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Examiners' Report/
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IGCSE

IGCSE Mathematics (4400)
Paper 4H Higher Tier

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IGCSE Mathematics
Specification 4400

There was an entry of approximately 2000 candidates (600 Foundation and 1400 Higher), most of whom took the opportunity the papers gave them to show what they knew.

Paper 4H

Introduction

The standard of this paper proved to be appropriate. Candidates found the questions accessible, although some of the later ones were demanding. Almost all questions had pleasing success rates and able candidates were able to achieve high marks. The working of a minority of candidates was untidy and difficult to follow, especially on Q18, Q20 and Q21 but, in general, methods were well explained and working presented clearly and neatly.

Report on individual questions

Question 1

On the rare occasions that the answer was wrong, it was usually 1140.233333, the result of evaluating $11.7+\frac{18.4^2}{0.3}$.

Question 2

Both factorising and equation solving were clearly straightforward for almost all candidates. In part (b), a minority rearranged the equation incorrectly as $5x$ = 10 or $5x$ = −6 and even some of those who correctly obtained $5x$ = 6 went on to give an answer of $x = \frac{5}{6}$. Overall, though, there were few errors.

Question 3

In the first part, the size of the angle was usually correct. The most common wrong answer was 68, the result of assuming the *CA* makes an angle of 62° with South. There were many correct reasons, although this proved more demanding. Centres are reminded that ‘Z angles’ is not accepted as an alternative to ‘alternate angles’. ‘Alternate segment theorem’ gained no marks either.
Bearings usually cause difficulties for some candidates and part (b) was no exception. The most common wrong bearing was 118° (180 − 62). A significant minority calculated $\frac{180-62}{2}$ to obtain 59 but then either gave this as their answer or used it in a variety of incorrect ways, notably to obtain a bearing of 301° (360 − 59). Another regular wrong bearing was 56° (180 − 2 × 62). Finding the bearing by measurement from the diagram was more common than usual and received no credit.

Question 4

Both parts were almost always answered correctly, although 30 appeared occasionally in part (b).

Question 5

The first part was very well answered, although a small minority of candidates gave an answer of 21.7 (3500 ÷ 161).
The second part, while still well answered, posed greater problems. A minority obtained their answer from a misconceived method, the most regular ones being £17.576 (338 × 0.052), £1757.60 (338 × 5.2) and £321.29 $\left(338 \times \frac{100}{105.2}\right)$, which was sometimes rounded to £321.

Question 6

Most candidates described the first transformation fully. Some scored 1 mark out of 2 for 'reflection' but then described the mirror line incorrectly, often giving its equation as $x = 4$ or $x4$.
The majority of candidates realised that the second transformation was an enlargement and many described it fully. The most common errors were $\frac{1}{2}$, 1 or 2 for the scale factor and (0, 6) or (2, 6) for the centre of enlargement.
No marks were given for a combination of two transformations, even if one of them on its own would have received credit.

Question 7

The vast majority of candidates gained full marks.

Question 8

Most candidates produced the necessary standard construction with two arcs, centred on the ends of the line and intersecting above and below the line. Some used an unnecessarily large radius, often the length of the line. The onus is on candidates to make their method clear to examiners. The use of an HB pencil, which is not too sharp, is recommended

Question 9

The majority of candidates drew the correct line in the first part and identified the correct region in the second part, either by shading in or by shading out. A variety of wrong lines were, however, seen in part (a), including $3x - 2y = 6$ and $2x + 3y = 6$.

Question 10

Most candidates gained full marks on the first part. Those who correctly calculated the total rainfall and then went on to use it in some way, usually dividing by 31 to find the mean, were not penalised. Those who used upper limits or lower limits instead of halfway values scored 1 out of 3. A noticeable minority gave an answer of 310, only 5 less than the correct answer, but the result of a completely wrong method ($10 \times 23 + 10 \times 3 + 10 \times 2 + 10 \times 3$).
Understanding of histograms varied significantly and there was a wide range of wrong answers to the second part.

Question 11

Many candidates successfully found the HCF, using either the factors or the prime factors of both numbers. The most frequent incorrect HCF was 8.
There was also a high success rate for the LCM. The most popular wrong answers were 640, a common multiple but not the lowest, 2, possibly because candidates thought it was the lowest common factor, 8, 16 and 64×80.
Some candidates reversed the answers to the two parts, confusing HCF and LCM.

Question 12

There were few errors in the first two parts, although both $12x^5y^6$ and $7x^5y^6$ appeared occasionally as the answer to part (b). The final part proved considerably more difficult, $18q^4$ being a regular incorrect answer, but it was still well answered.

Question 13

The majority of candidates gained full marks; a small minority used differences in length to obtain answers of 21 cm and 17 cm respectively for parts (a) and (b).

Question 14

Many scored full marks. Those who did not made a variety of mistakes. If an error were made in completing the table, it was often calculating 16 as the y value, when
$x = -2$, even though this gave a point which went off the grid. Plotting points incorrectly was also quite common, usually one slip, rather than consistent misinterpretation of the scale on the y-axis. Plotting y coordinates at 9 or −9, instead of at 8 or −8 were the most common plotting errors. A small minority joined their points with line segments, instead of a smooth curve.

