MATHEMATICS

General Certificate of Education (New)

Summer 2022

Advanced Subsidiary/Advanced

PURE MATHEMATICS A – AS UNIT 1

General Comments

Generally speaking, this paper contains more E grade marks and fewer A* or A grade marks than examination papers in previous years. Good solutions were seen to all questions. However, there were parts of the paper where candidates did not seem well prepared.

Surprisingly, almost all candidates did well in question 10, but, in question 1, seemed unaware that the inverse of $\mathbf{e}^{\boldsymbol{x}}$ is $\mathbf{ln}\boldsymbol{x}$, which is a fact they used in question 10. The responses to question 16 were weak, showing that candidates' knowledge of vectors is insecure, although this may also partly be attributed to question 16 being the last question on the paper.

A common problem is the standard of algebraic skills of the candidates. In many questions, candidates managed all the A level work, but lost many marks failing to finish the questions satisfactorily owing to their inability to solve a pair of simple simultaneous equations, or solve a quadratic equation accurately.

In questions involving some geometry, such as the coordinate geometry or the circle questions, candidates would greatly increase their chances of success if they **drew a good diagram** right at the start showing all the relevant information; the geometry would then be clear at a glance. Additionally, an incorrect answer could be spotted at once and hopefully corrected.

Comments on individual questions/sections

Q.1 Many candidates seemed unaware that the inverse of e^x is $\ln x$.

Q.2 Many candidates were able to express all three terms in the form $a\sqrt{3}$. However, they failed at the last hurdle where collecting terms was required. Many did not know how to deal with the denominator of –2 in the middle term. Some simply stopped whilst others multiplied by 2 but failed to correct this in the final answer.

Q.3 Responses to this question would benefit from a diagram drawn approximately to scale, showing all the information given in the question.

Parts (a), (b) and (d) were well done generally, with the occasional sign error made in calculating the gradient.

In part (c), there was a very simple method rarely seen and a relatively easy method used by the majority of candidates. However, some candidates failed to use the fact that triangle *OAC* is right angled at *C*, and used some very long and multi-stepped methods involving the sine or cosine rules.

The answer in part (e) was simply 4 times the answer in part (c). Some candidates replicated the work done in part (c), which must have been very costly in time for one mark.

Q.4 This was a reasonably well done question, though some candidates made a variety of unexpected errors in the solution of the very simple quadratic equation. The most common mistake was losing the zero root. Many candidates failed to bracket the $2k$ and so failed to square the 2 when expanding and simplifying. The required inequality at the end was often incorrect.

Q.5 Part (a) was very well done. In part (b), some very strange quadratic curves were seen, including cubics, sine/cosine graphs, circles, or some joined up straight lines. In part (c), regions satisfying inequalities proved incomprehensible for many candidates.

Q.6 Part (a) was reasonably well done, though some candidates kept trying combinations of two positive numbers, which will get nowhere, as either one positive and one negative, or two negative numbers were required. Very few satisfactory solutions were seen to part (b), as candidates thought it was a sufficient proof if they found a pair of numbers that worked.

Q.7 Parts (a) and (b) were generally well done, with many candidates gaining full marks. In part (c), surprisingly, some candidates attempted a very roundabout method of finding the midpoint of *PQ* when the coordinates of *P* and of *Q* had already been found. This usually involved finding the equation of *PQ* again, even though it was given in the question, and then the equation of the perpendicular line passing through the centre, and finally solving these simultaneously to find the midpoint. As with question 3, a sensible diagram drawn after finding the centre and the radius would have helped enormously with part (d). Perhaps candidates would have seen that the sector *OPQ* is a quarter circle, making the solution very simple.

Q.8 This was a reasonably well done question with many gaining full marks in parts (a) and (b). Part (c) caused some problems with some candidates taking a stepwise approach 1000m at a time. Though this got them the correct answer, it was time consuming.

Q.9 The response to this question was a bit disappointing as candidates were often let down by their algebra. Many got the incorrect determinant by failing to bracket $2k$. Additionally, the solution to the simple equation $4k^2 - 32k = 0$ proved difficult with the zero root often lost.

Q.10 This was an extremely well done question. Most candidates got full marks here.

Q.11 Part (a) was well done. A few candidates substituted $x = 0$ instead of $x = 2$ to find the gradient of the tangent.

Part (b) was also well done generally, though some candidates got the wrong limits when integrating for the area under the curve, using the y values rather than the x values.

In part (c), most candidates who attempted the question started off by considering where the gradient function is positive, or by considering the end points where the gradient is zero. However, they had difficulties solving the resulting quadratic equation, simply because it did not factorise.

Q.12 The factor theorem is well known to candidates and questions requiring its use are usually well done and part (a) was no exception. Part (b) was a very simple trigonometric equation. However, in its solution, a number of inexplicable errors were seen. Some candidates obviously had their calculators set to radian mode in spite of the 51° given in the question. Others, more seriously, thought cosine is distributive. The majority of candidates did not realise that −27° was relevant and lost the solution 12°.

Q.13 This was another generally well done question. Disappointingly though, most candidates simply expanded $(2 - 3x)^5$ using the binomial theorem rather than just picking out the relevant term. Some then failed to present the required answer and lost the last mark. Errors were made expanding $(-3x)^3$. Candidates who tried to work out $(2 - 3x)^5$ by multiplication were usually unsuccessful.

Q.14 Part (a) was a very standard question on local maximum and minimum, and was very well done by most candidates. A few candidates lost the constant term in the differential coefficient. Some candidates had the correct answer, then inexplicably, crossed out the constant term.

In part (b)(i), candidates were supposed to re-write the equation in the form $f(x) = -7$ and noticing that −7 is a minimum value in part (a), so that one of the roots must be a double root. In part (b)(ii), the rearrangement gave $f(x) = -6.5 > -7$, so there must be 3 roots. Very few correct solutions were seen, though in (i), the roots are sufficiently nice so that the cubic equation can be solved using the factor theorem. However, no credit was given for this.

Q.15 The laws of logs are generally well known and candidates were able to apply them correctly in this question. The exception is when the candidate decided to combine the second and third terms first but ignore the minus sign in front of the second term. Thus, they incorrectly used the addition law when the subtraction law should have been used. Generally, candidates' poor algebraic skills were evident. In expanding $(x^2y)^3$, many only cubed the y term and not the x^2 term. Candidates confused themselves by failing to cancel down common terms in the numerator and the denominator. Disappointingly, a number of candidates correctly obtained the pair of simplified equations and were then unable to proceed.

Q.16 The responses to this question were weak. In part (a), candidates did not seem to know the definition of a unit vector and simply found the modulus. Many correct responses were seen in part (b). The most common error was finding the complement angle to the required one. Extremely few attempts were seen in part (c) and even fewer correct ones, though this may be because it was the last part in the last question on the paper.