Qualification Accredited

Oxford Cambridge and RSA

A LEVEL

Examiners' report

MATHEMATICS A

H240

For first teach in 2017

H240/01 Autumn 2021 series

Version 1

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

i	Reports for the November 2021 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate responses.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Paper 01 series overview

H240/01 is one of the three examination components for the A Level examination for GCE Mathematics A. It is a two-hour paper consisting of 100 marks, which tests Pure Mathematics topics. Pure Mathematics topics are also tested on the first half of Papers 2 and 3, and any Pure Mathematics topic could be tested on any of the three papers. If a topic is tested on one paper it does not preclude the same topic appearing on another paper as well, but it will then be testing different aspects.

To be successful on this paper, candidates need to be familiar with all areas of the Pure Mathematics content and be able to apply it to a variety of questions, including multi-step questions and those set in context.

H240/01 has a gradient of difficulty throughout the paper and it is not unusual, as in this paper, for the initial questions to focus on an extension of the subject knowledge gained from the Higher Tier GCSE.

Candidates should make sure that they are familiar with the meanings of the command words used, especially 'determine', 'show that' and 'show detailed reasoning' and make sure that their solution includes sufficient detail and justification.

i	**OCR support**	Section 2d in the specification gives explanations and examples of the command words; this should be shared with the candidates. OCR have summarised this in a poster that can be displayed within the classroom: A/AS Level Mathematics Poster - Command Words Examples can also be seen in the Exam hints for students document.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Gave clear and concise worded explanations when required. • Included sufficient detail in their method, especially on 'show that' questions. • Showed good subject knowledge across the entire specification.	• Made vague statements in their explanations, leaving examiners unsure as to what was being referred to. • Did not provide sufficient detail in a mathematical argument or explanation. • Were unable to make an attempt on some questions, suggesting a lack of confidence with some topic areas.

Comments on responses

The first three questions involved extending knowledge already gained at GCSE, yet some candidates made only limited progress with these. Question 1 required candidates to use the conditions for real distinct roots and Question 3 examined proportional relationships. Question 2 was a real-life application of linear equations with candidates expected to set up two equations in the first part of the question, and then solve them in the second part.

In the final part of Question 4 one root of the cubic polynomial could not be further pursued to find a value for y, and a similar situation occurred in Question 8(c). In such cases candidates are expected to give a reason for discarding the root, explaining why no solution is possible; statements such as 'can't be done', N/A or 'math error' are not sufficient.

Candidates should make sure that they read each question carefully, possibly highlighting or underlining any key points or vocabulary. The graph in Question 5(b) was clearly identified as a gradient function graph, yet several candidates did not interpret it as such.

Question 6(a) was a routine question, and many candidates were able to provide clear and correct solutions. Should an error be made in evaluation, partial credit can still be given for an attempt to use a correct method. As such, candidates are advised to show such detail in their working and not just write down a final answer of 3 terms. In part (c) candidates were required to come up with their own strategy, namely rewriting the denominator with a negative indices and hence find the product of the two expansions. This proved challenging for many, with the most common misconception being an attempt to cancel across the numerator and dominator, the latter of which had been expanded into three terms.

The first part of Question 7 was a 'show that' question and candidates were expected to provide sufficient detail to be convincing, including expressing the derivative equated to 0 before dealing with the fractional term. Part (b) also required sufficient detail of the algebraic rearrangement to be shown. This part of the question was also a demonstration of candidates not reading the question carefully; with many applying Newton-Raphson to the equation of the curve given in the stem as opposed to the equation in part (a), as stated.

In Question 8(a) candidates who did a quick sketch graph of the functions were more successful in identifying the required ranges. In part (b)(i) successful candidates showed clearly the correct composition of functions, also providing interim values so as to be convincing. Part (b)(ii) proved to be more challenging, with students focusing more on the actual values rather than the functions themselves. The final part of this question was generally well attempted, with candidates able to devise a strategy and apply relevant identities. A common error was to not consider further solutions once the principal angle had been found.

Question 9, covering aspects of parametric equations, proved challenging for a significant proportion of candidates. However, it was pleasing to see that most attempted the differentiation in part (c) even if they had struggled with the other parts.

Some structure was given at the start of Question 10(a) to support candidates in making progress through the geometric proof of the trigonometric identity. When attempting later parts of a question, candidates should review the content of previous parts and consider whether it is relevant and helpful. Candidates should be prepared to link different areas of the specification together in the same question; in part (b) many were able to make a good attempt at finding an exact value for $\tan\alpha$, this gaining the first three marks, but only a minority could make further progress by rationalising the denominator to give their answer in the required form.

