Examiners' Report

January 2010

GCE

Core Mathematics C4 (6666)

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Introduction

The paper was accessible to nearly all candidates and the general standard of work seen was high. The vector question proved easier than some set in recent years and the majority of candidates were able to score some marks on all of the questions.

Calculators were, in general, used sensibly and accurately. Not all were able to construct adequate proofs leading to results printed on the paper and the working needed to establish results involving exact surds was often inadequate. Calculators cannot be used to establish such results.

The majority had sufficient time to complete the paper. Those running short of time in Q8 had often used inefficient methods solving earlier questions. This was particularly notable in Q4, where it was not unusual to see, in part (a), a page and a half of working leading to an often correct result, which can just be written down. Unnecessarily complicated methods were also often used in Q5 and Q7.

The general standard of presentation was acceptable. These papers are marked online and, if a pencil is used in drawing sketches, a sufficiently soft pencil (HB) should be used and it should be noted that coloured inks do not come up well and may be invisible.

Report on individual questions

Question 1

This proved a suitable starting question and there were many completely correct solutions. The majority of candidates could complete part (a) successfully. In part (b), those who realised that working in common (vulgar) fractions was needed usually gained the method mark but, as noted in the introduction, the working needed to establish the printed result was frequently incomplete. It is insufficient to write down $\sqrt{1-\frac{8}{100}}=\frac{\sqrt{23}}{5}$. The examiners accepted, for example, $\sqrt{1-\frac{8}{100}}=\sqrt{\frac{92}{100}}=\sqrt{\frac{23}{25}}=\frac{\sqrt{23}}{5}$. In part (c), most candidates realised that they had to evaluate their answer to part (a) with $x=0.01$. However many failed to recognise the implication of part (b), that this evaluation needed to be multiplied by 5. It was not uncommon for candidates to confuse parts (b) and (c) with the expansion and decimal calculation appearing in (b) and fraction work leading to $\sqrt{23}$ appearing in (c).

Question 2

Nearly all candidates gained both marks in part (a). As is usual, the main error seen in part (b) was finding the width of the trapezium incorrectly. There were fewer errors in bracketing than had been noted in some recent examinations and nearly all candidates gave the answer to the specified accuracy. The integration by parts in part (c) was well done and the majority of candidates had been well prepared for this topic.

Some failed to simplify $\int \frac{x^2}{2} \times \frac{1}{x} \mathrm{d}x$ to $\int \frac{x}{2} \mathrm{d}x$ and either gave up or produced $\frac{\frac{1}{3}x^3}{x^2}$.

In evaluating the definite integral some either overlooked the requirement to give the answer in the form $\frac{1}{4}(a \ln 2 + b)$ or were unable to use the appropriate rule of logarithms correctly.

Question 3

As has been noted in earlier reports, the quality of work in the topic of implicit differentiation has improved in recent years and many candidates successfully differentiated the equation and rearranged it to find $\frac{\mathrm{d}y}{\mathrm{d}x}$. Some, however, forgot to differentiate the constant. A not infrequent, error was candidates writing $\frac{\mathrm{d}y}{\mathrm{d}x} = -2\sin 2x - 3\sin 3y \frac{\mathrm{d}y}{\mathrm{d}x}$ and then incorporating the superfluous $\frac{\mathrm{d}y}{\mathrm{d}x}$ on the left hand side of the equation into their answer. Errors like $\frac{\mathrm{d}}{\mathrm{d}y}(\cos 3y) = -\frac{1}{3}\sin 3y$ were also seen. Part (b) was very well done. A few candidates gave the answer $20°$, not recognising that the question required radians. Nearly all knew how to tackle part (c) although a few, as in Q2, spoilt otherwise completely correct solutions by not giving the answer in the form specified by the question.

Question 4

The majority of candidates made good attempts at parts (a) to (e) of this question. Many, however, wasted a good deal of time in part (a), proving correctly that $\lambda = \mu = 0$ before obtaining the correct answer. When a question starts "Write down ….", then candidates should realise that no working is needed to obtain the answer. The majority of candidates knew how to use the scalar product to find the cosine of the angle and chose the correct directions for the lines. Parts (c) and (d) were well done. In part (e) , as in Q1(b), the working needed to establish the printed result was often incomplete. In showing that the printed result is correct, it is insufficient to proceed from $\sqrt{416}$ to $4\sqrt{23}$ without stating $416 = 16 \times 26$ or $4^2 \times 26$. Drawing a sketch, which many candidates seem reluctant to do, shows that part (f) can be solved by simple trigonometry, using the results of parts (b) and (e). Many made no attempt at this part and the majority of those who did opted for a method using a zero scalar product. Even correctly carried out, this is very complicated $\left(\mu = \frac{104}{19}\right)$ and it was impressive to see some fully correct solutions. Much valuable time, however, had been wasted.

