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Mathematics 4400

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IGCSE Mathematics 4400
Paper 1F

There was an entry of almost 10,000 candidates from 264 centres. Overall, the papers proved to be accessible and most candidates were able to demonstrate positive achievement.

Introduction

This paper gave a wide range of candidates the chance to show what they knew. It proved to be accessible, apart from part (e) of Q5 (locker numbers) and part (b) of Q14 (terminating decimals), on which only a small minority of candidates were successful. Most did well on the first half of the paper but only the ablest made much headway with the last few questions, especially Q21 (London Eye) and Q22 (region). Working was generally well presented and methods clearly shown.

As usual, the marks of many candidates were in the 80s and 90s, far above the grade C threshold. For them, the paper was a satisfying educational experience and, in their entry policies, centres will have to weigh this against the grade C ceiling.

Report on Individual Questions

Question 1

The majority of candidates either scored full marks or 3 out of 4. The first two parts were usually correct, although, in part (b), 7000 and 7300 appeared regularly. “Tenths” was given with surprising frequency in part (c) and, in part (d), 108 (436 − 328) and 54, probably the result of incomplete methods, were the most common wrong answers.

Question 2

Errors were rare but, if made, the most likely ones were 20.3 in the first and the omission of the decimal point in the second.

Question 3

Hardly any candidate failed to read the percentage accurately in part (a)(i) and many changed it to a fraction correctly in part (ii), although a substantial minority either failed to simplify $\frac{5}{100}$ or started with $\frac{5}{40}$, the denominator being the highest percentage on the scale of the bar chart.

Parts (b), (c) and (d) were almost always correct but, although well answered, part (e) proved more demanding. Those who were unsuccessful generally either got into difficulties as a result of trying to write 600 million in figures or used a completely wrong method, dividing 600 by 21, for example. Some candidates used the correct method for finding 21% of 600 million but then wrote down too many or too few zeros in their final answer.

There were many acceptable explanations in part (f), usually involving the sum of the percentages shown on the completed bar chart and its subtraction from 100. Unsuccessful candidates often just made a statement about China’s rice production or its population, unrelated to the information given.

Question 4

Full marks were common. If an error were made, it was generally in the final part, 3 and 5 being the popular wrong answers.

Question 5

There was a high success rate for the first three parts, although, presumably resulting from confusion between "above" and "below", 4 and 32 sometimes appeared as answers to parts (a) and (b) respectively. 8 was the most common incorrect answer to part (c), perhaps from rounding down $41 \div 5$.
Part (d) proved difficult and part (e) was beyond the majority of candidates. Many did not understand what an expression was and gave numbers or inequalities. Candidates who appreciated the meaning of "expression" usually gave the correct one in part (e) although $p - 5$ appeared occasionally. In part (e), however, expressions were often incorrect, especially $q + 5$ and $q + 4$.
Part (f) was well answered, although $\frac{39}{50}$ appeared regularly in part (i).

Question 6

2.85^2 was usually evaluated correctly but sometimes rounded to 8.1 (2 significant figures). In part (b), the cube of 28 or the square root of 28 were frequently found. Those who found the cube root correctly sometimes made an error in rounding it to 3 significant figures. Uncertainty about the significance of the zero was no doubt sometimes the reason for an answer of 3.037, although confusion between "significant figures" and "decimal places" may have been a factor as well. A truncated answer of 3.03 suggests a candidate understands "correct to 3 significant figures" but not the basic principles of rounding.

Question 7

Candidates were more familiar with "diameter" than "tangent" and part (i) was generally correct. Part (ii) was also well answered but it was not unusual to see "chord" as the name of the line *AB*. In the second part, the line was almost always measured accurately and the length was often converted to millimetres correctly. When it was not, the most common error was multiplication by 100, instead of 10, but division by 10 or 100 also appeared occasionally.

Question 8

Predictably, there was wide variation in candidates' algebraic skills and in the quality of answers to this question. In part (a), q^4 was a popular wrong answer. In part (b), no credit was given if a multiplication sign appeared in the answer. In part (c), y^6, $6y$ and $3y^6$ all appeared regularly. Part (d) was probably the best answered part but uncertainty with signs led to a range of incorrect expressions, particularly $5g + 2h$, $5g + 8h$ and $3g + 8h$.

Question 9

Most candidates scored well on this question. It was pleasing to see acceptable reasons given in parts (a)(ii) and (c)(ii), with very few candidates only showing their working. If just one mark were lost, it was usually on part (b)(i); "obtuse" was the most common wrong answer and "exterior" also appeared occasionally.

Question 10

This question was quite well answered but some candidates stopped after finding the scale factor and the height of rectangle **Q**, presumably through not reading the question carefully enough. A substantial number of candidates found the height of rectangle **Q** by adding 13 (19.5 − 6.5) to 4.8. Even they could salvage a mark by using their incorrect height to find the perimeter of rectangle **Q**. A significant minority calculated the area of rectangle **Q**, instead of its perimeter.