Question 15

Knowledge of circle properties varied widely. Many candidates were successful in finding the sizes of the angles but were unable to give acceptable reasons, even though some latitude was allowed. In part (a), 58° and 122° (180 − 58) were common wrong answers and statements which were specific rather than general, for example, angle $AOC = 2 \times$ angle ABC, were frequently offered as reasons.
In part (b), ‘The opposite angles of a quadrilateral add up to 180°’ appeared regularly. The expected reason had to include the words ‘opposite’ and ‘cyclic’.

Question 16

A substantial proportion of candidates drew a completely correct tree diagram but a sizeable minority treated this as a ‘with replacement’ question. Others omitted labels and some did not appreciate the need to add extra branches.
The majority of the candidates who completed the tree diagram correctly also successfully calculated the probability. Use of the tree diagram reduced the risk of omission of a product in the second part. If one product were omitted, it was usually $\frac{3}{10} \times \frac{2}{9}$. Even candidates with an incorrect tree diagram could still score 2 marks out of 3, if they used it correctly.

Question 17

The vast majority of candidates gained full marks in part (a). Part (b) was much more demanding but many candidates demonstrated the algebraic skills needed to change the subject of the formula. Of the rest, some were unable to make a realistic attempt or any attempt at all, while others were able to make a start by removing the factions $T(1-e) = n(1+e)$ and sometimes expanded the brackets as well $T - eT = n + en$. Some who successfully reached the stage $en + eT = T - n$ went on to write $2e = \frac{T-n}{T+n}$.
Questions of this type usually polarise candidates and this was no exception.

Question 18

Many candidates scored full marks, often using the most direct method – Pythagoras’ Theorem for the length of *CD* and then $\tan(\text{angle DBC}) = \frac{CD}{BD}$. Some lost the accuracy mark through premature approximation, usually rounding *CD* to 4.1, instead of working to sufficient accuracy. A wide range of alternative methods was employed successfully, including the Sine Rule and the Cosine Rule, although the more involved the method, the more likely was the loss of the accuracy mark. A surprising number of candidates made an error in using Pythagoras’ Theorem at the start with $CD^2 = 8.3^2 + 7.2^2$ and were unfazed when their *CD* was longer than the hypotenuse.

Question 19

Many candidates gained full marks but a significant minority either could not attempt this question or did not appreciate that calculus was required. For example, some divided the displacement expression by *t* to obtain their velocity expression. Of those who did realise that calculus was needed, some made errors in the differentiation,
$2t^2 - 10$ appearing regularly in the first part. The most common error, though, was the incorrect use of $6t - 10$ in part (b), candidates evaluating $6 \times 20 - 10$ as 110, instead of solving the equation $6t - 10 = 20$

Question 20

This question was well answered but a substantial minority did not understand the meaning of ‘n’, interpreting 9 and 5 as the members of sets *P* and *Q*, instead of the number of members in each set. So it was not unusual to see 9 and 5 listed as the answer to part (a). The other two parts were often correct but 4 and 14 were popular wrong answers to part (b). In part (c), 9, 3 and 5 were regularly used to complete the Venn Diagram but even when the diagram was correctly completed with 6, 3 and 2,
n(*P* U *Q*) was frequently given as either 8 (6 + 2) or 14 (9 + 5).

Question 21

Many candidates produced completely correct solutions to this question. Some of these solutions were direct and concise, using either intersecting chords or Pythagoras' Theorem. Others were more circuitous, sometimes involving not only Pythagoras' Theorem and basic trigonometry but also the Sine Rule and the Cosine Rule. A minority did not start this question but many more made a misconceived, although still often lengthy, attempt. Some assumed that $OM = \frac{1}{2}\times 18 = 9$ cm. The formulae for the area and circumference of a circle made regular appearances and unjustified assumptions, for example, that angle *AOB* was 45°, were sometimes used to simplify the problem.

Question 22

The general standard of algebra was high and there was a large proportion of completely correct solutions. Inevitably, a minority were unable to make a worthwhile attempt or could not make a start. One typical example of faulty algebra was attempting to square both sides of $y - 3x = 4$ to obtain $y^2 + 9x^2 = 16$ or $y^2 - 9x^2 = 16$. Another was attempting to find the square root of both sides of $x^2 + y^2 = 39$ to obtain $x + y = \sqrt{39}$. Most of those who rearranged correctly, usually $y = 3x + 4$, and substituted correctly, $x^2 + (3x+4)^2 = 34$, went on to gain most, if not all, of the remaining marks. For solving the quadratic equation, factorisation was more popular than use of the formula. Surprisingly, it was noticeable that a few candidates, having cleared all the algebraic hurdles to obtain the values of x successfully, made a mistake when substituting, usually when the substitution of $x = -3$, led to $y = 5$.

Statistics

Overall Subject Grade Boundaries – Higher Tier

Grade	Max. Mark	A*	A	B	C	D	E
Overall subject grade boundaries	100	85	66	47	28	15	8

Paper 3H – Higher Tier

Grade	Max. Mark	A*	A	B	C	D	E
Paper 3H grade boundaries	100	86	66	46	27	15	9

Paper 4H – Higher Tier

Grade	Max. Mark	A*	A	B	C	D	E
Paper 4H grade boundaries	100	85	66	47	28	15	8

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