Examiners' Report/
Principal Examiner Feedback

Summer 2010

GCE

Core Mathematics C2 (6664)

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Introduction

Many of the more familiar questions on this paper were well answered by the majority of candidates, with 'common mistakes' appearing less frequently than in previous C2 papers. As before, candidates struggled with questions involving trigonometry or logarithms. Standards of algebra and mathematical notation were often disappointing. There were a number of 'show that' questions (with given answers) on this paper, where, to obtain full marks, all necessary steps in the working had to be shown. It was common for marks to be lost in these questions. In numerical work, accuracy marks were sometimes lost either through premature approximation or through failure to give an answer to the required level of accuracy.

In general, candidates appear to have had plenty of time to complete the paper. Indeed, for the last part of Q10, many had time to attempt a very lengthy alternative method when it should have been clear from the mark allocation (3 marks) that there was a much more concise approach.

As noted in many recent reports, candidates who quote standard formulae before beginning to use them are more likely to safeguard method marks when they make mistakes.

Report on individual questions

Question 1

Part (a) was answered correctly by the majority of candidates, although 4.00 (or 4) was sometimes given instead of 4.01 as the third missing value in the table.

The trapezium rule was often accurately used in part (b), although using n $\left(\text{in } \dfrac{b-a}{n}\right)$ as the number of ordinates instead of the number of intervals was again a common mistake. Some candidates left out the main brackets and multiplied only the first two terms by $0.5h$. Others wrongly included 1 and/or 5 in the bracket to be doubled. Just a few ignored the demand for the trapezium rule and attempted the integration by 'calculus'.

Question 2

Although many candidates opted for long division rather than the remainder theorem in part (a), most scored the method mark and many accurately achieved the correct value for the remainder.

Long division in part (b) often led to the correct quadratic, which most candidates factorised correctly. Correct factorisation by inspection was seen occasionally, but attempting (by trial and error) to find further solutions by using the factor theorem was rarely successful. Some candidates, having found factors, thought they had finished and did not proceed to give any solutions to the equation. The ‘obvious’ solution x = 5 was sometimes omitted. ‘Implicit’ solutions such as $\mathrm{f}(5) = 0$ were generously allowed on this occasion.

Question 3

The differentiation in part (a) of this question was usually completed correctly, although the $k\sqrt{x}$ term sometimes caused problems, with k being omitted or $\sqrt{x}$ misinterpreted.

It was clear in part (b), however, that many candidates did not know the condition for a function to be decreasing. Some substituted $x = 4$ into y rather than $\frac{\mathrm{d}y}{\mathrm{d}x}$ and some used the second derivative. Even those who correctly used $\frac{\mathrm{d}y}{\mathrm{d}x}$ were usually unable to proceed to a correct solution, either making numerical mistakes (often being unable to find the correct value of $4^{-\frac{1}{2}}$) or failing to deal correctly with the required inequality. The answer $k = 32$ was commonly seen instead of $k > 32$.

Question 4

In part (a), most candidates exhibited understanding of the structure of a binomial expansion and were able to gain at least the method mark. Coefficients were generally found using the $(1+x)^n$ binomial expansion formula, but Pascal's triangle was also popular. The correctly simplified third and fourth terms, $21a^2x^2$ and $35a^3x^3$, were often obtained and it was pleasing that $21ax^2$ and $35ax^3$ appeared less frequently than might have been expected from the evidence of previous C2 papers. Candidates tend to penalise themselves due to their reluctance to use brackets in terms such as $21(ax)^2$ and $35(ax)^3$.

Part (b) was often completed successfully, but some candidates included powers of x in their 'coefficients'. There is still an apparent lack of understanding of the difference between 'coefficients' and 'terms'. Although the question asked for the ‘values’ of a, some candidates gave only $a = 5$, ignoring the other possibility $a = -5$.

Question 5

While many struggled with this question, strong candidates often produced clear, concise, well-structured responses.

Finding the value of $\tan\theta$ in part (a) proved surprisingly difficult. The most common wrong answer was $\frac{5}{2}$ instead of $\frac{2}{5}$, but many candidates failed to obtain *any* explicit value of $\tan\theta$. Some, not recognising the link between the two parts of the question, failed in part (a) but went on to find a value of $\tan 2x$ in part (b) before solving the equation. Most candidates achieved an acute value for $2x$ and then used the correct method to find the second solution. At this stage some omitted to halve their angles and some did not continue to find the other two solutions in the given range. Alternative methods using double angle formulae were occasionally seen, but were rarely successful. Some candidates resorted to using interesting ‘identities’ such as $\cos 2x = 1 - \sin 2x$.

Question 6

In parts (a) and (b) of this question, most candidates were able to quote and accurately use the formulae for length of an arc and area of a sector. Wrong formulae including π were occasionally seen and it was sometimes felt necessary to convert 0.7 radians into degrees.

Despite the right-angled triangle, a very popular method in part (c) was to find the angle C and use the sine rule. For angle C, many candidates used 0.87 radians (or a similarly rounded version in degrees) rather than a more accurate value. This premature approximation resulted in an answer for AC that was not correct to 2 decimal places, so the accuracy mark was lost.

In part (d), although a few candidates thought the region H was a segment, most were able to make a fair attempt to find the required area. There was again an unwillingness to use the fact that triangle OAC was right-angled, so that $\frac{1}{2}ab\sin C$ appeared frequently. Unnecessary calculations (such as the length of OC) were common and again premature approximation often led to the loss of the accuracy mark.

