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Examiners' Report Summer 2007

IGCSE

IGCSE Mathematics (4400)

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Summer 2007

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There was an entry of almost 19,000 candidates, approximately double that in May 2006. The papers proved to be accessible and gave appropriately entered candidates the chance to show what they knew.
The error in Q16(b) of paper 3H is regretted and all possible steps were taken to ensure that candidates were not adversely affected by this.

The papers were marked online for the first time this summer. It appeared that some candidates may not have received (or did not implement) some relevant advice. For each individual part of each question, candidates should be careful to write only within the given space for that part. If this space proves insufficient, candidates should not write elsewhere on the paper, even in the space for the following part. Instead, they should ask for extra sheets of paper and attach these to the back of the paper. It is also important that candidates use only black or blue pens and HB pencils, making sure that drawing is not faint.

IGCSE Mathematics 4400
Paper 1F

Introduction

This paper gave 1600 candidates the opportunity to demonstrate positive achievement, which was taken by the majority of them. No questions proved to be inaccessible although only a minority gave completely correct answers to both parts of Q16 (transformations). Predictably at this tier, some candidates’ limitations in algebra were apparent on Q7(b) (equation), Q10 (equations of lines), Q14 (substitution and factorisation) and Q18 (expanding and simplifying). Working was generally well presented and methods clearly shown.

Report on Individual Questions

Question 1

Errors were rare but, if they occurred, the most likely ones were shading only four squares in part (a)(i) or, in part (c), giving a fraction which was not in its simplest form.

Question 2

The coordinates in part (a) were usually correct, although candidates found the coordinates of the point on the x-axis a little harder.
In part (b), most were able to give the length of the line in millimetres within the permitted tolerance but some, probably having measured in centimetres, were unable to convert it to millimetres, which led to answers such as 0.64 mm and 640 mm.
Many gained full marks for the perimeter in part (c), although a minority either worked in centimetres or in a mixture of millimetres and centimetres.
In part (d), the majority gave ‘isosceles’ or some variant but ‘equilateral’ appeared regularly and ‘right-angled’ was occasionally seen.
In part (e), most were able to measure the angle with sufficient accuracy and knew the angle was acute.

Question 3

The first part was well answered, although 21, 33 and 39 were regularly given as prime numbers. The vast majority successfully found the missing numbers in the second part.

Question 4

Candidates sometimes found the two explanations more of a problem than the numerical parts but, overall, this question was well answered. 'Add 7' appeared occasionally as the explanation in part (b) and some thought the fact that the difference was an even number was relevant in part (e). All that was required in this part was evidence that the candidate appreciated that all the terms of the sequence were odd or that any two terms were odd.

Question 5

There was a higher success rate on the parts which involved one type of symmetry than on those which involved two. In the second part, most candidates realised which flag had a rhombus on it.

Question 6

This was another well answered question, only two errors appearing with any frequency. In part (e), the numbers were occasionally reversed in the ratio while, in part (g), $\frac{143 \times 332}{100}$ was sometimes used.

Question 7

While there were many correct solutions to the first equation, it was not unusual to see the incorrect rearrangement $2x = 8$ and, less often, $2y = 10$.
Solving the second equation proved much more difficult and various wrong rearrangements appeared regularly, especially $5y + 2y = 7 - 4$, $5y - 2y = 7 - 4$ and $5y + 2y = 7 + 4$. Correct solutions were often given in the form of mixed numbers or improper fractions. If only a decimal solution were given, at least 2 decimal places, rounded or truncated, were required.

Question 8

All parts had a pleasing success rate, the only wrong answers appearing often enough to be noticed being 3 for (i) and 11 for (ii) in part (d).

Question 9

Most found this question very straightforward and many gained full marks. A small minority calculated 3.8×3 instead of 3.8^3 in the third part.

Question 10

Knowledge of equations of lines varied widely and answers ranged from coordinates through those which suggested some understanding, for example y 3 instead of $y = 3$, to correct equations. The most common errors were to give $x = 3$ instead of $y = 3$ and $y = 5$ instead of $x = 5$.

Question 11

A fair proportion of candidates gave the correct calculator display, although some rounded it incorrectly, usually to 7.6. A similar proportion gave 30.90357…, obtained by evaluating $\frac{(3.7+4.6)^2}{2.8}+6.3$. In general, the mark in part (b) was awarded if an incorrect calculator display was rounded correctly. In the case of 30.90357…, it often was but 30.9 also appeared regularly. Answers in the form of fractions were accepted in part (a) but, of course, had to be converted to decimals before part (b) could be attempted.

Question 12

The probabilities in the first two parts were often correct. The third part, although it had a reasonable success rate, proved more difficult and produced a wide variety of incorrect answers, including some, particularly 450, which were greater than 150. Some candidates lost a mark by giving their answer as $\frac{90}{100}$ instead of 90.

Question 13

Many candidates found the area correctly in part (a), the most popular wrong answer being 86 cm, the perimeter. 43 (28 + 15) and 210 (½ × 28 × 15) also appeared occasionally.
The scale drawing in part (b) was often completed accurately. If an error were made, it was usually with the side of the rectangle representing 28 m.

Question 14

At this tier, many candidates are weak in algebra and so both parts were not widely accessible.
In the first part, only a minority evaluated the expression accurately, although others received some credit for either substituting correctly or for evaluating one of the terms correctly.
In the second part, many were apparently unfamiliar with factorisation, only a minority understanding what was required.

