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Examiners' Report
Principal Examiner Feedback

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International GCSE Mathematics
4MA1 2HR Principal Examiner's Report

This paper gave students, who were well prepared, ample opportunity to demonstrate positive achievement. Some challenging questions towards the end of the paper discriminated well and stretched the most able students.

Some students still need to heed the wording 'showing all your working' as on questions where this is requested no marks are awarded for merely seeing a correct answer.

Question 1
This question was answered well by most candidates, however a small number of students showed poor understanding of probability, especially in part (b) where multiplication was often seen. The other common error was to divide answers by 4. Accuracy when adding or subtracting was occasionally lacking.

Question 2
Part (a) was generally well done, with the 78 × 12 = 936 by far the more common approach. Some students correctly found the multiplier as 1.3 but then failed to give final answer as 30% increase. A few candidates attempted to use 720 ÷ 936 which could not lead to a correct answer. In terms of approaches, those using the (1+P/100) route were generally more prone to errors.

In part (b), a pleasing number of correct answers were given with the majoirity comparing the total costs 2112 and 2100 from various routes, some finding 288 and 300 first. Fewer compared 288 and 300 occasionally leading to the wrong conclusion. Some responses suffered from a lack of understanding about what was being reduced or what they had to calculate in order to make a valid comparison. Thus answers of 1312 were being compared with 2100 and the wrong choice of coupon made.

Question 3
In part (a) the majority of candidates were able to give a correct answer, the main error was to use an = or incorrect equality sign, often when the correct answer seen in working. Errors were made when subtracting, since candidates are allowed a calculator they should be reminded to use it to check their working, however simple it may seem. Part (b) was very well answered with the vast majority of responses getting full marks. Some candidates struggled to rearrange the equation, attempting to remove the 7 or the $4x$ out of the fraction without considering the denominator. A few candidates got as far as $8x = 3$ and gave an incorrect answer of $\frac{8}{3}$ rather than $\frac{3}{8}$.

Question 4
Very many students were able to make a good start by finding the internal angles of the pentagon and the octagon. However, many went on to make the assumption that the line *IC* bisects the interior angle of the octagon and hence scored no further marks. The realisation that the angle *IBC* was part of an isosceles triangle was less often seen.

Question 5
Answers to this standard question were commonly correct. Most correct answers were gained by the shortest method i.e. 7100×1.025^3.
There were a few who incorrectly gave a simple interest answer, or used a multiplier of 125 instead of 1.025 leading to an very large amount of money, which should have indicated an error in their method. Additionally, candidates need to be aware that the use of the % sign in a calculation such as (1 + 2.5%) risks losing method marks. The correct working to show is (1 + 0.025) or $\left(1+\frac{2.5}{100}\right)$.

Question 6
Parts (a) and (b) were well answered well, although a slightly higher proportion of errors on (a) as some candidates incorrectly gave 0 as the answer.

Part (c) proved more of a challenge with students being unable to combine the powers of 7 in a meaningful way that allowed them to find the value of m. The most successful students were those who first wrote $7^{206} \times 7^{m} = 7^{211}$, with not many students using the method of writing the linear equation $206 + m - 214 = -3$ to obtain an answer. Overall, a majority of students got a correct answer of $m = 5$, with a few giving −11 due to sign errors.

Question 7
In part (a), many candidates gave correct answers. Most students either knew or wrote down $y = mx + c$. Errors included mixing up gradient and intercept to get $y = 5x - 3$. Some missed out the x in their equation to get $y = (3) +5$. Quite a few did not answer at all and left their page blank.

Part (b) was similarly answered well by most candidates, although errors included not shading or clearly indicating the required area. The lines $x = 6$ and $y = 2$ were drawn correctly in almost all cases, with a small minority reversing them. However, a difficulty arose with the line for $y = x + 1$, with quite a few drawing either $x = 1$ or $y = x$ in error.

Question 8
Students who recognised this as a problem about a weighted mean generally scored full marks. Most others simply ignored the fact that the numbers of Siberian and Bengal tigers were different. The most common error was solving $(260+x) \div 2 = 218$, resulting in an answer of 176kg.