Question 11

The understanding of percentage and ratio varied widely but full marks were not uncommon. In part (b), even those who gave an answer of 0.4 (the reciprocal of the correct answer) or 2 : 5 (the simplest form of the ratio 14 : 35) received some credit.

Question 12

In both parts, trial methods were very much in evidence but frequently unsuccessful, as neither solution was a positive integer. In the first part, $5t = 2$ regularly led to an answer of $t = 2.5$. In the second part, the most frequent wrong steps were $4x = 10 - 7$, which led to an answer of $x = 0.75$, and $4x = 10 + 7$, which led to an answer of $x = 4.25$ but reaching $4x = -3$ was no guarantee of full marks, sometimes leading to answers of $x = \frac{3}{4}$ or $x = -\frac{4}{3}$.

Question 13

The quality of responses was centre dependent. Candidates were either familiar with probability and gained 3 or 4 marks or simply did not understand what was required. It was rare to see probabilities expressed in an unacceptable format, such as ratio, answers usually being given as decimals and, much less often, fractions. A small number of candidates gave answers such as “likely” and “unlikely”.

Question 14

Part (a) proved quite demanding and some of those who knew what to do made rounding errors, 0.58 being a popular wrong answer. Full marks were, however, still awarded if more decimal places appeared in the working. Very few candidates scored full marks on part (b). In part (i), for which only positive whole numbers were accepted, the most common correct answers were 9 and 45. For (ii), “multiples of 9” was hoped for but answers such as “in the 9 times table” were also accepted. “Multiples of 45” was a common incorrect answer.

Question 15

The transformation was often described fully but there were some regular errors. A substantial number of answers referred to flips or mirrors, rather than a reflection. Others either made no reference to a mirror line gave its equation wrongly, usually as $x = 3$ or $y3$, rather than $y = 3$. Rotation was also quite a popular answer.

Question 16

Using indices is a relatively high level algebraic skill for Foundation tier candidates and so it was not surprising that the quality of answers to both parts varied widely both within centres and between them. Even if the answer to part (a) were wrong, a mark could still be gained for working which showed either that −3 had been squared correctly or that

-4×-3 is +12. Evaluating $(-3)^2$ caused some difficulty and -9 appeared regularly. In part (b), the most common wrong answers were p^{15} for (i) and q^7 for (ii), q being interpreted as q^0.

Question 17

As with probability, knowledge of statistics varied widely. Some who had met mean, mode and median got them mixed up. Many candidates found the mode correctly in part (a), although 6 also appeared frequently, but, in part (b), a range of 5 (6 − 1) appeared as often as the correct value, 4.
In part (c), 3 was the most popular wrong answer, probably because it could be obtained in at least three ways (the middle value of 1, 2, 3, 4, 5 or the middle value of 1, 1, 3, 4, 6 or $\frac{6+3+1+1+4}{5}$).
In part (d), 39 (the correct sum of the products) was sometimes divided by 5, instead of by 15. The correct answer of 2.6 in the working was occasionally rounded up to give 3 on the answer line but this was not penalised.

Question 18

Both parts were quite well answered. In the first part, both numerator and denominator were sometimes multiplied by 6. In the second part, the most common errors were with the whole number part of $2\frac{2}{3}$ and multiplying by $\frac{5}{6}$, instead of its reciprocal. Another regular wrong answer was $2\frac{4}{5}$ $(2+\frac{2}{3}\times\frac{6}{5})$. Some candidates evidently did not understand what a mixed number was and gave the answer as an improper fraction. In both parts, no credit was given for decimals, either in the working or as final answers.

Question 19

The majority of candidates realised that Pythagoras' theorem was needed and many used it correctly. A few obtained 4.41 $(7.5^2 - 7.2^2)$ but either did not go on to find its square root or went on to halve it. A large number of candidates, however, started by adding 7.5^2 and 7.2^2, failing to consider whether their answer was sensible. A minority made attempts, usually doomed, to use trigonometry.

Question 20

Many candidates knew how to share a quantity in a given ratio, usually dividing 54 by 9 and then multiplying the result by 4, but fractions were sometimes used ($\frac{4}{9}\times 54$). Common wrong answers were 13.5 (54 ÷ 4), 27 (54 ÷ 2) and 36 [4 × (2 + 3 + 4)].

Question 21

There were some very good solutions but only the strongest candidates gained full marks. There was a fair success rate for the first part, although some used 360 ÷ 32 to obtain 11.25 but then doubled it. Answers of 30° and 32°, without working, appeared regularly and were presumably obtained by measurement from the diagram, which was not accurately drawn.
In part (b), some candidates realised that πd or $2\pi r$ was needed but the latter was sometimes used incorrectly with $r = 135$. πr^2 was used on occasions and 4320 (32 × 135) also appeared with some regularity. In part (c), the most frequent error was the use of multiplication by 0.26, instead of division by it.
Throughout this question, many candidates gave answers without any supporting method. An incorrect answer with no working cannot be awarded any marks.

Question 22

Strong candidates demonstrated a clear understanding of inequalities and shaded (in or out) the correct region. Others received credit for giving evidence of some understanding, for example, two rectangles with one satisfying the first inequality and the other satisfying the second inequality. A common error was to interchange x and y in the inequalities and shade the regions $-4 \leq x \leq -2$ and $1 \leq y \leq 3$. Candidates who shaded both regions but then failed to label the double shaded area lost a mark for not making clear what their final region was.

IGCSE Mathematics 4400
Paper 2F

Introduction

Most candidates were able to display a reasonable level of mathematical understanding and skills. A few gained very high marks, showing a high standard of competence in the topics on this paper. A few candidates were unable to tackle any but the most elementary questions.

Many candidates threw away marks by premature rounding.

Many candidates lost marks because they omitted to show working. It should be emphasised that if an answer is incorrect, some marks can still be gained, but only if working is shown.

Algebraic skills were generally somewhat weak, especially in Q10. However, a few centres found the algebraic work easier than the geometrical or statistical topics.

Report on Individual Questions

Question 1

Most candidates answered all parts of this question correctly, although some omitted one or two of the factors of 35 (usually 1 and/or 35) in part (d).

Question 2

Again, many candidates were successful. A common pair of wrong answers was
(i) Certain (ii) Likely. Perhaps there was confusion of "more than 1" with "at least 1". The word "likely" was not understood by many candidates.

Question 3

Many candidates multiplied 2 x 3 x 4, ignoring the actual shape of the solid. Many gave incorrect or no units.

Question 4

This question was generally well answered. Some candidates interpreted "range" to mean "total". A few confused one statistic with another.

Question 5

(a) Although "Cuboid", was the expected answer, "Prism" and "Rectangular prism" were accepted. "Rectangle" was a common incorrect response, as was "Cube".
(b) This part was usually answered correctly.
(c) Many candidates did not understand how to find a volume. Some added the dimensions. Others multiplied only two dimensions. In part (ii) many divided by 100 to change to litres.

Question 6

(a) Some candidates just gave the fraction, $^1/_4$. Others found the number of male players. Some candidates wrote $^1/_4$ x 72 or $^3/_4$ x 72, gaining a method mark, but then evaluated this expression incorrectly.
(b) Many candidates did not understand the expression "What fraction of . . ." Some found 72/30. Others gave 30/72 correctly but made errors in simplifying this fraction.
(c) This question was answered more successfully than similar ones in the past. A few candidates made errors when attempting to add 4: 40 to 10:30. A few gave the answer as 3:10 pm.
(d) Almost all candidates answered this question correctly. Many gave more information than was necessary. An acceptable answer was a plain "no" together with either "£25/£0.85 = 29(.4…) which is less than 30" or "30 x £0.85 = £25.50 which is more than £25".

Question 7

(a) This part was well answered. A few candidates drew four complete squares, not using common sides for adjacent squares. A few others omitted the diagonals.
(b) Many candidates drew the 6^{th} pattern and counted sticks, not always successfully. Some used the sequence but made errors such as adding 5 or 3 each time instead of 4. A common method was to count the number of sticks in diagram 4 (often obtaining an incorrect answer of 16) and then adding either 3 or 4 to this, giving 19 or 20.

Question 8

(a) Almost all candidates scored the mark for this part.
(b) Most candidates marked *S* correctly. A few placed it at either (3, 4) or (5, 3).
(c) Most candidates used the incorrect method of *QR* x *QP*. A few counted squares, with varying success. Very few found areas of triangle by the formula.
(d) This part was well answered on the whole. Some candidates reflected in $x = 5.5$, others in $y = 5$. A few candidates did not understand the concept of reflection and gave a translation or a distorted shape of some kind.

Question 9

Both parts of this question were well answered. A few candidates gave the answer 3.1 in (a).

Question 10

Responses to this question were disappointing. Most candidates did not appreciate the order of precedence of the two operations.
(a) 5 + 3 x 2 = 16 was common.
(b) $35 = 8t$, $t = 35/8 = 4.375$ was common. A few candidates used 35 as the term number.

Question 11

(a) This part was answered well.
(b) Most candidates gave the correct numerator. Some gave 5 or 11 as the denominator. A few lost a mark by giving the probability as a ratio.
(c) This part was not well understood. Following a correct answer of $^2/_6$ in (b), many candidates gave an answer of $^{60}/_{180}$ or 60. Some gave the answer $^{10}/_{30}$, which gained only one mark.

Question 12

Parts (a), (b) and (c) were answered correctly by most candidates. A few gave 3 in (b) or 1 in (c).
(d) Some candidates expanded the bracket correctly and found the correct answer. Many, however, failed to multiply the 4 by 3. Many also used Trial and Improvement, often successfully. Some gave a correct statement: $3(5 + 4) = 27$, but then either gave no answer or gave an answer of 9.

Question 13

Although many candidates answered parts (a) and (b) correctly, many others were confused as to whether to multiply or divide by 1.8.
(c) The most common response was 1.80. A few candidates found 1/1.8, but failed to multiply by 100.

Question 14

The correct answer was often seen. However, many candidates invented interesting methods for multiplying fractions, such as "cross-multiplying" or adding the numerators and adding the denominators. Some resorted to decimals. Most calculators are capable of multiplying fractions and giving the simplest form of the answer, but it seemed probably that even those candidates who possessed such calculators were unsure of how to use them.