Question 7

In part (a), while some candidates showed little understanding of the theory of logarithms, others produced excellent solutions. The given answer was probably helpful here, giving confidence in a topic that seems to be demanding at this level. It was important for examiners to see full and correct logarithmic working and incorrect statements such as $\log(x-5)^2 - \log(2x-13) = \frac{\log(x-5)^2}{\log(2x-13)}$ were penalised, even when there was apparent 'recovery' (helped by the given answer). The most common reason for failure was the inability to deal with the 1 by using $\log_3 3$ or an equivalent approach. From $\log_3 \frac{(x-5)^2}{(2x-13)} = 1$, it was good to see candidates using the base correctly to obtain $\frac{(x-5)^2}{(2x-13)} = 3^1$, from which the required equation followed easily.

Even those who were unable to cope with part (a) often managed to understand the link between the parts and solve the quadratic equation correctly in part (b). It was disappointing, however, that some candidates launched into further logarithmic work.

Question 8

To establish the x-coordinate of the maximum turning point in part (a), it was necessary to differentiate and to use $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$. Most candidates realised the need to differentiate, but the use of the zero was not always clearly shown.

Methods for finding the area in part (b) were often fully correct, although numerical slips were common. Weaker candidates often managed to integrate and to use the limits 0 and 2, but were then uncertain what else (if anything) to do. There were some attempts using y coordinates as limits. While the most popular method was to simply subtract the area under the curve from the area of the appropriate rectangle, integrating $24-(x^3-10x^2+28x)$ between 0 and 2 was also frequently seen. Occasional slips included confusing 24 (the y-coordinate of P) with 28, subtracting 'the wrong way round' and failing to give the final answer as an exact number.

Question 9

Parts (a) and (b) of this geometric sequence question were usually correctly answered, although 0.03 instead of 1.03 was occasionally seen as the common ratio.

In part (c), lack of confidence in logarithms was often apparent. Some candidates failed to get started, omitting the vital step $25000r^{N-1} > 40000$, while others tried to use the sum formula rather than the term formula. Often the working was insufficiently convincing to justify the progression to $(N-1)\log 1.03 > \log 1.6$. Showing each step in the working is important when, as here, the answer is given.

There was much more success in part (d), where the result of part (c) had to be used (although other methods such as 'trial and improvement' were possible). Manipulation of the inequality often gave $N > 16.9$, but it was disappointing that many candidates lost a mark by giving 16.9 rather than 17 as the value of *N*.

The majority of candidates interpreted the requirement of part (e) correctly as the sum of a geometric series. A few used ar^{n-1} instead of the sum formula, but in general there were good attempts to find the total sum of money. It was, of course, possible to avoid the sum formula by calculating year by year amounts, then adding, but those who used this inefficient approach tended to make mistakes. Rounding to the nearest £1000 was required, but some candidates ignored this or rounded incorrectly, losing the final mark.

Question 10

In part (a), most candidates were able to write down an expression for the radius of the circle (or the square of the radius). Most were also familiar with the form of the equation of a circle, although some weaker candidates gave equations of straight lines. Sometimes radius was confused with diameter, sometimes (10, 7) was used as the centre instead of (2, 1) and sometimes the equation of the circle was given as $(x-2)^2 + (y-1)^2 = 10$ instead of $(x-2)^2 + (y-1)^2 = 10^2$.

Many candidates knew the method for finding the equation of the tangent at (10, 7). Typical mistakes here were to invert the gradient of the radius *AB*, to find a line parallel to the radius and to find a line through the centre of the circle.

Part (c), for which there was a very concise method, proved difficult even for able candidates. Those who drew a simple sketch were sometimes able to see that the length of the chord could easily be found by using Pythagoras' Theorem, but a more popular (and very lengthy) approach was to find the equation of the chord, to find the points of intersection between the chord and the circle, and then to find the distance between these points of intersection. This produced a great deal of complicated algebra and wasted much time. Mistakes usually limited candidates to at most 1 mark out of 3, but a few produced impressively accurate algebra.
Weaker candidates often made little progress with this question..

Grade Boundary Statistics

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

Module		**Grade**	**A***	**A**	**B**	**C**	**D**	**E**
		Uniform marks	**90**	**80**	**70**	**60**	**50**	**40**
AS	6663 Core Mathematics C1			59	52	45	38	31
AS	6664 Core Mathematics C2			62	54	46	38	30
AS	6667 Further Pure Mathematics FP1			62	55	48	41	34
AS	6677 Mechanics M1			61	53	45	37	29
AS	6683 Statistics S1			55	48	41	35	29
AS	6689 Decision Maths D1			61	55	49	43	38
A2	6665 Core Mathematics C3		68	62	55	48	41	34
A2	6666 Core Mathematics C4		67	60	52	44	37	30
A2	6668 Further Pure Mathematics FP2		67	60	53	46	39	33
A2	6669 Further Pure Mathematics FP3		68	62	55	48	41	34
A2	6678 Mechanics M2		68	61	54	47	40	34
A2	6679 Mechanics M3		69	63	56	50	44	38
A2	6680 Mechanics M4		67	60	52	44	36	29
A2	6681 Mechanics M5		60	52	44	37	30	23
A2	6684 Statistics S2		68	62	54	46	38	31
A2	6691 Statistics S3		68	62	53	44	36	28
A2	6686 Statistics S4		68	62	54	46	38	30
A2	6690 Decision Maths D2		68	61	52	44	36	28

Grade A*

Grade A* is awarded at A level, but not AS to candidates cashing in from this Summer.

- For candidates cashing in for GCE Mathematics (9371), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 180 UMS or more on the total of their C3 (6665) and C4 (6666) units.
- For candidates cashing in for GCE Further Mathematics (9372), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.
- For candidates cashing in for GCE Pure Mathematics (9373), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their A2 units.
- For candidates cashing in for GCE Further Mathematics (Additional) (9374), grade A* will be awarded to candidates who obtain an A grade overall (480 UMS or more) *and* 270 UMS or more on the total of their best three A2 units.

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