Question 5

Part (a) of this question proved awkward for many. The integral can be carried out simply by decomposition, using techniques available in module C1. It was not unusual to see integration by parts attempted. This method will work if it is known how to integrate $\ln x$, but this requires a further integration by parts and complicates the question unnecessarily. In part (b), most could separate the variables correctly but the integration of $\frac{1}{y^{\frac{1}{3}}}$, again a C1 topic, was frequently incorrect.

Weakness in algebra sometimes caused those who could otherwise complete the question to lose the last mark as they could not proceed from $y^{\frac{2}{3}} = 6x + 4\ln x - 2$ to $y^2 = (6x + 4\ln x - 2)^3$. Incorrect answers, such as $y^2 = 216x^3 + 64\ln x^3 - 8$, were common in otherwise correct solutions.

Question 6

Connected rates of change is a topic which many find difficult. The examiners reported that the responses to this question were of a somewhat higher standard than had been seen in some recent examinations and the majority of candidates attempted to apply the chain rule to the data of the question. Among those who obtained a correct relation, $1.5 = 2\pi r\frac{\mathrm{d}r}{\mathrm{d}t}$ or an equivalent, a common error was to use $r = 2$, instead of using the given $A = 2$ to obtain $r = \sqrt{\frac{2}{\pi}}$. Unexpectedly the use of the incorrect formula for the area of the circle, $A = 2\pi r^2$, was a relatively common error.

Question 7

Part (a) was well done. The majority of candidates correctly found the x-coordinates of A and B, by putting $y = 0$, solving for t and then substituting in $x = 5t^2 - 4$. Full marks were common. Part (b) proved difficult. A substantial minority of candidates failed to substitute for the $\mathrm{d}x$ when substituting into $\int y\,\mathrm{d}x$ or used $\frac{\mathrm{d}t}{\mathrm{d}x}$ rather than $\frac{\mathrm{d}x}{\mathrm{d}t}$. A surprising feature of the solutions seen was the number of candidates who, having obtained the correct $\int t(9 - t^2)10t\,\mathrm{d}t$, were unable to remove the brackets correctly to obtain $\int (90t^2 - 10t^4)\,\mathrm{d}t$. Weaknesses in elementary algebra flawed many otherwise correct solutions. Another source of error was using the x-coordinates for the limits when the variable in the integral was t. At the end of the question, many failed to realise that $\int_0^3 (90t^2 - 10t^4)\,\mathrm{d}t$ gives only half of the required area.

Some candidates made either the whole of the question, or just part (b), more difficult by eliminating parameters and using the cartesian equation. This is a possible method but the indices involved are very complicated and there were very few successful solutions using this method.

Question 8

Answers to part (a) were mixed, although most candidates gained some method marks. A surprisingly large number of candidates failed to deal with $\sqrt{4-4\cos^2 u}$ correctly and many did not recognise that $\int \frac{1}{\cos^2 x}\,\mathrm{d}x = \int \sec^2 x\,\mathrm{d}x = \tan x\,(+C)$ in this context. Nearly all converted the limits correctly. Answers to part (b) were also mixed. Some could not get beyond stating the formula for the volume of revolution while others gained the first mark, by substituting the equation given in part (b) into this formula, but could not see the connection with part (a). Candidates could recover here and gain full follow through marks in part (b) after an incorrect attempt at part (a).

Grade Boundaries

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

Module	80	70	60	50	40
6663 Core Mathematics C1	63	54	46	38	30
6664 Core Mathematics C2	54	47	40	33	27
6665 Core Mathematics C3	59	52	45	39	33
6666 Core Mathematics C4	61	53	46	39	32
6667 Further Pure Mathematics FP1	64	56	49	42	35
6674 Further Pure Mathematics FP1 (legacy)	62	54	46	39	32
6675 Further Pure Mathematics FP2 (legacy)	52	46	40	35	30
6676 Further Pure Mathematics FP3 (legacy)	59	52	45	38	32
6677 Mechanics M1	61	53	45	38	31
6678 Mechanics M2	53	46	39	33	27
6679 Mechanics M3	57	51	45	40	35
6683 Statistics S1	65	58	51	45	39
6684 Statistics S2	65	57	50	43	36
6689 Decision Maths D1	67	61	55	49	44

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