Question 15

Many candidates found the correct value of p, but few could give their reasons using the correct vocabulary. Some gave incorrect reasons such as "opposite angles". "Angles on a straight line" was often quoted, but referring to pairs such as *BAD* and *ABD*. "Isosceles triangle" was sometimes seen, but "corresponding angles" hardly ever. Some candidates gave an inadequate reason such as "parallel lines" or "F angles". Some gave "alternate angles" without linking this to "vertically opposite angles". Some wrote a long description of their method, but omitted the required vocabulary.

Some candidates gave $p = 38^{o}$, sometimes stating that triangle *ABD* was equilateral.

Question 16

(a) Many candidates clearly did not understand the term "factorise". Answers such as $3(x^2 – 2)$ and 3 x x x x – 2 x x were common.
(b) A common error was $y^4 – 4y$. Some candidates obtained the correct answer but followed it with incorrect "simplification".
(c) Many candidates started with an incorrect attempt to rearrange the formula. Others started correctly with $30 = 5 + 10t$, but most of these continued with $30 = 15t$ and $t = 2$.

Question 17

(a) Most candidates answered this successfully, although a few lost the mark by writing "$x = 4x$". Some wrote x^4.
(b) Many candidates did not understand what was meant by "form an equation in x." Others wrote equations such as $4x – 6 = x$. A few appeared to have done some mental arithmetic using common sense rather than algebra, and wrote equations such as $x + 6 = 10$.

(c) Most candidates had no sensible equation to solve. Those who did have such an equation could usually solve it correctly. A few started afresh from the context, often successfully.

Question 18

This question was well answered by some candidates. Very few candidate used unnecessarily long methods involving Pythagoras' theorem. In (a) some candidates obtained sin$x$ = 0.5 but could not proceed. In (b) some found $12/\cos 32^0$ and others $12\sin 32^0$. A large number of candidates showed no familiarity with trigonometry.

Question 19

(a) This question was not well understood, with many answers appearing to be guesses.
(b) Many candidates listed some numbers here. Some gave an (incorrect) answer of 0. A few correct answers were seen, although there was some confusion between union and intersection. Some candidates stated that 10 is not a multiple of 3, and hence is in $P \cup Q$. Some candidates did not understand the $\in$ notation.

Question 20

Parts (a) and (b) were well answered by many candidates. Perhaps the most common error was in (b) $2 + 3 \div 4$. Many candidates omitted (c) or gave $2 + 3 \div 4$.

Question 21

(a) Most candidates gave two 5's but not all found the third number correctly. Some correctly started with two 5's and worked out the third number to be 8, but wrote only 8 on the answer line.
(b) Most candidates included two 7's, but few found the other two numbers correctly. Common wrong answers were (7, 7, 5, 5), (7, 7, 6, 5) and (7, 7, 7, 7).

IGCSE Mathematics 4400
Paper 3F

Introduction

The paper made appropriate demands of candidates and gave them the opportunity to show their knowledge, many achieving high marks. Full marks were rare on Q17 (Fraction and bounds) and Q10(b) (London Eye) although all the other questions proved to be accessible and had high success rates.

Most candidates showed their working clearly, even for questions which can be answered completely using modern calculators, on fractions and surds, for example. The board recognises, however, that this is an issue which will have to be addressed in the near future.

Report on Individual Questions

Question 1

Full marks were common on this straightforward start to the paper. In part (b), even those who gave an answer of 0.4 (the reciprocal of the correct answer) or 2 : 5 (the simplest form of the ratio 14 : 35) received some credit but those who worked with 14 : (14 + 35), which led to an answer of 2 : 7, did not.

Question 2

The majority of candidates solved the equation correctly. The most frequent wrong steps were $4x = 10 - 7$, which led to an answer of $x = 0.75$, and $4x = 10 + 7$, which led to an answer of $x = 4.25$ but reaching $4x = -3$ was no guarantee of full marks, sometimes leading to answers of $x = \frac{3}{4}$ or $x = -\frac{4}{3}$.

Question 3

The transformation was usually described fully, although occasional answers either referred to mirrors, rather than a reflection, or gave the equation of the mirror line wrongly, usually as $x = 3$, rather than $y = 3$. A few candidates believed the transformation was a rotation.

Question 4

Both parts were well answered. Even if the answer to part (a) were wrong, a mark could still be gained for working which showed either that −3 had been squared correctly or that -4×-3 is +12. Evaluating $(-3)^2$ caused some difficulty and −9 appeared regularly.
Part (b) was usually correct, although, in (ii), an answer of q^7 appeared occasionally, q being interpreted as q^0.

Question 5

Many candidates found both the median and the mean accurately but, if an error were made, it was more likely to be in part (a), for which 3 was the most popular wrong answer, probably because it could be obtained in at least three ways (the middle value of 1, 2, 3, 4, 5 or the middle value of 1, 1, 3, 4, 6 or $\frac{6+3+1+1+4}{5}$).