Question 9
Many candidates were able to get 2 or 3 marks by finding the length of AC or the arc length of the semicircle. Some students preferred to find AC by using a combination of $\tan 30^{\circ}$ and Pythagoras; they usually were able to stay within the accuracy required by the question.
In general, candidates were less successful in pulling together all 3 strands of the problem - finding the hypotenuse, finding the arc length and remembering to subtract 6. A few students used the area formula for the arc length of the semicircle.

Question 10
Many candidates were able to demonstrate an understanding of what to do, recognising that they had to divide total spent on healthcare for each country by their population to find how much was spent per person. Working directly in standard form was the most successful approach, however some tried to do this, but ended up with absurd powers of 10, presumably from mishandling the powers in the calculation. Other students displayed a lack of understanding - such as subtracting the populations and subtracting the health care expenditure and trying to use these. Students were expected to work directly in standard form. If they chose to convert to ordinary numbers they were at greater risk of losing marks.

Question 11
Both parts of this question were answered very well. Entries in the table were nearly alawys correct and generally the points were plotted accurately and a suitable graph drawn. Students should be aware that joining all the points with straight line segments will lose a mark, as the graph should be a smooth curve. Another common error on part (b) was to plot the first point at (1, 12) as the scale of the axes caught some out.

Question 12
Not that many students knew that the angle of depression is the angle measured from the horizontal so a very common wrong answer was 84.3, the complement of the correct 5.7. Other incorrect answers, with otherwise correct trigonometry included 264.3, and occasionally candidates found 84.3 then subtracted from 180 to get 95.7.

Question 13
Missing brackets in the first $(a - b)$ meant that many students failed to gain any marks, even when brackets present many candidates made sign errors. There were many students who could evaluate the given algebraic expression, but then could not identify the value of the unknown 'y'. Some guessed and then checked the value and came out with $y = 8$. The final mark proved elusive, with a common incorrect answer of 2. Those who arrived at an answer of 8 did so by a wide variety of routes, some squaring to obtain $y^3 = 512$, whilst others simplified the surd fully to get $32\sqrt{2}$ as an intermediate step.

Question 14
Many candidates were able to get the first two parts correct. Some were confused in part (a) and halved 110 and then looked up the cumulative frequency axis to read off their value. generally they were consistently wrong for these two parts.

Part (c) was less successfully answered - many gave an answer of 30 presumably from 45 - 15. It was pleasing to see many students giving a convincing explanation to part (d), but there were still students who got all parts of this question correct apart from this one; some candidates did not score as they gave a more generic description of IQR and spread rather than the specific case of algebra and geometry.

In part (e) many were able to isolate the 10. However, many did not appreciate that selection really had to be without replacement and incorrectly calculated the probability to be $\frac{1}{6} \times \frac{1}{6}$. In general there was a lack of understand of 'without replacement'.

Question 15
This was generally answered very well. Many students had a clear idea of the algebraic processes to use and employed them accurately. Many gained the 1^{st} mark but there was then a failure to isolate terms in t^3 and factorise the correct expression. In some cases the subject was left as t^3 and a minority of candidates failed to write $t =$ as part of their answer, thus losing the final accuracy mark.

Question 16
Most candidates recognised that they had to start by using the area of a triangle and could often find the size of angle *C* and progress to find the length of *BD* using the cosine rule, with few progressing to the correct final answer often losing the final answer mark due to premature rounding, a common error in this paper. Those using height in *BCD* rarely got further than h and a number used the idea that opposite angles added up to 180°, confusion with cyclic quadrilaterals. A number found angle *BAD* and gave this as their answer. Some assumed incorrectly that *BD* was 28 (*ABD* isosceles triangle) or used Pythagoras where there was no right angle.

Question 17
Candidates who drew a tangent to the curve at $x = 2$ almost always went on to gain full marks. There were a few exceptions where students had not used the given scales but had counted squares, for example. Some misinterpretation of scale lost marks and a few found the reciprocal of the gradient instead of the gradient required. Students who drew a chord were not awarded any marks. It was disappointing to see that many responses were left blank, with no attempt at a tangent drawn.