Question 15

In part (a), many found the mode correctly, 3 (the mode of the numbers in the frequency column?) being the most common wrong answer.
Finding the range in part (b) had a lower success rate but was nevertheless quite well answered. Those who did not score full marks could gain 1 mark for giving evidence of some understanding, albeit imperfect, of range with answers such as 46-51.
A substantial number of candidates showed a clear understanding of the technique and scored full marks in part (c). Some found the mean of the numbers of sweets ($\frac{46+47+48+49+50+51}{6}$ = 48.5) or worked out $\frac{46+47+48+49+50+51}{20}$ and gave an answer of 14.55, even though this was not sensible. Unfortunately, the median had the same value as the mean but candidates who had clearly found the median received no credit for a numerically correct answer.

Question 16

There was wide variation in knowledge of transformations and only a minority of candidates provided two completely correct descriptions. A high proportion simply did not know what was required and gave descriptions in their own words, especially in part (a). Many recognised that part (b) was a rotation, but the often omitted ‘clockwise’ or gave the wrong centre of rotation. No marks were awarded to candidates who gave a combination of transformations, for example, a rotation and a translation in part (b), as the question requires a *single* transformation.

Question 17

Many candidates demonstrated a sound understanding of indices, especially in the first part, although occasionally answers like 7^{15} and 49^{8} appeared in part (i) and 5^{3} and 1^{6} in part (ii). The second part demanded a higher level of understanding but a fair number of candidates were able to find the value of n.

Question 18

In part (a), a significant proportion of candidates had the algebraic skills to score at least the 1 mark available for three or four correct terms in the expansion. Predictably, the main error which occurred at this stage was expanding $-4(2x + 1)$ incorrectly, usually as either $-8x + 4$ or $-8x - 1$. The most popular wrong answer was $4x - 11$, resulting from either the expansion of the brackets as $-8x + 4$ or the inaccurate collection of the constant terms following a correct expansion.
The absence of negative signs in part (b) probably boosted the success rate and a fair number of candidates gained some credit but this was outside the algebraic scope of many.
Although a substantial number of candidates made some headway in expanding the brackets, there was a wide range of incorrect attempts including $5p^2 + 4p$, $6p^2 + 4p$ and $5p^2 + 4$.

Question 19

A sizeable minority found the average speed correctly in the first part. Many more received 1 mark for demonstrating their knowledge of average speed = $\frac{\text{distance}}{\text{time}}$ with expressions such as $\frac{38.5}{21}$.

In the second part, many of those who made a realistic attempt did not convert 38.5 km to metres, started with $\pi \times 4.19^2 \times 38.5$ and obtained an answer of 2120 m^3. A smaller number converted incorrectly, usually multiplying by 100 and starting with $\pi \times 4.19^2 \times 3850$.

IGCSE Mathematics 4400
Paper 2F

Introduction

There was some evidence of good basic skills, although the standard of algebra shown in Q13, Q15 and Q18 was generally rather poor. Order of operations was poorly understood by many candidates. Trial and Improvement methods were used by a large number of candidates, often failing to result in fully correct answers. Centres should note that as from May 2008, Trial and Improvement methods, even when leading to correct answers, may not be awarded any marks. Questions requiring written explanations were often poorly answered, with candidates unable to put their understanding into words.

Report on Individual Questions

Question 1

Most of this question was answered correctly by most candidates. In part (b)(i) some candidates multiplied the four digits. In part (b)(ii) a few gave answers such as 2413 and 1234.

Question 2

Most candidates placed A and B correctly, but many placed C at 0 or nearer to 0.5 than 0 or even above 0.5.

Question 3

Part (a) was well answered on the whole, with an occasional incorrect answer such as “arc” or “arch” for (i) or “segment” for (ii). In part (b) many gave “segment”.

Question 4

Parts (a) to (d) were often answered correctly. 400 or 4000 was sometimes seen in part (c) and 4 in (d). In part (e) many candidates found 3969^2. Part (f)(i) produced a large variety of answers involving $\sqrt{(\sqrt{3969})}$, 3969^2 and 3969^3. In part (f)(ii) candidates were able to score the mark by rounding their answer to (i), but most candidates failed to round to 3 significant figures correctly. Typical errors were (i) 15.832 896 26, (ii) 15.833 and (i) 15 752 961, (ii) 157.

Question 5

(a) Many candidates found $4 \times (5 + 2)$.
(b) Common mistakes were, for example, $30 \div 4 - 2$, $30 \div 6$, $30 - 2 - 4$ and $30 + 4 - 2$.

Question 6

(a)(b) These parts were usually answered correctly, although a disappointing number of candidates believed that $^3/_{10} = {^1/_3}$.

(c) Those candiates who used a calculator to convert to decimals generally scored well. Some selected the smallest rather than the largest, with those who divided "upside down" often making this error. One or two used a common denominator of 900 and produced excellent solutions. A few had no recognisable strategy.

Question 7

Many candidates found no problem with this question. A few forgot to subtract from £10.00. Others only included one bar and one cake. A small number added or subtracted incorrectly.

Question 8

(a) This part was usually answered correctly.

(b) Some candidates confused mean and median.

(c) Many candidates arranged the numbers in order, but chose 5 or 6 as the middle one. A few gave "5 or 6". A small number averaged the middle two numbers from the original list.

(d) A common misconception was that because the number of points decreased, the median must decrease. A few candidates misunderstood the question to mean that the "4" was deleted from the list altogether, giving a median of 6. Many candidates stated that the median would be unchanged but their explanations were incomprehensible. Some gave inadequate reasons such as that the total number of teams had not changed. Only a few stated clearly that the reduction in the "4" made no difference to the numbers in the middle of the list.