Despite being given the substitution in Question 11(a) this question proved to be challenging for many. Differentiating the substitution implicitly was rarely seen, and introducing the square root made the differentiation more awkward. Many of the candidates who did manage to carry out the integration successfully still struggled to gain the final mark for correctly and convincingly taking out the common factor.

The second part of this question had a small error in the description of the graph. Most candidates did not notice the error and continued with the original equation. However, to minimise the impact of the error, the mark scheme was adapted so that full credit could still be gained for any combination of using the original equation and the one containing the error. This was a challenging multi-step question, which also required candidates to make the link back to part (a).

Although the mathematical models described in parts (a) and (b) of the final question should be familiar, a number of candidates found it challenging to convert the given information into differential equations. In part (b) partial credit could still be gained for attempting to solve their differential equation, including use of the given boundary conditions.

Common misconceptions

Candidates should appreciate that merely discarding a value that cannot be pursued is not sufficient; a reason is also required e.g., in Question 4(c) $2^y = -2$ has no solution as 2^y is always positive.

On Question 5(b) the common misconception was that the graph showed a function rather than a gradient function. Candidates should make sure that they read each question carefully rather than assume that they know what they are being asked to do.

Question 9 highlighted confusion about when to use $x = 0$ or $y = 0$ when investigating the path of a particle defined parametrically. Candidates also struggled to recognise the implication on the numerator and denominator in the expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ for when the path of the particle is parallel to either the x-axis or y-axis.

Key teaching and learning points – comments on improving performance

Candidates should make sure that they appreciate the precise meanings of the command words, and what is hence expected of them. Teachers should draw explicit attention to this when practising questions, and could also make use of wall displays as a visual reminder.

Candidates should make efficient use of their calculator where appropriate, such as carrying out an iterative process and ensuring that it is in the correct mode for questions involving trigonometry. Where appropriate answers should be given in an exact form; if giving a non-exact answer then 3 significant figures should be used unless the question states otherwise.

When showing a given result, candidates should provide sufficient justification i.e., explaining their reasoning and not doing too much in a single step. In Question 10(a)(iii) the more successful candidates clearly identified which lengths, angles and triangles were being considered.

	AfL	Students need to develop their own strategies in attempting unstructured problems. This could be achieved using graduated worksheets, where candidates see a similar question presented in both a structured and unstructured format. Teachers could also make use of [ExamBuilder]() to redraft and remove the structure from past examination questions – for example setting up a question similar to 4(c) as a single request with none of the preceding parts being given.

Guidance on using this paper as a mock

Teachers should pay close attention to the additional guidance in the mark scheme to make sure that feedback to candidates clearly identifies when marks are awarded explicitly for explanations and/or method shown.

Teachers should make sure that they use an amended version of the question paper, correcting the description of the graph in Question 11(b) as "part of the curve $y = \frac{4x^3}{\sqrt{x^2+3}}$" to match the information in the rest of the question.

Supporting you

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website.

Supporting you through 2021-2022

Our priority is supporting you and your students this autumn and to support you as you prepare for summer 2022 exams. We'll update our website information regularly with resources, guidance and key information.

Take a look at our support for:

- Teachers
- Students
- Exams officers

Keep up-to-date

We are sending a weekly roundup to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular CPD courses to hear directly from a senior assessor or drop in to a Q&A session. All our courses for the academic year 2021-2022 are being delivered live via an online platform, so you can attend from any location.

Please find details for all our courses on the relevant subject page on our website or visit OCR professional development.

Signed up for Exambuilder?

ExamBuilder is the question builder platform for a range of our GCSE, A Level, Cambridge Nationals, Cambridge Technicals and Functional Skills qualifications. See the full list of available qualifications in the sign up form.

ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

If you do not have an Interchange account please contact your centre administrator (usually the Exams Officer) to request a username, or nominate an existing Interchange user in your department.

Supporting you

Active Results

Review students' exam performance with our free online results analysis tool.

For the Autumn 2021 series, results analysis is available for GCSE English Language, GCSE Mathematics and Cambridge Nationals (moderated units) only.

It allows you to:

- review and run analysis reports on exam performance
- analyse results at question and/or topic level
- compare your centre with OCR national averages
- identify trends across the centre
- facilitate effective planning and delivery of courses
- identify areas of the curriculum where students excel or struggle
- help pinpoint strengths and weaknesses of students and teaching departments.

Find out more at ocr.org.uk/activeresults.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit
- **ocr.org.uk/qualifications/resource-finder**
- **ocr.org.uk**
- **/ocrexams**
- **/ocrexams**
- **/company/ocr**
- **/ocrexams**

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

I like this **I dislike this**

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT