many previous years this task was far too generously assessed by centres and where submitted it is the main reason that a centres marks are out of tolerance.

5.2.2. A04: HANDLING DATA PROJECT

It is disappointing to have to report that after 5 years of this component the assessments by many centres are far too generous. The assessments in these centres are normally based around a technique led project rather than a project that should be 'using and applying' techniques in the context of an investigation. It was also noticeable that many centres now enter their candidates for GCSE Statistics and double enter the coursework. However, there were many occasions where the marks for GCSE Statistics was recorded on the candidate's work as grade C/D but this same work became Grade A* for GCSE Maths data-handling. Often increased in the data-handling assessments because of the techniques used even though the quality was no better.

It must be reported, however, that the majority of centres this year marked their candidates work diligently and with great accuracy. The marks were realistic and not over-inflated. The work was assessed on its quality and not the candidate's tier of entry/expected overall grade in mathematics.

Where centre's assessments were too generous was often a result of the following:

STRAND 1

- Have multi-hypotheses. The data-handling project is supposed to be a single project and not a series of smaller ones unless these are all linked together. If the candidates do several hypotheses then these have to be assessed individually, if not linked together, and the best overall mini tasks marks are awarded. The number of hypotheses does not determine whether the task is a particular mark in strand 1. t was noticeable that several centres had their own 'marks schemes' for AO4 and these included, as a part of the marks to be awarded in strand 1, the number of hypotheses that had to be included.

- The above point was very important in the awarding of marks of 7/8 in strand 1. Many candidates submitted projects that had multi-hypotheses and treated each of these separately. The produced, therefore, several substantial tasks and not a demanding one as required at mark 7/8. This has been mentioned before in the Principal Moderator's Reports to centres but it is apparent that the advise, in many cases, has not been heeded.

- Sample sizes are also very important in the AO4 project. Many candidates are still using stratified sampling as the norm rather than for any valid reason and this often gives rise to very small sample sizes in certain groups of data. This means that candidates were using samples sizes of 4/5/6 to draw box plots, calculate standard deviation and then attempted to draw valid inferences from the results. Where is the quality of use and understanding in this type of work?

- Centres were often making automatic awards in strand 1 for certain aspects of the candidate's work. Many centres automatically awarded mark 7 in strand 1 where candidates did stratified sampling or a mark of 8 for a pre-test. No consideration was given to the rest of the planning or whether the task itself was substantial or demanding. The latter determine the marks in strand 1 and not the techniques being used.

STRAND 2

- The awards in this strand are for the quality of use and understanding shown by the candidates when using a particular technique. This is often reflected in the way that the candidates are interpreting and discussing their results.

- Many centres this year awarded automatic marks, on sight, for techniques. The most popular automatic awards were:

  1. Mark 5 for lines of best fit irrespective whether there was any correlation or not.

  2. Mark 6 for cumulative frequency curves/box plots.

  3. Mark 7 for Histograms.

  4. Mark 7/8 for any technique from beyond the National Curriculum.

  Very often there was no consideration about the way the candidate had interpreted the results from these techniques but the mark was for 'doing' the technique. The marks were still awarded where the techniques were not even used. This is not correct, as techniques must be used if they are to gain credit. Even after five years, several candidates' marks were recorded by the centres as; 6-6-2, 4-7-4 and my best this examination session was 3-8-2. Hopefully, these centres will not want any further explanation when their marks are possibly regressed this year.

- Centres were awarding very high marks for techniques from beyond the National Curriculum even though the candidates had not used these techniques fully and with understanding. If candidates are using such techniques then they must realise that these come as a package. The candidates cannot, if they want to be awarded the higher marks, simply use part of the technique. The classic one this year was the use of Correlation Coefficients. Candidates were happy to talk about the numerical values and what this meant in terms of a strong/weak correlation but unfortunately there was no reference AT ALL to the sample sizes,. When sample sizes were considered the comments/interpretations made by the candidates were incorrect and so the high marks awarded by the centres were generous as the quality of use and understanding required in this strand was lacking.

- Many centres gave credit to candidates who drew lines of best fit onto scatter diagrams even when there was no correlation and the candidates often then proceeded to uses this Line o0f Best Fit to make further predictions. Quality and understanding, again, lacking in the work.

STRAND 3

- To gain credit for the techniques used the candidates must interpret their results. Centres were awarding too much credit where candidates simply quoted numerical values. These mean little without interpretation. This also applies where candidates make comments such as: 'My result confirm my hypothesis/ My result show that boys are taller than girls'.

- The candidates must look at evaluating their work at mark 5, seeing if there are any limitations to the techniques/samples used for mark 6 and then seeing how statistically significant their results are at mark 7. Many centres award high marks where candidates just state that a larger sample size would have been better. This aspect, for the higher-level candidates, should really have been thought about in the planning stages.

Many centres, as mentioned earlier, had designed their own mark scheme for their staff to use. These were often very prescriptive and taken literally by the person marking the work. With data handling this is not the situation because everything has to be taken together in the whole project. It must be noted that some of these 'mark schemes' did not take into consideration the minimum requirements of the Elaboration Document for the assessment of AO4. This is the document that all centres should be using to assess their candidates work.

5.2.2.1 A04: ASSESSMENT

The assessment of the AO4 projects this year was more realistic than previous years. Centre are beginning to understand the nature of the tasks that have to be undertaken and the requirements of the assessment criteria in relation to the middle strand.

Centres are beginning to understand that the AO4 project is all about 'Using and Applying' and not about the 'doing' of techniques.

The Data Handling Project has to reflect this using and applying, with doing as a supporting role. There has to be planning in the work showing some thinking. Every technique has to be used for a purpose and there has to be clear understanding shown by the candidates in their interpretations/discussions.

Pointers that centres need to remember in the Data Handling Project are:

- Do not do a technique because you can.
- Where there is, for example, no correlation at all, why is there the necessity to use a correlation coefficient to confirm this.
- Do not make claims that cannot be supported by you work/results.
- Consider carefully the techniques that you are using bearing in mind the type of data that you are using.
- There are no automatic awards in any of the strands for the Data Handling Project.
- Pre tests only add value if they inform and they have to be a part of a Demanding Task.
- Only use multi hypotheses if they can be linked together to form one overall project. Remember the Data Handling Project is meant to be ONE project and not a series of mini projects.

The main problem encountered from some centres is the idea that it is the technique that determines the nature of the task. Therefore, where candidates had employed techniques from beyond the National Curriculum there were automatic awards of marks 7/8 in all strands. This is not correct.

Some centres assessments were very good up to awards of marks of 6/7 but then, possibly because a candidate was in a higher set, the awards shot to marks of 7/8 without the work warranting such an award.
This over assessment of the candidates at the higher awards was often the primary reason for the marks going outside the permitted tolerance. Once the work is outside this tolerance then the marks of the whole centre could be affected.

The assessment of the Data Handling Project should be completed using ‘ The Elaboration Document For the Assessment of AO4’ issued by QCA and the examination bodies. Where centres have ‘their own’ assessment grids then they must encompass this document. If not, then the centre may be consistent in their assessment but not applying the criteria correctly. This is most evident in strand 2 where some centres still give credit for techniques being ‘done’ whether they are used in the task or not. Remember the award in strand 2 has to reflect a ‘ quality of use and understanding’ about the technique not just the ‘doing’

MAYFIELD HIGH SCHOOL
This is by far the most popular database used by centres. There are many different avenues considered by the candidates but the majority of the candidates attempt by far a consideration of Height/Weight/Gender.

Most candidates look towards investigating the difference in height/weight from different year groups or comparing the same features across different age groups. It is a pity that they cannot then link these together into one overall project for the higher awards.
Other aspects relating to this database concern IQ/KS results.

NEWSPAPERS
Fewer centres attempted this year. One of the problems is the amount of time taken to collect the necessary data.. At marks 4/5/6 candidates looked at aspects of comparing different newspapers in terms of word length od sentence length. This was generally fine for awards at this level.

At the higher awards their has to be some element of 'thinking' by the candidates. If candidates simply look at 'sentence length' across three different newspapers then this is not a demanding task. They should be considering all of the elements that affect readability and trying to formulate a plan to bring their ideas together into one project. This could be done by comparing different newspapers or by looking at different aspects of one newspaper.

CAR SALES
More centres used this database this year. Candidates set up comparisons of different models in terms of depreciation. Comparisons across different engine sizes and price were also considered. In fact they considered a considerable number of different approaches.