(e) This was well answered on the whole. A few candidates incorrectly used one or both of the two figures (8 and 10) given in the question, eg $^2/_{10}$, $^8/_{10}$ and $^8/_{56}$. Some found $^2/_8$ correctly and then either cancelled incorrectly or changed to an incorrect form such as "2 in 8" or 2:8.

Question 9

(a) Many candidates were unable to find the area of the triangle. Examples of incorrect working were 3×4, $3 + 4 + 5$ and $0.5 + 3 + 4$. Many candidates omitted the units or gave cm or cm^3.

(b) Many good drawings were seen. Some candidates reflected in the hypotenuse or in the vertical line 1 cm to the right of the given line. Some "squashed" the image. Others omitted the part of the image to the left of the mirror line. Some gave a translation or an enlargement.

Question 10

In this question, lack of understanding of the order of operations was common, leading to (a) 21, (b) 55 (c) 70 and (d) $x + 15$. Another error in (c) was $-17 - 3 = -14$. In part (d) $x + 3 \times 5$ was common. Also in this part, partially correct working was often followed by incorrect "collecting up", eg $15x^2$. Many candidates inserted "$x =$" before their answer, thus losing a mark

Question 11

Parts (a) and (b)(i) were usually correct, although 140 and 310 were not uncommon in (b)(i).

(b)(ii) Many candidates simply showed their arithmetic without a written reason. Others gave as their reason "angle *B* is 90^{o}" or "because it's a right angled triangle". Some wrote essays, although all that was required was "Angle sum of triangle" or "The angles of a triangle add up to 180^{o}".

Question 12

This question was well answered on the whole.

(a) Some answers greater than £4800 were seen.
(b) Some candidates found 85% of £4800. Others found $^{1}/_{85}$ of £1920.

Question 13

(i) Many candidates failed to give an equation, sometimes just omitting the "= 17". It appeared that many did not know the difference between an expression and an equation. A few wrote "P =" instead of "= 17". $(2x+1)(3x-5)$ was often seen, leading to a quadratic equation.
(ii) Collecting terms was a problem for most (of the minority) who got that far. There were some mistakes after finding $6x - 4 = 17$, usually $6x = 13$. Trial and Improvement was common.

Question 14

This question was answered well by most candidates. Others found, for example, $^{2}/_{7}$ of 27 or $^{7}/_{9}$ of 27.

Question 15

This question was also answered well by some candidates. Most chose to multiply out brackets as a first step rather than divide both sides by 5. $5x - 4 = 35$ was very common, as was $5x = 15$.

Question 16

(a) Many candidates rounded 47.6 to 48. Some rounded 2.09 to 2.1. Others did not round at all.
(b) Some candidates did not use rounded figures. However, some good answers were seen that followed from sensible rounding. Some failed to round to 1 S.F. and they were obviously more likely to make mistakes in the arithmetic. There was little evidence to suggest that calculators were used frequently. A significant number did not round the answer to 1 S.F.
(c) Most answers were vague (eg "some" or "most" numbers were rounded up) or plain wrong. Many candidates did not express themselves clearly at all. A few said that the denominator was rounded down less than the numerator was rounded up, missing the point. Very few appreciated the effect of rounding the number in the denominator down.

Question 17

(a) Most candidates, divided the shape into a rectangle and a triangle. Where mistakes were made using this method, it was usually by using wrong dimensions for the triangle. Some made the question far more difficult by dividing the area into more difficult parts, such as with a diagonal, and these inevitably failed. $6 \times 3 = 18$ was surprisingly common, as was $6 + 2 + 3$ and some candidates even tried to multiply three dimensions.

(b) Many candidates multiplied by 20. Some failed to use the area of the wall at all. The fraction 15/20 was rarely seen and there were few correct answers. The conversion of litres to cm^3 caused difficulty, with many using 100 instead of 1000. Many made no attempt to convert at all. Others tried to convert the $15m^2$ and $20m^2$ to cm^2 but they rarely used correct conversions or reached a correct answer.

Question 18

A large number of candidates did not know how to start. Some others attempted an elimination method, even though this particular question is more easily solved by substitution. $y = 7x + 21$ was a frequent incorrect start, and those who did get $7y = 7x + 21$ often subtracted incorrectly to give $8y = +/- 21$ or $6x = - 21$. There were many other errors of a similar nature as well as more significant ones that led to quadratic equations or other complicated algebra. Trial and Improvement was not unusual, sometimes leading to a correct answer.

Question 19

(a) This was well answered by those who had learnt trigonometry. Some chose to use Pythagoras' Theorem in combination with sin or cos. These were much more likely to make mistakes or to suffer rounding errors. A large minority started with $\tan x = 4.2/5.1$. Some found $\tan^{-1}5.1 \div 4.2$ instead of $\tan^{-1}(5.1 \div 4.2)$. Premature rounding sometimes lost accuracy marks, in this part and in part (b). Many candidates attempted various methods without trigonometry.

(b) This was sometimes well answered, normally with sensible working, but there were also convoluted methods. 5 cos 29 = 4.37 was seen from time to time, and just occasionally tan was used (incorrectly). A few candidates gave 5 sin 29 = 2.2. Others gave 29 sin 5 or sin (29x5).

Question 20

(a) This part was well answered, with just a few candidates giving 0.4.

(b) This part was also well answered.

(c) 'No' possibly outweighed 'yes', but not by far. Many candidates had no idea how to justify their answer. Amongst those who did, 'Yes' was usually justified by "OR means ADD". 'No' had more varied reasons: "It should be 0.1×0.8" was common; some said that the probabilities were not related or were from different groups. Very few gave clear and correct answers. Many students wrote essays, some of which went outside the borders and therefore could not necessarily be marked.

Question 21

This was well done by those candidates who had learnt how to use Pythagoras' Theorem, and 2 marks were usually managed by these candidates even if the calculation went wrong. Some candidates found $6^2 – 4^2$ and others failed to take the square root of 52. A few calculated 52^2. A small minority resorted to trig.

IGCSE Mathematics 4400
Paper 3H

Introduction

The standard of this paper proved to be appropriate and gave over 17,000 candidates the chance to show their knowledge, many achieving high marks. No question was inaccessible, although only the strongest candidates scored full marks on Q14(b)(ii) (degree of accuracy) and Q17 (differentiation).
The majority of candidates showed their methods clearly and presented their working neatly.

Report on Individual Questions

Question 1

This proved to be a straightforward start to the paper. Occasionally, candidates giving the correct calculator display in part (a) rounded it incorrectly, usually to 7.6, in part (b). The only common wrong answer to part (a) was 30.90357…, obtained by evaluating $\frac{(3.7+4.6)^2}{2.8}+6.3$.
In general, the mark in part (b) was awarded if an incorrect calculator display was rounded correctly. In the case of 30.90357…, it often was but 30.9 also appeared regularly. Answers in the form of fractions were accepted in part (a) but, of course, had to be converted to decimals before part (b) could be attempted.

Question 2

In the first part, many candidates evaluated the expression accurately and the majority of those who did not received some credit either for substituting correctly or for evaluating one of the terms correctly. -3^2 was often evaluated as -9.
The factorisation in the second part was routine for the majority of candidates and errors were rare.

Question 3

Many candidates showed a clear understanding of the technique and scored full marks. A minority found the mean of the numbers of sweets ($\frac{46+47+48+49+50+51}{6}$ = 48.5). Others divided the correct sum of the products (960) by 6 instead of by 20; an answer of 160 should perhaps have aroused suspicion. Unfortunately, the median had the same value as the mean but candidates who had clearly found the median received no credit for a numerically correct answer.

Question 4

The majority of candidates demonstrated a sound understanding of indices, especially in the first part, in which errors were rare, although occasionally answers like 7^{15} and 49^8 appeared in part (i) and 5^3 and 1^6 in part (ii).
The second part was almost as well answered as the first. Few needed formal equations and most successfully used their knowledge of indices to find the value of n. Some gave 2^5 as their answer, which scored 1 mark, while others confused 2^n and $2n$ but this was not penalised if their intention was clear.

Question 5

The majority of candidates obtained the correct answer and many of the rest scored 2 marks out of 3 for an answer of 80% $\left(\frac{48}{60}\times100\right)$. Occasionally, $\frac{60}{48}\times100=125$ and $\frac{60}{100}\times48$ resulted in answers of 25% and 28.8% respectively.

Question 6

In part (a), very few failed to gain at least the 1 mark available for three or four correct terms in the expansion. Predictably, if an error occurred at this stage, it was expanding $-4(2x + 1)$ incorrectly, usually as either $-8x + 4$ or $-8x - 1$, but many scored full marks. The most popular wrong answer was $4x - 11$, resulting from either the expansion of the brackets as $-8x + 4$ or the inaccurate collection of the constant terms following a correct expansion.
The absence of negative signs in part (b) probably boosted the success rate, which was extremely high. The constant term was occasionally given as 11 but no errors were made with any real regularity.
The majority of candidates expanded the brackets correctly. $5p^2 + 4p$, $6p^2 + 4p$ and $5p^2 + 4$ all appeared occasionally and the correct answer was sometimes wrongly 'simplified' to $9p^4$ or $9p^3$ but all these errors were unusual.

Question 7

Many found the average speed correctly in the first part. Some started by expressing 21 minutes as a decimal of an hour, the first step of others being $\frac{38.5}{21}$. Of course, both of these could lead to the correct answer but, in this case, the former approach had the advantage of not involving the risk of premature approximation, an error made by a sizeable minority. Most of those who did not score full marks received 1 mark for demonstrating their knowledge of average speed = $\frac{\text{distance}}{\text{time}}$ with expressions such as
$\frac{38.5}{21}$, $\frac{38.5}{0.21}$ and $\frac{38.5}{1260}$. A few used $\frac{60}{21} = 2.857$ and then found $\frac{38.5}{2.857}$.
While many found the volume correctly in the second part, a substantial minority did not convert 38.5 km to metres, started with $\pi \times 4.19^2 \times 38.5$ and obtained an answer rounding to 2120 m^3. A smaller minority converted incorrectly, usually multiplying by 100 and starting with $\pi \times 4.19^2 \times 3850$. No credit was given for simply quoting $V = \pi r^2 h$; values had to be substituted for r and h. So there was no reward for those who wrote, for example, $\pi \times 4.19 \times 38.5$. Some candidates used the wrong formula, the volume or the surface area of a sphere, example.

Question 8

The majority of candidates calculated the percentage accurately in part (a), usually starting with $\frac{270}{4500} \times 100$ or an equivalent expression. Even if the answer were wrong,
1 mark was awarded for $\frac{270}{4500}$. Very occasionally, the multiplier $\frac{4770}{4500} = 1.06$ was used. The only error which appeared with any regularity was the use of $\frac{4500}{270}$, leading to an answer of 16.7.
Part (b) was well answered but there was a variety of wrong methods, many of which involved finding 4.5% of \$117. There was also occasional confusion with reverse percentages, resulting in the division of 117 by multipliers such as 1.045 and 0.955.
Many candidates gained full marks in part (c) but it proved considerably more demanding. \$3194.88, usually obtained by finding 4% of \$3328 and subtracting the result from \$3328, was a popular wrong answer and \$113.12 (4% of \$3328) also appeared with some frequency.

Question 9

Most candidates were successful in solving the first equation, often giving solutions in the form of mixed numbers or improper fractions. If only a decimal solution were given, at least 2 decimal places, rounded or truncated, were required. The only wrong answer with much support was $x = 1$ resulting from the incorrect rearrangement $5x - 2x = 7 - 4$.
Many candidates solved the second equation successfully. The rest were usually able to make some headway, even if it were only to give evidence that they appreciated that both sides had to be multiplied by 4 or a multiple of it. $28 - 2y = 2y + 3$ received no credit but
$7 - 2y = 2y + 3 \times 4$ and similar equations, although algebraically incorrect, were accepted as evidence. Those who progressed as far as $7 - 2y = 8y + 12$ but failed to complete the solution usually either simplified this incorrectly as $6y = -5$ or got as far as $10y = -5$ and then gave the solution as $y = -2$ or $y = -2$.

Question 10

Part (a) posed few problems, although a minority of candidates lost a mark by giving their answer as $\frac{90}{150}$ instead of 90.
Part (b) revealed a wide variation in understanding of conditional probability. Some did not take into account "does **not** replace it.", either because they misread the question or because they did not appreciate the significance of the phrase, and answered the question as if there were replacement. Some credit was given to those who did this consistently but not to those who took account of 'without replacement' in their numerators and not in their denominators.
In part (i), $\frac{3}{5} \times \frac{2}{4}$, the probability that Alec will take two *white* squares, appeared regularly.
There was a wide range of answers to part (ii). The correct answer was obtained concisely by many but some reached it by a more circuitous route. Others gave as their answer the result of one of the products $\frac{2}{5} \times \frac{1}{4}$ and $\frac{3}{5} \times \frac{2}{4}$, considering, either intentionally or unintentionally, only one colour of square. Those using a more involved method sometimes omitted relevant products or included irrelevant ones. Nearer the bottom of the knowledge ladder, a small minority were unsure when to multiply probabilities and when to add them. An even smaller minority were unfazed by answers which were greater than 1 or even negative.

Question 11

Any sensible reason which included 'tangent' and either 'radius' or 'line from the centre' was accepted in the first part.
Many candidates scored full marks in the second part. Of those who did not, a high proportion used Pythagoras' theorem accurately to find the radius of the circle, although a minority used $OA = \sqrt{5.7^2 + 6.9^2}$. After that, some included one or two 6.9s in the perimeter while others, not appreciating that the tangents were equal in length, applied Pythagoras' theorem again in triangle *BOC* but with angle *BOC* as the right angle. Some candidates prematurely rounded their answer for the radius, which cost them the accuracy mark for the perimeter..

Question 12

A very high proportion of candidates scored full marks. The rest made three main types of error. At the end of part (c), some candidates failed to subtract their cumulative frequency reading from 60. Others made errors using the scales on the axes, especially, on the cumulative frequency axis, reading 44 as 42. On the weight axis, 430 was occasionally marked wrongly. Points were sometimes plotted mid-interval, although, if candidates then went on to use their graph correctly, the penalty for this was only 1 mark.

Question 13

Many candidates gained full marks and few failed to score at least 1 mark for a correct line, usually for $y = 5$, although some drew $x = 5$ instead. If the line $y = 2x$ were wrong, $y = \frac{1}{2}x$ or $x = 2$ often appeared in its place and $y = x - 1$ was the most common replacement for $y = x + 1$. A significant number of candidates drew all three lines correctly but then indicated the wrong region. Full marks were awarded if the correct region were shaded in or shaded out or labelled.

Question 14

For the majority, making r the subject of $A = \pi r^2$ was routine algebraic manipulation. The usual form of the answer was $r = \sqrt{\frac{A}{\pi}}$ but $r = \frac{\sqrt{A}}{\sqrt{\pi}}$ appeared regularly and $r = \sqrt{A \div \pi}$ occasionally. Amongst the unsuccessful minority, $r = \frac{\sqrt{A}}{\pi}$ was the most popular wrong answer, with some support for $r = \sqrt{A - \pi}$ and $r = \sqrt{\frac{\pi}{A}}$. Some candidates were careless in writing what may have been the correct expression as it was not clear whether it was the square root of $\frac{\pi}{A}$ or whether it was square root of π divided by A .
In the second part, a substantial number of candidates gained full marks, demonstrating a clear understanding of bounds and degree of accuracy. Others evaluated the lower bound accurately in part (i) but did not appreciate the requirements of part (ii); often $\sqrt{\frac{14}{\pi}}$ was evaluated. Even if they then happened to opt for the correct value (2.1), they received no credit, as the award of any marks in part (ii) was dependent on the use of $\sqrt{\frac{14.5}{\pi}}$.

Question 15

Many candidates scored full marks. If one mark were lost, it was usually because the sketch graph was a straight line with a negative gradient, instead of a hyperbola. The most common error was to use direct proportionality and so 9375 was a popular wrong answer to part (b). This was regarded as mathematical misunderstanding, rather than misreading, and received no credit. Some who started with $f = \frac{k}{w}$ evaluated the constant of proportionality as 7.5, which was penalised in part (a)(i), but, if they then used their value correctly, they could still gain full marks in part (b).

Question 16

The error in the question is regretted and everything possible was done to ensure that candidates were not disadvantaged. The mark scheme for the second part was changed so that full marks could be scored by candidates who obtained a correct unsimplified expression for $\overrightarrow{EF}$ in terms of **a** and **b**. Some candidates correctly obtained
$\overrightarrow{EF} = \frac{2}{3}\overrightarrow{PQ}$ but crossed out their attempt, thinking they had made a mistake. So crossed out work, even if replaced, was marked. If a candidate made more than one attempt, all were marked and the candidate received the mark for their best attempt.
There was the usual wide range of understanding of vectors, from a minority who appeared to be completely unfamiliar with them to those who produced concise, completely correct solutions with proper notation. Between these two extremes, those who had any knowledge of vectors realised that $\overrightarrow{PR}$ was 3**b**, or **b** + **b** + **b**, and many found an expression for $\overrightarrow{QR}$ but $\overrightarrow{PF}$ proved more difficult. The manipulation of vectors required in the second part was demanding but performed accurately by many candidates. Full marks could still be gained by candidates who made a mistake in the first part but then manipulated *their* vectors correctly.

Question 17

The majority were able to differentiate x^2 correctly but differentiating $\frac{16}{x}$ proved to be a major stumbling block. $\frac{dy}{dx} = 2x + 16$ was the most popular wrong derivative but there were many others, notably $2x - 16$, $2x + 1$ and $2x + \frac{16}{x}$. Solving the equation obtained by equating the correct derivative to 0 also posed problems, especially if the equation were in the form $2x - 16x^{-2} = 0$ rather than $2x - \frac{16}{x^2} = 0$. A few obtained the correct answer of (2, 12) using $\frac{dy}{dx} = 2x + 16$ and $\frac{d^2y}{dx^2} = 2$ but this gained only the 1 mark for $2x$.

Question 18

While many found the total surface area correctly in part (a), a common error was the omission of the area of the circular base of the solid, leading to answers of 49.2 cm^2 or 49.3 cm^2. The other main error, which was less frequent, was to find the surface area of a complete sphere (98.5 cm^2).
There was a substantial number of correct answers to part (b) using one of three methods. The most efficient method was the use of the area factor $(\sqrt[3]{125})^2 = 25$), although a minority mistakenly used $\sqrt{125}$. Less direct was the use of the scale factor (5) and substitution of $r = 14$ into the area formula. The most lengthy and perilous route was to start by finding the volume of hemisphere **A** and then to find and use the radius of hemisphere **B**. Candidates using this method sometimes persevered successfully, but many fell along the way, victim to a wide range of errors, especially confusion between spheres and hemispheres and the manipulation of $\frac{1}{2} \times \frac{4}{3} \times \pi \times r^3 = 5747.02...$ or $\frac{4}{3} \times \pi \times r^3 = 11494.04...$ to obtain the value of r.

Question 19

The general standard of algebra was very high and a large proportion of candidates solved the simultaneous equations correctly. The rest fell at various hurdles. Inaccurate expansion of $(3x - 1)^2$ accounted for some; usually the quadratic term was given as $3x^2$ or, less often, as $6x^2$ or $9x$, or the constant term as -1. After that, errors might occur in solving the quadratic equation $10x^2 - 6x - 4 = 0$, either in factorisation or in the use of the quadratic formula. A surprising number factorised correctly, but then wrote down the wrong values of x. Even a few who successfully found both values of x did not reach the finishing line; there were occasional errors in calculating the value of y when $x = -\frac{2}{5}$.

IGCSE Mathematics 4400
Paper 4H

Introduction

There was much evidence of good basic skills. Q14 and Q17 produced some very good algebra (although also some extremely inadequate algebra). On the other hand, Trial and Improvement methods were used by a significant minority of candidates. These often failed to produce fully correct answers. Centres should note that as from May 2008, Trial and Improvement methods, even when leading to correct answers, may not be awarded any marks.

Report on Individual Questions

Question 1

Most candidates found this a straightforward opening to the paper. A few failed to give an equation in (i), usually just omitting the "= 17". A few wrote "P =" instead of "= 17". There were some mistakes after finding $6x - 4 = 17$, usually $6x = 13$.

Question 2

This question was answered very well by most. A few candidates found, for example, $^{2}/_{7}$ of 27 or $^{7}/_{9}$ of 27

Question 3

This question was answered well by a good number of candidates. Most chose to multiply out brackets as a first step rather than divide both sides by 5. $5x - 4 = 35$ was a common error, as also was $5x = 15$.

Question 4

(a) Many candidates rounded 47.6 to 48.

(b) Some candidates did not use rounded figures. However, many good answers were seen that followed from sensible rounding. Some failed to round to 1 S.F. and they were obviously more likely to make mistakes in the arithmetic. There was little evidence to suggest that calculators were used frequently. A significant number did not round the answer to 1 S.F..

(c) There was a tendency to be vague (eg "some" or "most" numbers were rounded up) and some candidates did not express themselves clearly at all. However, many did give clear and correct answer. A few said that the denominator was rounded down less than the numerator was rounded up, missing the point.

Question 5

(a) Finding the area of a trapezium was not a problem for most candidates, who usually divided it into a rectangle and a triangle. Where mistakes were made using this method, it was usually by using wrong dimensions for the triangle. Some made the question far more difficult by dividing the area into more difficult parts, such as with a diagonal, and these inevitably failed. $6 \times 3 = 18$ was surprisingly common and some candidates even tried to multiply three dimensions.

(b) The fraction 15/20 was often correct and there were plenty of completely correct answers. The conversion of litres to cm^3 caused difficulty, with many using 100 instead of 1000. Many made no attempt to convert at all. Others tried to convert the $15m^2$ and $20m^2$ to cm^2 but they rarely used correct conversions or reached a correct answer.

Question 6

Most candidates attempted an elimination method, even though this particular question is more easily solved by substitution. $y = 7x + 21$ was a frequent incorrect start, and those who did get $7y = 7x + 21$ often subtracted incorrectly to give $8y = +/- 21$ or $6x = - 21$. There were many other errors of a similar nature as well as more significant ones that led to quadratic equations or other complicated algebra. Trial and Improvement was not unusual, sometimes leading to a correct answer. Stronger candidates often scored full marks.

Question 7

(a) This was well answered on the whole. Some candidates chose to use Pythagoras' Theorem in combination with the sine or cosine rule, or just sin or cos. These were much more likely to make mistakes or to suffer rounding errors. A large minority started with $\tan x = 4.2/5.1$. Premature rounding sometimes lost accuracy marks, in this part and in part (b).

(b) This was also well answered, normally with sensible working, but there were also convoluted methods. 5cos 29 = 4.37 was seen from time to time, and just occasionally tan was used (incorrectly). A few candidates gave 5sin 29 = 2.2.

Question 8

(a) This part was well answered, with just a few candidates giving 0.4.

(b) This part was also well answered.

(c) 'No' possibly outweighed 'yes', but not by far. 'Yes' was usually justified by "OR means ADD". 'No' had more varied reasons: "It should be 0.1×0.8" was common; some said that the probabilities were not related or were from different groups; quite a few candidates stated "mutually exclusive" when they meant "not mutually exclusive" or used "independent" instead. Some gave clear and correct answers, including reference to the fact that there was scope for probabilities greater than 1 (using other colours or "Not glass or Not green", for instance). Many students wrote essays, some of which went outside the borders and therefore could not necessarily be marked.

Question 9

This was well done. Very few failed to make a sensible start and 2 marks were usually managed even if the calculation went wrong. Some failed to take the square root of 52. A small minority resorted to trig. Did those who used the cosine rule realise that they were ending up with the same working as that given by Pythagoras' theorem?

Question 10

(a) Many candidates wrote an equation, with little or no working. Only some of these attempts were correct. Some made a table of points, and deduced the equation from this – usually wrongly. Those who knew that the gradient was required were usually able to find it and use it properly, although some had a gradient of $^1/_2$.

(b) The majority of candidates knew exactly what was required and scored the mark. Just a few had no idea, whilst some started from scratch to find an appropriate equation.

(c) Most candidates answered this correctly, with a few giving just 4 or (4, 0) or (0, -4) or x0, y4. A significant minority attempted to solve the two simultaneous equations, usually unsuccessfully.

Question 11

(a) 56 was the usual answer but a surprising number of candidates (not always the very weak ones) tried to scale the angle, usually dividing by 1.5 or 2.5.

(b)(c) The best answers used similar triangles, rather than trig, though both methods achieved reasonable success. Those who failed usually mixed up the sides to use in their ratios, a problem that was less common amongst those who redrew the triangles with corresponding orientation.

Question 12

(a) Some candidates stopped at a^7/a^2. $a^{12}/a^2 = a^{10}$ was common

(b) Many candidates could not handle the mixture of notations. Of those who could do so, some found $x^{1/2 \times 6}$ or $^1/_2 \times x^6$ or $6 \times x^{1/2}$.

(c) This caused considerable difficulty. Many started by multiplying out brackets. They usually got into trouble, frequently resorting to cancelling individual coefficients or terms. Some candidates started well, but finished with $3(x + 1)/6$.

Question 13

(a) This question was designed to make the determination of the quartiles simple. Many candidates failed to see this. It was common for candidates to look for quartiles at positions $n/4$ and $3n/4$, causing them to choose the wrong values (possibly fractional) for the quartiles. Those who used $(n + 1)/4$ etc generally scored full marks. Plenty of wrong answers started by adding the numbers (146/4, 3 × 146/4 leading to an IQR of 73 for A). Others used $n/4$ or $(n + 1)/4$ etc for the quartiles, and then just subtracted, leading to IQR 12 – 4 = 8 for A and 9 – 3 = 6 for B.

(b) Many candidates knew what they wanted to say but expressed it poorly. Words like ‘wider range’ and ‘more variety’ were common. Those who did not understand the point tended to say one group did better, were higher in general, or had a better average.

Question 14

Though there were plenty of good answers, this question did challenge the moderate and less good candidates. Step one was an immediate stumbling block. $(x – 1)$ sometimes appeared alongside $(5x – 7)$ instead of, or as well as, with the $(x + 1)$. Sometimes the sign was lost, giving $(x + 1)^2$, or brackets were wrongly multiplied. Collecting terms added more mistakes. Those who collected terms correctly, generally completed the question. Both factorisation and use of formula were common and often successful. Only a few used completing the square (which is allowed, although not required by the Specification) and trial and improvement was, happily, not especially common.

Question 15

In this question candidates' reasoning was often difficult to follow, with numbers appearing without any explanation or labelling. Candidates who adopted this approach usually scored low marks because even though their thinking may have been correct, there was no evidence of this. On the other hand, those who drew a Venn diagram often scored higher marks. Some candidates correctly found the number of students who played tennis only (2), but failed to go on to the final answer. Of those who did not get this far, a reasonable proportion scored 1 for showing 12 in the intersection on a diagram, or 2 for showing 6 in the "Hockey only" section. Many candidates, however, seemed confused between the number doing a sport and the number doing only that sport, so it was frequent to see 18 in the "Hockey only" section of the diagram. It was also not unusual to see a third circle to account for those involved in neither sport. 18 + 12 +15 – 35 = 10 was seen quite often, whilst 35 – 18 – 15 = 2 was a very quick way to earn 3 marks.

Question 16

sin x = 6/9, tan x = 6/5 and cos x = 5/9 were all seen, although many candidates recognised that the cosine rule was appropriate. Sadly, a significant minority could not even copy the equation down correctly from the formulae page. Indeed, some versions were so far from correct that it seems unlikely that those candidates even looked on the formulae page. Those attempting to write down a rearranged version of the cosine rule were most likely to start off with an incorrect statement. Statements such as $(5^2 + 9^2 - 2\times5\times9)/6^2 = \cos A$ were not unusual. Many of those who started with a correct statement made the usual mistake of "collapsing" the cosine rule, arriving at $36 = 16 \cos A$, which was then conveniently written as $\cos A = 16/36$, since the "correct" next step was recognised to give nonsense. The better candidates had no difficulty obtaining the correct answer, maintaining accuracy well.

Question 17

(a) Common incorrect answers in (i) were $x = 0$ and $x < -2$, and in (ii) were $x < 0$, $x \leq 1$, $x > 1$, $x = 0, -1, -2, \ldots$, and $x = 1$,

(b) There were many correct answers. Common errors were gf(10), f(10) × g(10) and f(10) + g(10). Some lost the square root and calculated 1/(9 + 2). Just a few gave the additional answer of -1 which is not appropriate in this context.

(c) There were plenty of correct answers, more often coming from an algebraic approach than from a flow diagram. There were also plenty of mistakes in the algebra. A common one was to go from $y^2 = x - 1$ to $y^2 - 1 = x$, giving an answer of $g^{-1}(x) = x^2 - 1$. An answer of $g^{-1}(x) = (x + 1)^2$ sometimes appeared, often following little or no working at all or deduced from an incorrect flow diagram. Some candidates showed no understanding at all and there were attempts to give purely numerical answers, usually linking to part (b). Occasional scripts had an answer of $1/\sqrt{(x - 1)}$.

Question 18

(a) Although this part was well answered by some, others found multiples of $(1/6)^3$ and many candidates added the probabilities. Some candidates included the number 18 in their calculation. Many showed no understanding of the manipulation of fractions.

(b) The better candidates sorted this question out well. Others found it difficult to identify all of the correct combinations. One of 126 or 216 was commonly missed, whilst 114 was sometimes included twice. Two very common misunderstandings were to use 112, 224 and 336 (adding scores) or 122, 224, 236 (multiplying scores), although the question was quite clear as to what was required. Working out probabilities was less troublesome, but 1/6 × 1/6 × 3 was certainly not uncommon.

Question 19

(a) ½ × 5 × 5 × sin 60 was used well, usually giving the correct answer, though 13.366 was sometimes obtained (how?). Many just found ½ × 5 × 5. Those dabbling with Pythagoras were more likely to make a mistake, $h^2 = 5^2 + (5/2)^2$ being one of the more common ones.

(b) Candidates who correctly found the area of the sector had a fairly good prospect of achieving the correct result, adopting one of several possible approaches. Surprisingly, a good number of those who found the triangle to have area 12.5 went on to use a correct method in (b), gaining two method marks. Candidates who were struggling used different fractions of a full circle, especially ×2, ½ or ¼. There was one interesting answer using a semi-circle. Subtracting 3 triangles and dividing by 3 gave the area of a segment, which was then added twice to a triangle in the usual way. Other mistakes were to use $2\pi r$ or $\pi \times (2.5)^2$.

Question 20

Many gave correct answers though in some cases it may have been the result of faulty reasoning, e.g guessing that the intervals on the vertical axis went up in 5's and putting 5 as the answer for part (a) and 30 for part (b). A few counted squares to give 4, 6. It is worth noting that by far the most fruitful approach was to use area = frequency and to consider the areas of the blocks, rather than to use frequency density.

Question 21

(a) A substantial number of candidates did not know this standard factorisation, giving such answers as $x(16x)$-1, $x(16x - 1)$, $16x(x - 1)$, $16x(x) - 1$ and $4x(4x) - 1$.

(b) Very few candidates made any use of (a). Those who did tended to get lost, though there were just a few very elegant answers. The traditional approach to find prime factors was quite successful, 3 × 533 being the most common incomplete answer.

(c) Relatively few candidates linked this to (b). Those who did so generally achieved a correct final answer quite easily. Most candidates started all over again. There was much success doing this, though it obviously gave scope for numerical errors.

Statistics

Overall Subject Grade Boundaries – Foundation Tier

Grade	Max. Mark	C	D	E	F	G	U
Overall subject grade boundaries	100	70	55	40	25	10	0

Paper 1F

Grade	Max. Mark	C	D	E	F	G	U
Paper 1 grade boundaries	100	71	56	41	27	13	0

Paper 2F

Grade	Max. Mark	C	D	E	F	G	U
Paper 2 grade boundaries	100	70	55	40	25	10	0

Overall Subject Grade Boundaries – Hier Tier

Grade	Max. Mark	A*	A	B	C	D	E
Overall subject grade boundaries	100	84	65	46	28	14	7

Paper 3H

Grade	Max. Mark	A*	A	B	C	D	E
Paper 3 grade boundaries	100	83	64	45	27	14	7

Paper 4H

Grade	Max. Mark	A*	A	B	C	D	E
Paper 4 grade boundaries	100	85	66	47	28	14	7

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