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Mathematics MFP1

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Further Pure 1

Report on the Examination

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General

The presentation of work was reported by examiners as being very good. A large majority of candidates completed their solution to a question at a first attempt. Candidates generally found the paper to be straightforward and most were able to score high marks on each of the nine questions.

Teachers may wish to emphasise the following point to their students in preparation for future examinations in this unit:

- When an answer is given, candidates should take extra care to ensure that they show sufficient intermediate steps/evaluations before writing the printed answer.

Question 1

This opening question, which tested roots and coefficients of a quadratic equation, proved to be a good source of marks for almost all candidates.

With the answer given in part (b), examiners expected candidates to show some evaluation between '$(-3.5)^2-2(4)$' and the printed answer $\frac{17}{4}$.

In part (c), where a quadratic equation was asked for, most candidates applied a correct method but a number of solutions were seen which ended without an equation, the '$= 0$' having been omitted.

Question 2

The basic integration was usually carried out correctly in this question on improper integrals, but a significant minority of candidates failed to include reference to the limit of $(3)x^{1/3}$ as $x \to \infty$ within their concluding statement in part (a).

In part (b) a surprising number of solutions ended with the value $-\frac{3}{2}$ instead of the correct value $\frac{3}{2}$.

Question 3

In this question on complex numbers, part (a) generally caused more problems than part (b).

In part (a)(i) a significant number of candidates failed to include the $\pm$, but, as follow through was accepted, most of these scored the mark in part (a)(ii).

Almost all candidates correctly expanded $(1 + x)^3$ in part (b)(i) and used their expansion within part (b)(ii) but there were many examples of incorrect/no squaring and cubing of the 2. The meaning and use of the complex conjugate z^* was well understood and a majority of candidates went on to give a correct follow through answer in part (b)(iii).

Question 4

There were some excellent solutions seen in answers to this question on series which used at an early stage the fact that $n(n+1)$ was a factor of the two expressions. However a significant number of candidates expanded out to reach a quartic expression and then jumped too quickly, without sufficient intermediate steps being shown, to the printed form of the answer. It was not uncommon to see incorrect quartics being followed by the 'correct' printed form of the answer. The most common error, which resulted in the loss of the final

accuracy mark in part (a), was to write $'= 2n(n+1)(2n^2-1)'$ having correctly reached $'n(n+1)(n^2-\frac{1}{2})'$.

In part (b) the most common error was to subtract $S(20)$ rather than $S(19)$ from $S(40)$.

Question 5

Full marks for this question on linear interpolation and Newton-Raphson were not as common as for some other questions. Most candidates drew a line joining points A and B but not all appreciated that it illustrated the method of linear interpolation. In part (a)(ii), arithmetical errors were relatively common and some better solutions failed to score the final mark because the final answer was not given in the requested form.

Part (b)(i) was omitted by a significant minority of candidates but even some of these candidates gained some credit for applying Newton-Raphson method in part (b)(ii). The most common errors in part (b)(ii) were to either take $f(x_n)$ as 2 instead of -10 or to leave the final answer as $\frac{13}{4}$ instead of giving the exact decimal 3.25.

Question 6

In part (a) many candidates gave the correct general solution of the given trigonometric equation. It was pleasing to see almost all candidates using $\tan\frac{\pi}{6}=\frac{1}{\sqrt{3}}$ but some incorrect rearrangements of $\frac{x}{2}-\frac{\pi}{4}=n\pi+\frac{\pi}{6}$ to 'x =…' were also seen.

Part (b) provided much more of a challenge. A significant proportion of candidates did take the square root of both sides, but more than expected forgot to include the '±' and so just reproduced what they had done for part (a).

Question 7

This question, involving hyperbolas, was generally answered well although the final part was frequently not answered in the required manner.

In part (a) some gave the wrong equations $y = \pm 3x$ for the asymptotes and some others did not even give an equation.

Most candidates, in part (b), were able to show the main features of the curve in their sketches and to state the correct coordinates of the points of intersection with the axis although some other sketches were seen which bore little resemblance to the shape of a hyperbola.

As expected, the most common wrong answer for part (c)(i) was '$\frac{(x-3)^2}{9}-y^2=1$' but this error was not overly penalised as some follow through was allowed in the later part. There were, however, many correct solutions to both parts (c)(i) and (c)(ii).

Generally only the more able candidates were able to **deduce** the correct coordinates in part (d). Candidates who started afresh, making no reference to their answers in part (c)(ii), were awarded no credit. Common wrong follow through answers were obtained by either subtracting 3 from their x-coordinates in part (c)(ii) or adding/subtracting 3 to/from their y-coordinates in part (c)(ii).

Question 8

Parts (a)(i) and (a)(ii) were generally answered correctly although some rectangles for R_3 were drawn which had vertices with either the wrong x-coordinates or the wrong y-coordinates.

The most common wrong answer for part (b)(i) was the matrix which represented a rotation of 90^o anticlockwise and in part (b)(ii) it was not uncommon to see the matrices being multiplied in the wrong order. A small number of candidates gave solutions which had matrices left in terms of trigonometric functions; these were penalised.

Question 9

Most candidates were able to state the correct equations of the two asymptotes. Answers to part (a) which were not equations did not score the marks.

The method required to answer part (b) was well understood, but candidates who made sign errors, omitted brackets and still reached the printed answer were not awarded full credit.

Most candidates realised that the discriminant of the quadratic was to be used to answer part (c)(i) but a number of candidates failed to state that its value had to be 0 for the line to be a tangent. Some used an inequality and then, in finding the critical values, just stated the two values of c without any reference back. Some errors were seen in finding the discriminant, normally due to the negative sign and squaring $-(c+3)$ incorrectly to get $-c^2-6c-9$. This, and similar errors, led to horrendous quadratics and candidates would have been better advised to check earlier working rather than try to solve them. There were, however, many fully correct solutions seen to this final question on the paper.

Mark Ranges and Award of Grades

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