In part (b), 39 (the correct sum of the products) was sometimes divided by 5, instead of by 15. The correct answer of 2.6 in the working was occasionally rounded up to give 3 on the answer line but this was not penalised. A small number of candidates confused the mean and the median.

Question 6

The majority answered part (a) correctly but some multiplied both numerator and denominator by 6. In part (b), the most common errors were with the whole number part of $2\frac{2}{3}$ and multiplying by $\frac{5}{6}$, instead of its reciprocal. $\frac{16}{6} \div \frac{5}{6} = \frac{11}{6} = 1\frac{5}{6}$ appeared occasionally. Some candidates evidently did not understand what a mixed number was and gave the answer as an improper fraction. In both parts, no credit was given for decimals, either in the working or as final answers.

Question 7

Most candidates used Pythagoras' theorem correctly. A few obtained 4.41 ($7.5^2 - 7.2^2$) but did not go on to find its square root and a tiny minority started by adding 7.5^2 and 7.2^2 but such errors were unusual. Candidates using trigonometric methods usually failed to score full marks because of the inaccuracy of their final answer.

Question 8

The majority of candidates knew how to share a quantity in a given ratio, usually dividing 54 by 9 and then multiplying the result by 4, but fractions were sometimes used ($\frac{4}{9} \times 54$).

Question 9

Many candidates demonstrated a clear understanding of inequalities and shaded (in or out) the correct region. Others received credit for giving evidence of some understanding, for example, two rectangles with one satisfying the first inequality and the other satisfying the second inequality. A common error was to interchange x and y in the inequalities and shade the regions $-4 \le x \le -2$ and $1 \le y \le 3$. Candidates who shaded both regions but then failed to label the double shaded area lost a mark for not making clear what their final region was.

Question 10

Although full marks were uncommon, many candidates lost only one mark on the whole question. For part (a), the usual working was 360 ÷ 32 = 11.25 but 32 × 11.25 = 360 and 360 ÷ 11.25 = 32 were equally acceptable.
In part (b), many candidates scored 2 marks out of 3 for obtaining 5.625°, the angle between *BC* and the vertical, using a variety of approaches, but only a minority went on the find the angle with the horizontal. 168.75 (180 – 11.25) and 78.75 (168.75 – 90) were popular wrong answers. A few candidates produced elegant solutions by drawing a tangent at *C* and using the alternate segment theorem.
Parts (c) and (d) were very well answered, the only regular error being the use of multiplication by 0.26, instead of division by it, in part (d). Occasionally, in part (c), πr^2 was used or $2\pi r$ used incorrectly with $r = 135$. The time taken for the London Eye to make a complete revolution ranged from 18 seconds to 4 months but the vast majority of answers were sensible, even when wrong.

Question 11

Both parts had a high success rate but, if an error occurred, it was predictably more likely to be in the second part with the negative index. Candidates with some understanding gave answers such as 0.29, 0.029 and 0.00029 in (ii) but a minority gave negative answers.

Question 12

Calculating scale factors was the most popular means of demonstrating that the rectangles were not similar but three other approaches were used successfully. Comparing each rectangle's length with its height or assuming that the rectangles are similar and using three of the given dimensions to find the fourth were also seen regularly. A small number of candidates showed that the ratio of the areas of the rectangles was different from the square of the ratio of the linear dimensions. Others calculated the areas correctly but did not know how to use their results. A minority thought the rectangles were similar because their dimensions differed by 10 cm.

Question 13

This was another well answered question. If an error were made in the first part, it was usually either with the signs of the x terms or with the product of $3x$ and $4x$, which was given as $12x$ or $7x$.
The second part was better answered than the third and, in both cases, errors were more likely with the coefficient than with the index. So, while $8p^7$ was seen in part (b), $2p^{12}$ and $6p^{12}$ appeared more often and, in part (c), $42\frac{2}{3}y^4$ and $64y^4$ appeared with some regularity.

Question 14

Part (a) and part (b)(i) caused few problems. Although there were many correct solutions to part (b)(ii), it did prove more challenging. Solutions which consisted of only
$0.6 \times 0.4 = 0.24$ or $0.3 \times 0.6 \times 2 = 0.36$, scoring 1 mark, were not uncommon. Some thought that outcomes were equally likely and used a sample space to obtained a probability of $\frac{6}{16}$.
Candidates who assigned values to the individual probability of scoring a 3 or that of scoring a 4, usually
P(3) = P(4) = 0.05, were penalised for making an unjustified assumption, even if they obtained the correct answer.

Question 15

There was greater familiarity with the complement of a set than with the meaning of $Q \subset P$ and $n(Q) = 3$ and, overall, knowledge of set theory varied significantly between centres.

Question 16

Although, in part (a), the coordinates of the minimum point were often correct, (1, 5) appeared with noticeable regularity. Many candidates were able to find the solutions of the equation in part (b) but, although it still had a reasonable success rate, part (c) proved much more demanding, $y = -x - 2$ being the most common incorrect line. Some candidates knew that $x + 2$ was involved but failed to interpret this as $y = x + 2$; instead they equated $x + 2 = 0$ and then drew the line $x = -2$ on the graph. Others realised that the line $y = x + 2$ was required and drew a line with an intercept of 2 on the y-axis but failed to take account of the different scales on the axes. Another approach was to draw the graph of $y = x^2 - 3x - 6$. A number of

able candidates used the formula to find the two solutions and then used these values to plot two points on the parabola. They then drew a straight line going through these two points. Unfortunately for them, the line was not always within the allowed tolerance. As a method was specified in the question, candidates had to draw the line $y = x + 2$ on the grid to receive credit for the correct solutions.
In part (d), many candidates were familiar with the technique of differentiation and answered (i) correctly but not all were certain what then to do with their answer in (ii). Consequently, some equated $2x - 2$ to 0 or 6. Others found the value (20) of y when $x = 6$ or, having found the correct answer (10), went on to do something further with it, such as dividing by 6.

Occasionally, $\frac{y_2 - y_1}{x_2 - x_1}$ was used to find the gradient of a line joining two points on the parabola.

Question 17

Full marks for this question were rare. In part (a)(i), for which only positive whole numbers were accepted, the most common correct answers were 9 and 45. For (ii), 'multiples of 9' was hoped for but answers such as 'in the 9 times table' were also accepted.
In part (b), many candidates gained a mark for expressing the two improper fractions as decimals but very few could both find and justify an appropriate degree of accuracy. To score the final mark, it was necessary to state that both bounds agree to 2 significant figures or to 1 decimal place or that both numbers round to 1.4. Typical correct explanations were "At 2 sf, they have the same answer.", "The highest number of figures they will both round to." and "They are the same at 1 dp."

Question 18

This was another very well answered question with many completely correct solutions. The most common errors were the incorrect rearrangement of $\tan 74° = \frac{2.03}{BQ}$ as $BQ = 2.03 \tan 74°$ and the assumption that hypotenuse *CQ* was also 2.3 cm. Few used $\tan 16° = \frac{BQ}{2.03}$ which requires a simpler rearrangement. The Sine Rule was also often used successfully. Many candidates lost one accuracy mark for approximating the result of 2.3sin 62° (2.03...) to 2, often without showing the 2.03.

Question 19

Overall, this was quite well answered but the quality of responses was very much centre dependent. If only one mark were scored, it was usually for the bar for the $50 \le t < 70$ interval, the height of which could be found using proportion. If only one mark were lost, it was usually for the bar for the $80 \le t < 90$ interval, which was often half the correct height or drawn with a width of 80-100.

Question 20

Although not all candidates had the algebraic skills to make a meaningful attempt at changing the subject, full marks were not uncommon. The incorrect step $A = \pi R^2 - r^2$ appeared regularly, resulting from either the omission of brackets or the inaccurate expansion of

$\pi(R^2 - r^2)$ A substantial minority obtained a correct answer of $R = \sqrt{\frac{A}{\pi} + r^2}$ but went on to "simplify" it to $R = \sqrt{\frac{A}{\pi}} + r$, which was penalised.

Question 21

The standard of surd manipulation varied widely. There were many accurate, concise answers but there were also some long, tortuous and, ultimately, doomed attempts, often involving the use of a calculator, covering the answer space and more. The evaluation of $(3\sqrt{5})^2$ caused considerable difficulty, often being evaluated as 15 or, and $1 + 9\sqrt{5}$ was a common error.

Question 22

There were many completely correct solutions, including some elegant ones which involved only a minimum of evaluation. Some candidates misunderstood the question, thinking that the cylinder was completely filled after the sphere had been dropped into it. Others misinterpreted the question completely, equating the rise in water level (5 cm) to the volume of the sphere. Many candidates, having correctly found the volume of the sphere, had difficulty in dividing their volume by $\frac{4\pi}{3}$. The usual error was to evaluate $\frac{V}{\frac{4}{3}\pi}$ as $\frac{V}{\frac{4}{3}} \times \pi$. The cube root of $\frac{4}{3}\pi r^3$ was sometimes taken as $\frac{4}{3}\pi r$.

Question 23

An encouraging proportion of candidates gained full marks. Many started correctly with $(2x + 3)^2 = x^2$. Some then fell at the next hurdle, by expanding $(2x + 3)^2$ as $4x^2 + 9$, $2x^2 + 9$ or $2x^2 + 12x + 9$ or by taking only the positive square root of each side, thereby losing a root. It was also pleasing to see the resulting quadratic equation often solved by factorisation, even though $3x^2 + 12x + 9 = 0$ was not always simplified to $x^2 + 4x + 3 = 0$. $fg(x)$ was sometimes interpreted as the product of $f(x)$ and $g(x)$.

IGCSE Mathematics 4400
Paper 4F

Introduction

Most candidates were able to display plenty of their knowledge and skills. A few gained very high marks, showing a very high standard of facility with even the more complex areas of mathematics. However, a small number were unable to tackle any but the most elementary questions. These candidates would have benefited by entering Foundation Tier.

Candidates frequently threw away marks by premature rounding.

On the whole algebra was less good than sometimes in the past, although some candidates' algebra was excellent. Rearrangement of formulae or of equations was often poor in Q2(c) and Q9(b). Many candidates attempted to solve equations using trial and improvement. In most cases this led to the loss of all the marks. In fact marks are awarded for this method only if it leads to a wholly correct solution. In the case of quadratic equations these candidates generally found only one answer and therefore scored no marks at all. This method should be discouraged.

A frequent source of error was the incorrect rearrangement of formulae before substitution of values. This led to the unnecessary loss of marks for many candidates. In particular, use of the given formulae was poor. Many candidates copied the cosine rule correctly, but then rearranged it incorrectly. Others made sign errors in the quadratic equation formula.

Some candidates lost marks because they omitted to show working. It should be emphasised that if an answer is incorrect, some marks can still be gained, but only if working is shown.

In a few cases it was noticeable that a whole centre was unable to tackle a particular topic, such as set notation, powers or simultaneous linear and quadratic equations.

Report on Individual Questions

Question 1

Most candidates found the correct value of p. But few could give their reasons using the correct vocabulary. "Isosceles triangle" was often seen, but "corresponding angles" hardly ever. Some candidates gave an inadequate reason such as "parallel lines" or "F angles". A few candidates mentioned similar triangles, but failed to give reasons for their being similar. Some gave "alternate angles" without linking this to "vertically opposite angles". Some wrote a long description of their method, but omitted the required vocabulary. Some gave incorrect reasons such as "alternate segment theorem."

Question 2

(a) This was well answered although a few candidates clearly did not understand the term "factorise".

(b) A common error was $y^4 - 4y$. Some candidates obtained the correct answer but followed it by combining unlike terms.

(c) Most candidates started correctly with $30 = 5 + 10t$, but a disappointingly large number continued with $30 = 15t$ and $t = 2$.

Question 3

(a) Most candidates answered this successfully, although a few lost the mark by writing "$x = 4x$".
(b) $4x – 6 = x$ was very common.
(c) If a linear equation had been given in (b) most candidates were able to solve it correctly. A few started afresh from the context. Some gave the answer for Nikos.

Question 4

This question was well answered, even by candidates whose work was generally poor elsewhere. A few candidate used unnecessarily long methods involving Pythagoras' theorem or the sine rule. In (b) some found $12/\cos 32^0$ and others $12\sin 32^0$.A few candidates used the sine rule in one or both parts. Notation was often poor, sometimes leading to errors such as sin (4/8) = 0.0087.

Question 5

This question was not well understood, with many answers appearing to be guesses. Correct answers with subsets listed in addition were common and were accepted (eg (a)(i) "Parallelograms and squares").
(a) Answers such as "squares" or "quadrilaterals" were common, suggesting that candidates were generally unable to combine their knowledge of geometry with their understanding of the logic of set notation.
(b) A good number of correct answers were seen, although there was some confusion between union and intersection. The (incorrect) answer of 0 was not uncommon.

Question 6

This question was well answered by most candidates. Perhaps the most common errors were in (b) $2 + 3 \div 4$ and in (c) also $2 + 3 \div 4$.

Question 7

(a) This was well answered.
(b) Most candidates gave two 5's but not all found the third number correctly. Some correctly started with two 5's and worked out the third number to be 8, but wrote only 8 on the answer line. A common incorrect answer was 5, 5, 7, perhaps due to confusion between mean and median.
(c) Most candidates included two 7's, but few found the other two numbers correctly. Common wrong answers were (7, 7, 5, 5), (7, 7, 6, 5) and
(7, 7, 6, 6).

Question 8

(a) Most candidates expanded the bracket correctly and found the correct answer.
(b) Factorisation was the most common method and was generally successful. A few candidates found the two answers correctly but only wrote the positive one on the answer line. Some candidates used the formula, but often made arithmetical errors. A few used the completing the square (which is an acceptable method although is not required by the syllabus). Many candidates showed no familiarity with quadratic equations at all. Attempts such as $y = \sqrt{2y + 120}$ and $y(y – 2) = 120$ were common.

Question 9

(a) Mistakes were rife. $35^2 - 20^2$ and $35^2 + 10^2$ were often seen, as were $^1/_2$ x 20 x 35 and $^1/_2$ x 10 x h. Many candidates rearranged the cosine rule incorrectly. Some found a base angle, but then used an area formula involving 35 and 35 instead of 35 and 20. Some assumed the triangle was equilateral.
½ x 35 x 35 x sin 20 was often seen.

(b) Many candidates rearranged the cosine rule incorrectly. Others substituted correctly but then "collapsed" the rule, obtaining 1600 = 100cos$A$. There was often confusion about which sides were represented by "*a*", "*b*" and "*c*". Some candidates found the wrong angle. A few assumed that the area found in part (a) was still the same in (b). Some candidates correctly obtained cos$A$ = - 0.25, but then gave the acute angle (73.5°) as the answer.

