Mathematics Specialised

Subject Code: MSP5C

2004 External Examination Report

Overall the students have coped with Sections A and B quite well, as I would have expected seeing that the questions are fairly straightforward.

Section A – Sequences and Series

Question 1

Generally well done. Students either used t(n)=S(n)-S(n-1) or determined the first three terms and saw the GP. A number of students made errors with (-) signs when subtracting (3^n - 3).

Question 2

Mostly well done. The epsilon/N argument was generally put together successfully, no doubt because students could include the correct form of words and symbols on their formulae sheets.

Question 3

Well done, either by working out the series from scratch or by adapting the standard series for e^x. The general term was the weakest part and many either left it out or gave the term in x^(n-1) rather than the term in x^n. I gave them full credit for any correct general term.

Question 4

Correctly done more often than not. There was considerable confusion between rth and nth terms. Many obtained the correct difference, but then called it v(r)-v(r+3). A few ignored the instructions and gave a proof by mathematical induction. Level of algebraic manipulation was encouraging. The sum to infinity was well done and I saw very little evidence of sum to infinity = a/(1-r).

Section B – Matrices and Linear Transformations

Question 5

Well done, although some students wasted time deriving the equation of the image curve. A disturbing number of students did not know the formula for the area of a circle.

Question 6

Well done, but some students did not write a matrix as instructed.

Question 7

This was the hardest question in this section. The majority could obtain four equations in a, b, c and d, but relatively few could obtain a particular or general solution. A few students did not distinguish between the lower and upper case a.

Question 8

This was well done by most students. The rotation was often given as anticlockwise instead of clockwise. The reflection matrix was correct more often than the rotation matrix, and the order of multiplication of matrices was seldom wrong. Some obtained the images of two points on the object parabola and assumed the image was a straight line - some confusion about the use of linear in "linear transformation" perhaps?

Section C – Differential Calculus

Question 9

Generally well done. A common error was to differentiate 1 and got 1 for the answer instead of zero.

Question 10

Many students found the equation to the tangent instead of the normal.

Question 11

Well done, though many made the manipulation more difficult by not simplifying $\frac{dy}{dx}$ before differentiating again.

Question 12

The majority of students had trouble differentiating $\arcsin\sqrt{1-x^2}$. A common error was to simplify $\sqrt{1-(1-x^2)}$ and obtain $\sqrt{-x^2}$. There were few *clearly explained* solutions to the last part.

Question 13

Many students were unable to rewrite $\sin^2 3x$ as $\frac{1}{2}(1-\cos 6x)$ or similar, to enable the integration to be performed.

Section D – Integral Calculus

Question 14

The most common error was to rotate around the *x*-axis. This made the problem more difficult.

Question 15

Most students were unable to find $\int \frac{1}{y^2-1}dy$. Partial fractions were needed.

Question 16

This question seemed to be outside the experience of most students.

Section E – Complex Numbers

In general, this section was answered well by candidates. However, many candidates would have benefited by more efficient use of graphics calculators; particularly in terms of the time taken to answer the questions.

Question 17

Candidates experienced no difficulties in finding the sum and difference of the given complex numbers. Many candidates were inaccurate in plotting the four complex numbers: scaling of axes being a notable absence.

Question 18

Once again, this question was answered well by the majority of candidates. However, there were a number of students who were not familiar with the symbolism of the conjugate.

Many candidates did not format the proof of the given hypothesis.

Question 19

Many students, when expanding $(x+iy)^2$, missed the x in the term $2xyi$. Another common error was to take the positive solution only to $x^2 = 25$.

Some students made efficient use of the graphics calculator by taking $\pm\sqrt{24+10i}$.

Question 20

Many candidates got lost in "the algebra" of this question while those who made z the subject of a complicated-looking fraction, before using the graphics calculator to evaluate this fraction, devised an efficient solution to the question.

A significant number of candidates used their graphics calculators to find products and quotients of complex numbers as they stepped through their solution. This also proved to be an effective and efficient method.

Another subset of the candidature became confused between the numeral 2 and the complex number z when effecting their solutions.

Section F

Question 21

(a) Most students interpreted the question as $\sum_{k=1}^{n} z^k = ...$ and consequently fewer than 5% of candidates were able to justify the result

(b) Some good solutions, however the trig manipulation was beyond most students and once again less than 5% were successful

(c) Too difficult and symbolic for students.

Question 22

(a) Students set up the trapezoidal rule reasonably well but most weren't able to cope with the heavy algebra component in the latter part of the question.

(b) Quite well done, although the question was a bit misleading in its wording.

Question 23

(a) The derivative of $\tan^3 x$ was attempted by most students but many were unable to make the connection between $3\tan^2 x \sec^2 x$ and the required answer. Only about six students were able to successfully find the definite integral of $\tan^4 x$, most students were unable to see the link to the derivative provided.

(b) (i) Generally well done but many students did not attempt to locate the point of inflection by examining the second derivative, and very few justified the existence of the point of inflection at $y'' = 0$

(ii) Generally well done, and students were not penalized at this stage for not indicating a point of inflection.

(iii) Most students were able to attend this but few were able to follow through to the correct answer. The setting out was poor and many students did not recognize that because the area was below the x-axis meant the integral was negative.

Question 24

(a) Generally well done.

(b) Very few students scored well on this question, only 2 or 3 found the correct values of k. Most students attempted a few row manipulations then stopped. Time may have been a factor in this.

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