The more able candidates were then able to link together these features into a 'mathematical model' to determine the depreciation of different makes of cars based upon their variables.

OTHER DATABASES
Some centres used their own database, or primary data that had been collected in their centre. This is to be encouraged as there are not any limits on the type of database that has to be used.

5.3. OVERVIEW

In conclusion can I thank the vast majority of our centres who did everything correctly from the basic task of getting the candidates to complete the work through the administration and assessment for the moderation process. On behalf of myself, and my team of moderators I offer you my sincere thanks and congratulations on a job well done. In addition, I would also like to personally thank the many centres that have chosen and supported Edexcel over many years. Coursework will no longer be a part of the Specification and I know that some centres are celebrating its passing whilst others are not so convinced. My hopes are that the aspect of using and applying Mathematics never vanishes from the curriculum as I personally feel that this is what Mathematics is all about.

I would also like to add my thanks to the many moderators who have supported me in the past and in particular Peter Jolly and Stuart Bagnall. Stuart is Principal Examiner for 5507/7B this year, but I know that he would also wish to offer his best wishes and thanks for your support over the past years.

Malcolm Heath
Principal Moderator

6. PRINCIPAL EXAMINER'S REPORT – PAPER 5507 / 7B

6.1. GENERAL POINTS

The overwhelming majority of centres submitted their work inside the deadline and had used the correct forms. In some cases, the general 'authentication form' had been used instead of the specific mathematics 'candidate record form'. On 5507B this did not constitute a problem. In the very best examples, each piece was securely fastened once, all the candidates had been submitted in candidate number order and the candidate record forms had been completed with teacher signature, candidate signature, centre name and number, candidate name and number. However, in too many cases, important information was omitted. It is a QCA requirement that all work is authenticated as the student's own, with awarding bodies permitted to award zero marks when these signatures are not present.

Once again, a significant proportion of the work submitted by centres indicated that collusion in some form had occurred, either by candidates copying each other's work or, much more often, through a centre based approach where the entire cohort had followed very prescriptive routes and techniques. Some centres had produced very structured templates or worksheets that led candidates through a task or project, resulting in work that was very similar and in some cases identical. It is regrettable that the centres who had adopted this approach often hindered the progress of their candidates as, from mark 5 onwards on AO1 and AO4, candidates should be choosing, justifying and following their own ideas. Guidance upon what constitutes accepted good practice and permitted guidance is available through Edexcel's publications and INSET support. Cases where 'copying' had occurred were forwarded to Edexcel's compliance department where further action is carried out.

6.2. REPORT ON ASSESMENT

6.2.1. A01: COURSEWORK

THE FENCING PROBLEM

Candidates produced some fine examples of the use of Pythagoras and Trigonometry to evaluate the areas of their shapes. However, central to this piece is establishing that the regular case, for a given number of sides, will give the greatest area for a fixed length of perimeter. All too often this was not derived or stated. It is essential that the values to each side of a stated maximum are examined to determine that they are a maximum. It is insufficient to state that, for example, the square case of 250 by 250 is the maximum when the closest other examples are 240 by 260. The candidate has no evidence that the 251 by 249 case is less without examining this. An argument based upon the symmetry of the rectangle is sufficient to avoid repetition of calculations. However, with a triangle this is not the case and a more rigorous examination and verification of the maximum is required. Too many stated that the equilateral triangle and the square were the maximum without any evidence to justify it. Such an argument is 'built upon sand' and severely restricts progress in the third strand. Many candidates were capable of producing several polygons with correct trigonometry; although it was often obvious that they were following a set algorithm with little understanding. Indeed, many failed to produce a sufficient range of polygons from which to make any inferences at all. As a rule, a range beyond a decagon, perhaps extending into polygons with 10, 20, 100, 1000 sides etc would yield results where the limiting case of a circle could be justified. We all know that the limiting case is a circle. Unfortunately too many think that this fact without justification is sufficient for credit at grade A. It is not! Production of a graph asymptotic to the area of a circle does not convince, especially when only based upon 4 or 5 sets of regular shapes. The best candidates were able to adopt an argument based upon the development of the general equation for the area as the number of sides increased. The very best moved away from a numerical argument, which can never be convincing, towards a general symbolic argument.