Question 10

(a) This part was well answered.
(b) 5 cents + 20% = 6 cents was a common response, as was 80% of 5 = 4.
(c) Some candidates truncated their (correct) answer in (b) and hence lost accuracy in this part. Many candidates wrote so little working leading to an incorrect or inaccurate answer that no marks could be awarded.

Question 11

Many candidates started by drawing lines at ¼, ½ and ¾ of the total frequency, but then either ignored or misused these. A very common error was to assume a total frequency of 50.
(a) Some candidates found half the greatest mass (57.5g). Others found the middle of the range of the masses (87.5g).
(b) Some candidates thought that "interquartile range" meant a single value read from the graph. Others divided the mass scale into four equal parts.
(c) Few knew that the answer had to be half the total frequency.
(d) Many obtained about 34 from the graph, but not all went on to subtract from 40. Many gave a decimal rather than an integer.

Question 12

A few candidates did not understand "factorise". Some factorised each term. Partial factorisation was sometimes seen in (a). Factors involving fractions were sometimes seen, but were not accepted.
(a) This was well answered, although 2x(5x – x) was often seen.
(b) Common errors were $(x-3)^2$, $(x-9)(x+9)$ and $x(x-9)$.
(c) A coefficient of x^2 other than 1 seemed unfamiliar to many candidates. Some used the quadratic equation formula, with varying success, but none of these went on to give the factors.

Question 13

This question was found to be very difficult by almost all candidates. Many resorted to decimals. Some interpreted the phrase "as a power of" to mean "raised to the power". There was some confusion between negative and fractional powers.
(a) Only a few used $8 = 2^3$.
(b) Very few used $3 = \sqrt{9}$. Very few used powers.

(c) Hardly any candidates used powers. Some squared. A few correctly rationalised the denominator, but made no relevant further progress.

Question 14

Column vectors rather than algebraic vectors such as ***a*** and ***b*** were included in this question in the hope that it would make the question more accessible. This proved not to be the case and candidates found the context unfamiliar. This was taken into account during the marking.

Alternative answers involving $k\begin{pmatrix}5\\2\end{pmatrix}$ or kOB were accepted.

(a) Many answered this part correctly.

(b) Most candidates did not recognise what was required here, but wrote a variety of things, some involving k. In (ii) and (iii) a few candidates gave correct answers but then "simplified" them incorrectly.

(c)(d) Some candidates knew that the answer to part (c) was 0.5, without needing to use their previous answers. These candidates generally failed to understand what was required in part (d), which asked them to "Use you answer to part (c) to show that . . ". A few stated (correctly) that since $\overrightarrow{OX} = 0.5\overrightarrow{OB}$, X must be the mid point of OB. Some thought (incorrectly) that this also showed that X was the mid point of AC.

Question 15

Many candidates understood proportion well and found this question easy, scoring high marks. A few lost marks through premature rounding. Some treated this as simple direct proportion, without squaring t. A few treated it as indirect proportion with t^2. Others used $x = k + t^2$.

(a) Many candidates wrote $x = kt^2$. Some stopped there. Others went on to find k correctly but failed to give the final answer of $x = 4.9k^2$.

(b)(c) Those who used t^2 in (a) generally answered these parts correctly. Some used $t = 10$ in (c). Others failed to take the square root. Some candidates used a method involving proportionality rather than using the equation. These were often unsuccessful.

Question 16

A disappointingly large number of candidates added probabilities instead of multiplying. Some multiplied only pairs rather than triples. Many used $(^1/_6)^3$, although fewer used $(^1/_6)^2$ x $^5/_6$. Very few combined the correct multiples of these two. A few candidates attempted to list (or put on a tree diagram) all the possibilities, using arrangements of 1, 2, 3, 4, 5 and 6, rather than 1 and "not 1". These usually did not manage to find the correct number of possibilities. Probabilities far greater than 1 were not uncommon.

Question 17

Many candidates attempted an elimination method, which necessarily involved a mistake such as "squaring" the first equation to give $y = 4x^2 + 1$. A few candidates made life difficult by substituting for x rather than y. Some of those who substituted for y failed to expand $(2x + 1)^2$ correctly. Those who arrived at the correct quadratic equation sometimes made a sign error in solving it. Some candidates lost marks by failing to show their working when substituting (incorrect) answers for x to obtain y. Many candidates failed to pair their answers. Trial and Improvement was not uncommon, but, yielding at most one pair of correct answers, failed to score any marks.

Question 18

This question, as the last one on the paper, was difficult. It combined three hurdles – recognition of the need to differentiate, differentiation of a negative power and double differentiation. In view of this, it was pleasing to find a substantial minority of candidates who successfully differentiated twice and achieved the correct answer. However, the majority of candidates failed to recognise this question as an example of kinematics requiring calculus. Perhaps the use of x rather than s failed to provide the trigger upon which they depended. Most candidates used a method involving $^{\text{distance}}/_{\text{time}}$ and $^{\text{velocity}}/_{\text{time}}$ or constant acceleration formulae. Those who knew that differentiation was required generally coped well with the negative power of t, although some omitted the negative sign and others did not rewrite the expression as $20t^{-1}$ before attempting to differentiate.

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