Question 18
This question was a fairly standard pair of simultaneous equations; one linear and one quadratic.
Students were equally divided between those who substituted $x = 2y - 1$ into the quadratic and those who used $y = \frac{x+1}{2}$. The latter substitution led to some more complicated algebra because of the $3y^2$ term. The former substitution often resulted in sign errors on the right hand side giving $(2y-1)^2 - 2y - 1$ which meant losing at least 2 of the 5 marks available.
Students should be reminded that they must show working when solving a quadratic equation - this can be as straightforward as substituting for '*a*', '*b*' and '*c*' in the quadratic formula, or factorising or completing the square, in all cases with the working visible.

Question 19
Those students who understood how to find the angle between a line and a plane usually had no problem in finding the answer of 31.4°. However a significant number worked out the complementary angle of 58.6°. These students understood the 3-D nature of the problem and could do the work in the triangle *ACE*, but had forgotten or not fully understood the concept of the angle between line and plane. The most common approach, of those who could visualise the 3D nature of the problem chose to find *AC*, then used tan *ECA* to find the angle. A high proportion of candidates did not know where to start.

Question 20
Many candidates did not know where to start with this question, and it would appear very few had seen a question like this before. A significant number were however able to write down an expression involving a constant of proportionality, but few realised that it was a different constant for the two expression and made little progression after this.
Very few correct solutions were seen, and unfortunately some students managed to navigate the algebra but wrote an approximate answer such as 11.1 thus losing the final accuracy mark.

Question 21
This question was answered with varying degrees of success. Most of those candidates who set up a correct equation for the total surface area gained full marks. A lot of errors when finding surface area, by omitting the base area of the cylinder, adding in an extra πr^2 or using volume of sphere formula. Algebraic manipulation of first equation sometimes very poor. Most gained marks by using 'their' x to find the volume (with a few forgetting to halve the volume of a sphere) then use this to calculate density, though only gaining 2 marks as their x had been found incorrectly.

Question 21
It was pleasing to see a number of clear and succinct answers to this challenging question. Most students started by setting up an equation in terms of x relating an expression for the total surface area to 81π. Often the term representing the base was omitted, but if followed through carefully could still earn 4 marks. Some incorrect responses included an extra πr^2 or used the volume of sphere formula, rather than the hemisphere. It was pleasing that the majority of candidates who got as far as density knew the correct formula. On occasion, marks were lost due to early rounding.

Question 22
There were very few completely correct solutions to this with many candidates not knowing where to start. Many could not get past the equation relating the gradient of the line AC to it's given value. That is $\frac{10-q}{p-8}=-\frac{6}{7}$ however often then provided the answer $q = 4$, $p = 1$ which does, of course satisfy the above equation but not the other information in the question.
This type of question, where there are two unknowns, will require a pair of independent equations to be set up and then solved for p and for q. For a second equation the more successful students used the fact that AB was perpendicular to BC to multiply the two expressions for the gradients of the respective lines and set the product equal to -1. This approach tended to more successful than using Pythagoras.

Question 23
A significant number of fully correct responses were provided, although including the '+' sign before the square root sign lost the final mark. Many candidates were able to substitute g(x) into f(x) to find fg(x) but then mistakenly solved the resulting quadratic equation.
It was pleasing to see that many more students appear to be able to find the inverse of a quadratic function (defined over suitable domains) - mainly by completing the square.

Many students were not aware of the significance of the domain of the function h and so lost a mark for h(x) = $6+\sqrt{x+11}$

Summary

Based on their performance in this paper, students should:

- Learn how to deal with weighted means.
- Develop understanding how the tangent of a graph relates to its gradient.
- Sketch curved graphs
- Calculate probabilities without replacement
- Ensure that their working is to a sufficient degree of accuracy that does not affect the required accuracy of the answer.
- When asked, show their working out or risk gaining no marks for correct answers.

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