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MFP2 Further Pure 2

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General

Overall, this paper proved to be accessible to candidates of all abilities and there were very few candidates scoring extremely low marks. Presentation on the whole was good. It does however need to be pointed out that if a question asks for a response by a particular method and a candidate chooses an alternative method, generally speaking such a candidate will score no marks for their attempt.

Question 1

Part (a) was done well by the majority of candidates. However, responses to part (b) were less successful. A number of candidates gave the roots of $z^5 = 1$ as their answer to part (b), whilst others left the modulus of the roots as $4\sqrt{2}$ instead of $\sqrt{2}$, and others again gave solutions outside the range of θ as specified in the question. Some candidates yet again were either unable to handle $\frac{1}{5}\left(\frac{\pi}{4}+2k\pi\right)\mathrm{i}$ or, when taking the fifth root of $\mathrm{e}^{\left(\frac{\pi}{4}+2k\pi\right)\mathrm{i}}$, wrote $\mathrm{e}^{\left(\frac{\pi}{4}+\frac{2k\pi}{5}\right)\mathrm{i}}$.

Question 2

Again part (a) was answered well, but solutions to part (b) were mixed. Generally speaking, the best solutions came from candidates who rewrote part (a) as $r^2 = \frac{1}{24}\left\{(2r+1)^3 - (2r-1)^3 - 2\right\}$ before making their summation. Those candidates who preferred to use part (a) in the form in which it was printed either forgot to sum the 2's to make 2*n* or only partially divided by 24. A small number of candidates used the method of induction either through confusing the two methods of summation or by deliberately choosing an alternative method. Either way, no credit could be given.

Question 3

Lack of clear evidence that candidates understood what they were doing in part (a) caused a loss of marks for this part of the question. Methods varied. Those candidates who turned this part of the question into a coordinate geometry exercise probably provided the clearest solutions.

Those candidates who evaluated $\left|-2\mathrm{i}-2\sqrt{3}\right|$ and $\arg\left(2\sqrt{3}+2\mathrm{i}\right)$ provided less convincing solutions and in some cases evident error. For instance it was not uncommon to see $\left|-2\mathrm{i}-2\sqrt{3}\right|$ written as $\sqrt{\left(2\sqrt{3}\right)^2-(2\mathrm{i})^2}$. Part (b) on the whole was done well except that in some instances not all the results of part (a) were incorporated in the candidate's Argand diagram. Part (c) was done well but, if a mistake did occur, it was almost always that the shaded area would be bounded by the real axis rather than by a line parallel to the real axis through the point represented by the complex number $z = -\mathrm{i}$.

Question 4

This question was probably the most popular question on this paper and certainly showed candidates well prepared to answer questions on this part of the specification. There were many fully correct solutions or correct apart from the odd sign error, the most common of which was to write down $(-\mathrm{i})^2$ as +1 instead of -1. If there was a major loss of marks, it was usually in the inability of a candidate to evaluate $\sum \alpha^2 \beta^2$ and in this case the candidate started by considering $\left(\sum \alpha^2\right)^2$ only to find that the evaluation of $\sum \alpha^4$ posed a serious problem.

Question 5

Responses to this question varied considerably. It was not, in general, that candidates did not understand the method of induction but rather that the algebraic manipulation especially in the handling of factorials proved to be a stumbling block. For instance $k(k+1)!$ would be written as $\left(k^2+k\right)!$ and in a significant number of solutions candidates, having managed to reach $(k+1)(k+2)(k+1)!$, abandoned their solutions not realising that the result was, in fact, $(k+1)(k+2)!$.

Question 6

Responses to this question were rather disappointing. In part (a)(i), although most candidates correctly quoted $\cos 3\theta + \mathrm{i}\sin 3\theta = (\cos\theta + \mathrm{i}\sin\theta)^3$, some immediately went on to use the multiple angle formulae instead of expanding $(\cos\theta + \mathrm{i}\sin\theta)^3$. Some of those candidates who expanded $(\cos\theta + \mathrm{i}\sin\theta)^3$ did not seem to realise that the answers to parts (a)(i) and (a)(ii) were obtained by simply equating real and imaginary parts.

Other candidates wrote i^3 as $+\mathrm{i}$ and so were unable to reach the correct result of part (a)(ii) and the printed result in part (a)(iii). Even those candidates who worked parts (a)(i) and (a)(ii) correctly in terms of $\sin\theta$ and $\cos\theta$, having written $\dfrac{\sin 3\theta}{\cos 3\theta}$, did not realise that the division of numerator and denominator by $-\cos^3\theta$ would give the printed result, but rather chose to use $\sin^2\theta + \cos^2\theta = 1$ to express numerator and denominator in a different form, with no hope of reaching the printed result. Although the question in part (b)(i) started with the word 'hence' few candidates took up the hint and replaced θ by $\dfrac{\pi}{12}$ in part (a)(iii).

If this part was attempted it was often done by solving the cubic equation in x to find its three roots and then by quoting that $\tan\dfrac{\pi}{12} = 2-\sqrt{3}$ and a corresponding result for $\tan\dfrac{5\pi}{12}$ and consequently using these results in part (c), a method not indicated by the question.

Question 7

Although many candidates were able to write down $\dfrac{1}{\tanh\frac{x}{2}}$ multiplied by $\dfrac{1}{2}\operatorname{sech}^2\dfrac{x}{2}$, fewer were able to combine these results to obtain $\operatorname{cosech} x$. Even those candidates who expressed $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

entirely in terms of $\cosh\frac{x}{2}$ and $\sinh\frac{x}{2}$ seemed to baulk at the algebra which led to $\frac{1}{2\sinh\frac{x}{2}\cosh\frac{x}{2}}$.

Part (b)(i) was done well and many candidates were able to arrive at $s = \ln\sinh 2 - \ln\sinh 1$ in part (b)(ii) but were unable to reach the printed answer. If the integral of $\coth x$ was performed incorrectly, it was often by $\coth x$ being replaced by $\frac{1}{\tanh x}$ followed by $\ln\tanh x$ or $\ln\ \cosh x$ as the integral.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.