MATHEMATICS (US)

Paper 9280/11
Paper 11

Key Messages

- Attention needs to be paid to making sure workings are carried out at a sufficient level of accuracy to ensure the accuracy of the final answer.
- Candidates need to be careful to eliminate arithmetic and numerical errors in their answers.

General Comments

This paper covered the whole breadth of the syllabus and for those candidates who had covered the syllabus thoroughly and had practised by answering previous papers, it gave the opportunity to achieve high marks.

General setting out was mostly satisfactory, but again it is necessary to request that candidates do not place questions, or parts of questions, side by side on the page, as this can make it much more difficult to follow their working.

Comments on specific questions

Question 1

Most candidates were able to make a good attempt at the first part of this question on the binomial expansion. A few candidates gave the second, third and fourth terms, which of course also affected their answers to the last part of the question. A few candidates misunderstood the word ‘ascending’ and gave the seventh, sixth and fifth terms. Candidates were not quite so successful with part **(ii)** of this question.

Answers: **(i)** $64 + 576x + 2160x^2$; **(ii)** -3.75.

Question 2

Most candidates realised that it was necessary to integrate the given function in order to find f(*x*). For the first term, division by the new power (½) sometimes resulted in multiplication by ½. Another common source of error was the omission of a constant of integration.

Answer: $2(x+6)^{1/2} - \frac{6}{x} - 3$.

Question 3

This was a straightforward vector question, and most candidates coped very well with it and obtained good marks.

Answers: **(i)** **DB** = 6**i** + 4**j** – 3**k**, **DE** = 3**i** + 2**j** –3**k**; **(ii)** 17.2º.

Question 4

This was a common type of trigonometric equation requiring, as a first step in part **(i)**, the use of the identity $\cos^2 x + \sin^2 x = 1$. A majority of candidates employed the correct procedure and were able to solve the resulting quadratic equation in *cos x* and hence to find the required two solutions in *x*. In part **(ii)**, a surprising number of candidates did not appear to spot the connection between the two parts but proceeded to go through the whole process again. However, many candidates did realise that all that was required was to equate ½ θ with each of the solutions from part **(i)**, rejecting the larger of the resulting values [...] it fell outside the required range.

Answers: **(i)** 60º, 300º; **(ii)** 120º.

Question 5

The majority of candidates were able to reach the correct expression in part **(i)** for the inverse of the function, but very few candidates seemed to realise that they needed also to state the domain of the inverse function. In part **(ii)**, most candidates were able to write down the correct expression for f(f(x)) and many were able to correctly start the process of solving the resulting equation. Unfortunately, instead of completing the square and taking the square root twice, many candidates expanded $(x^2+1)^2$ and thereafter mistakes were all too common.

Answers: **(i)** f(x) = $\sqrt{x-1}$ for $x \geq 1$; **(ii)** x = 1.5.

Question 6

Candidates usually made good attempts at writing down expressions for the perimeter in part **(i)**, and the area in part **(ii)**, but all too often made no attempt at simplifying the answers, which was specifically requested in the question. In part **(iii)**, candidates were often able to obtain a method mark for using their answer to part **(ii)**, but the correct answer eluded many candidates.

Answers: **(i)** $2\pi r + r\alpha + 2r$; **(ii)** $(3r^2\alpha)/2 + \pi r^2$; **(iii)** $\alpha = (2\pi)/5$.

Question 7

Part **(i)** was a standard type of question, asking candidates to find the perpendicular bisector of a line joining two given points, but candidates surprisingly did not take full advantage of the straightforward nature of this part. A significant proportion of candidates found the equation of AB first, which was not necessary, before going on to attempt the equation of the perpendicular bisector. Some candidates did not proceed beyond the equation of AB. Part **(ii)** was more challenging and depended on candidates realising that, in their answer to **(i)**, they needed to replace (x, y) by (p, q), as well as forming a second equation ($p^2+q^2=4$), and solving the two equations simultaneously.

Answers: **(i)** $y=2x-2$; **(ii)** (0, –2), (8/5, 6/5).

Question 8

Some candidates found obtaining the given answer in part **(i)** quite challenging, and struggled to obtain the given equation. Part **(ii)** was more successful in that most candidates were able to find the value of r corresponding to a stationary value of A and to demonstrate that A was a maximum. However, very few candidates substituted back to show that the corresponding value of x was zero and hence that there were no straight sections of the track.

Question 9

In part **(a)**, the majority of the candidates wrote down correctly the equation resulting from the sum of the first 10 terms but a common mistake for the second equation was to equate 10(2a + 19d) to 1000 instead of to 1400. Hence many candidates lost marks in part **(a)**. In contrast to this, part **(b)** was done quite well with most candidates obtaining the two equations correctly and going on to derive the correct quadratic equation. Candidates working in decimals had to be particularly careful in finding the value of a, having found the value of r to be 0.714(2). They needed to observe the rule that when the final answer is required correct to 3 significant figures, for example, calculations need to carry at least 4 significant figures. Hence candidates who used r = 0.714 when calculating a obtained an incorrect 3 significant figure answer of 1.72.

Answers: **(a)** d = 6, a = 13; **(b)** r = 5/7 (or 0.714), a = 12/7 (or 1.71).

Question 10

Part **(i)** was reasonably well done. A common mistake in finding the derivative was to forget to mu -2, the derivative of the function inside the bracket. Similarly, in part **(ii)**, a common mistake in integ was to forget to divide by –2. There were a number of different mistakes in part **(ii)** that were seen, many them arithmetic. The outcome was that the correct answer was unfortunately not seen as regularly as anticipated.

Answers: **(i)** $y = -24x + 20$; **(ii)** 9/8 (or 1.125).

MATHEMATICS (US)

Paper 9280/21
Paper 21

Key Messages

Centres should encourage candidates to check that they have given the answer in the correct form and also that they have completed the question.

General Comments

All candidates appeared to have sufficient time in which to complete the paper. There were questions in which it was common to see answers given to either an insufficient degree of accuracy, or in decimal forms rather than as exact expressions.

Comments on Specific Questions

Question 1

Most candidates were able to obtain the correct critical values by squaring each side of the given equation and solving the resulting quadratic equation. Very few correct ranges were seen.

Answer: $x < -2$, $x < -\frac{3}{2}$

Question 2

(i) Most candidates showed correctly that the *x*-coordinate of *P* lies between the given points.

(ii) Most candidates were able to show the given result either by manipulating the given result to obtain $x^4 + 2x - 9 = 0$ or by manipulating $x^4 + 2x - 9 = 0$ to obtain the given result.

(iii) Most candidates were able to apply the iterative formula correctly and give the iteration to 4 decimal places, however many gave their final answer as 1.55 rather than the correct answer of 1.56.

Answer: **(iii)** 1.56

Question 3

While many candidates were able to differentiate the given equation correctly, many found the solution of the resulting quadratic in e^x equated to zero problematic. For those that did solve the resulting equation correctly, very few chose to give an exact form as required choosing instead to give a rounded decimal answer which was then used when determining the nature of the stationary points. This use of a rounded decimal answer was only penalised once.

Answer: Maximum when $x = 0$, minimum when $x = \ln 4$

Question 4

(i) Apart from the occasional sign error or arithmetic slip, most candidates were able to obtain values for *a* and for *b*.

(ii) Many candidates factorised the given polynomial, having obtained the correct quotient and then did not complete the solution by not solving $p(x) = 0$.

Answer: **(i)** $a = 1, b = -10$ **(ii)** $x = 1, 2, -4$

Question 5

(i) Most candidates contrived to obtain the given answer by manipulating their often incorrect derivatives, thus losing method marks that could otherwise have been gained. Candidates should be advised not to use this practice.

(ii) The result of $\theta = \frac{\pi}{6}$ was common but there were varying degrees of success in the calculation of the *x* and *y* coordinates

Answer: **(ii)** $(-1, 3)$

Question 6

(a) (i) Few candidates realised that they needed to divide each term in the numerator by e^{2x}. Those candidates that did were often not successful in the ensuing integration of the exponential term.

(ii) Very few candidates recognised the need to use the appropriate double angle formula before attempting to integrate, so correct solutions were rare.

(b) Many completely correct solutions were seen.

Answer: **(a)(i)** $x - 3e^{-2x}$ $(+c)$ **(ii)** $\frac{3\sin 2x}{4} + \frac{3x}{2}$ $(+c)$ **(b)** 4.84

Question 7

(i) This question was done well by most; the main errors were when candidates chose to give the value of *R* correct to 2 decimal places rather than as an exact value as required. Similarly, the value of α was often given correct to 1 decimal place rather than the 2 decimal places as required.

(ii) Very few candidates attempted this part of the question and of those did, most chose to ignore the word ‘Hence’ and so attempted spurious and unsuccessful approaches. Candidates should be reminded that the word ‘Hence’ implies that work done in the previous part of the question is to be made use of.

Answer: **(i)** $R = \sqrt{10},\ \alpha = 18.43^\circ$ **(ii)** $69.2^\circ, 163.8^\circ, 214.6^\circ, 343.8^\circ$