NUMBER STAIRS

This task enabled candidates to produce a systematic list of results, tabulate their results and spot patterns. A pleasing number of candidates now offer a 'linking commentary' explaining why they have put the data into a table. Most were capable of explaining why the expressions worked and where the co-efficients came from. An increased proportion was able to label their stairs algebraically and add their expressions to arrive at the general expression for a particular stair size. Candidates then, typically, changed a feature such as the grid size and repeated their earlier approaches. A large number of candidates failed to define their variables correctly or, much more commonly, used a variety of letters to stand for the same variable. Commonly, *N,n* and *G,g* were used to stand for the same variable. This lack of algebraic rigour has increased this year, with candidates seemingly unaware that such things are important when creating, manipulating and interpreting algebra. It is hoped that the 'texting generation' can be prevented from destroying the correct and rigorous use of algebra as they are doing with the English language! More worryingly, perhaps, was the pattern for candidates to make the same labelling errors at the same stages, implying that there was a collective approach and that the labelling error was made by the originator of the work. To make progress in this task, candidates needed to link the co-efficients obtained across several general expressions. Too few were capable of forming this link, despite having enough evidence to do so. The very best candidates achieved an array of expressions quickly, spotting and generalising the 'triangular numbers' pattern and explored the other co-efficients through sophisticated labelling of the stairs and colouring of the key constituents, collating through the use of colour to produce a highly effective mechanism for displaying their structure.

Concise general arguments made use of published summations for sequences. However, at the top end, attempts that were made at using sigma notation often failed because of the correct use of the notation rather than the lack of understanding.

BORDERS
Candidates experience little difficulty in reaching the award of 4,4,3, producing a systematic list of results, correctly tabulating them and spotting and communicating patterns. A pleasing number of candidates now offer a 'linking commentary' explaining why they have put the data into a table. Their understanding of why the pattern worked was weak, with few demonstrating an understanding of the structure of the patterns that they had drawn. Many were able to symbolise their pattern, but once again, this tended to rely upon a mechanism such as differencing rather than an awareness of the link between the symbolic and the physical situation. Consequently, many candidates did not score well in strand 3, registering a mark profile in which the last strand score was well below the first two. Symbolism was often poorly defined. It is essential to link the numerical pattern to the physical situation it describes. A generalisation based on a numerical sequence i.e. 'shape number 1, shape number 2..' etc does not allow the candidate to solve a general arrangement of borders without referring to which position the particular arrangement would be in <u>their</u> sequence. Two different candidates starting their sequences, therefore, with different numbers of black and white tiles, would generate different expressions. Where candidates had indicated the link between their 'pattern number' and the dimension, however, this lack of generality was overcome. The simplest way to overcome this problem is through labelling a dimension of the 'borders shape' as *n* and adopting a structural argument based upon this dimension. In extending the 'borders shapes' into cubes, and hence extending into 3-D, candidates were able to 'explode' their diagrams and illustrate that the full generalisation comprised several arithmetic sequences. It should be noted, however, that many lost marks by not explaining or illustrating where their results for the 3D shapes came, with too many merely producing a numerical sequence without any evidence of its creation. Skilful (and concise) amalgamation of these complex expressions gained full marks on this task.

6.2.2. A04: HANDLING DATA PROJECT
The candidates who produced the best projects had work that was well planned, succinct and well presented. Candidates who stated what they expected to find, used and justified appropriate skills only and gave full reasoned results invariably achieved the better marks at their level. In the worst of cases, often fro candidates who clearly had ability, a lack of a plan severely handicapped their progress.

Achievement in this component varied considerably across centres, with some centres showing thorough preparation for the project whereas others showed little or none. The use of templates to help candidates set up their projects is encouraged but teachers must guard against becoming prescriptive. To achieve a mark 5, candidates must exercise choice of their own, in choosing appropriate data, appropriate techniques and diagrams. In many centres, candidates had clearly used a template provided by the centre indicating the data sampling techniques to be used, the diagrams that the candidate should draw for certain marks and the techniques and calculations that they should attempt. In all cases such as this, the work became too formulaic and failed to address the main objective of the project. It was clear that candidates did not generally understand the requirements of this project. There was an increase in the amount written in the projects, with far too many taking pages to write detailed explanations as to the different types of, for example, sampling methods. In addition, too many explained how each of their techniques should be carried out rather than why it was appropriate for them to be used in their context. Consequently, many read like textbooks rather than concise projects; a waste of both the candidate's and the examiner's time!

There is still, despite a biannual statement in the Principal Examiners' and Moderators' reports explaining that it is not so, an (incorrect) assumption that marks would be awarded for the use of skills, resulting in far too many diagrams and calculations occurring rather than candidates selecting the most appropriate and effective skill. It was common for candidates to list many hypotheses which were unrelated and then to explore each in isolation. There appears to be a misapprehension that three hypotheses are required to achieve mark 7. This is not what is required. Candidates need only investigate one hypothesis, which could be divided into smaller inter-related statements. Separate, unrelated hypotheses were treated by examiners as separate mini projects and were marked accordingly. It was therefore common to award 14 or 15 marks for each of the separate mini-projects when, it was clear, the candidate thought that their approach was worthy of more. The lack of any link between the separate hypotheses or any attempt to synthesise the information in answering their original investigation was a common occurrence.

The best work came from candidates who analysed a complex problem comprising a single hypothesis but with several sub factors. These were then explored independently and then fused to produce a single analysis. The best candidates had spent time producing a clear plan, with clear statements of expectation, full pre-analysis of what they expected to do and why. Sampling was well thought through and justified. The techniques were accurately carried out. Their results were discussed thoroughly and possible inconsistencies discussed.

A04: ASSESSMENT

MAYFIELD HIGH SCHOOL

This title remains the most popular on this examination. Many centres submit work which is well thought through, investigations involving height against weight being the most popular and successful. A worrying number still use TV hours against IQ or Weight against IQ as their area for investigation. No amount of higher level or sophisticated skills can hide the fact that there is no connection and, frankly, it is heartbreaking marking work where the candidate trawls through a variety of skills, diagrams and calculations to reach that conclusion. Better initial guidance would avoid this chronic waste of able candidates' time. Successful starting points were height v weight v age, IQ v SATs performance.

NEWSPAPERS

It is pleasing to report an improvement in attainment on this starting point. Many more candidates are choosing to use sentence length and word length as indicators of 'readability', have realised that different types of articles in the newspaper attract different writing styles and that this can be quantified and compared with techniques that are readily understood. The very best work, once again, compared beginnings and ends of articles, the perceived target gender, 'intelligence', age and reading difficulty. It is always a pleasure to read pieces that are exploring an idea that is unusual and that, however controversial and politically incorrect their premise, they are using data handing skills to try to resolve. It is extremely tedious to read tens of (and sometimes well over 100!) pages of repetitive skills, many duplicating their intended measure e.g. range, IQR and standard deviation on simple ideas. I have no idea what it must feel like to be creating these tombs, but it is certainly not fostering an appreciation and love of mathematics that it should.

USED CAR SALES

This project title had been added for the new specification, but few centres had attempted the project.

7. STATISTICS

7.1. MARK RANGES AND AWARD OF GRADE

Unit/Component	Maximum Mark (Raw)	Mean Mark	Standard Deviation	% Contribution to Award
5540F/1F	100	60.6	18.2	40
5540F/2F	100	54.1	17.4	40
5540H/3H	100	62.9	18.6	40
5540H/4H	100	57.6	21.4	40
5507/7A	48	29.1	7.9	20
5507/7B	48	27.5	6.0	20

7.2. GRADE BOUNDARIES

The table below gives the lowest raw marks for the award of the stated uniform marks (UMS).

	A*	A	B	C	D	E	F	G
5540F_1F				76	60	45	30	15
5540F_2F				68	54	41	28	15
5540H_3H	85	72	54	36	18	9		
5540H_4H	84	68	48	29	16	9		

	A*	A	B	C	D	E	F	G
UMS (max: 335)				288	240	192	144	96
5540F				144	114	86	58	30
UMS (max: 480)	432	384	336	288	240	216		
5540H	169	140	102	65	34	18		

GCSE Maths (Coursework)								
	A*	A	B	C	D	E	F	G
UMS (MAX 120)	**108**	**96**	**84**	**72**	**60**	**48**	**36**	**24**
5507 (A&B)	43	37	31	26	22	18	14	10

7.3. UMS BOUNDARIES

	A*	A	B	C	D	E	F	G
UMS	540	480	420	360	300	240	180	120