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Examiners' report

MATHEMATICS A

H230

For first teach in 2017

H230/02 Autumn 2020 series

Version 1

ocr.org.uk/maths

Introduction

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

	Reports for the Autumn 2020 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 answers.

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.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

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Paper 2 series overview

This paper consists of two sections. Section A is Pure Mathematics (Questions 1-7), allocated 50 marks and Section B is Mechanics (Questions 8-11), allocated 25 marks. All questions should be answered.

The exceptional nature of this Autumn 2020 series meant that there were only a few candidates for this paper. None of these candidates scored really high marks and there were several scoring under 20.

Candidates need to understand the significance of 'In this question you must show detailed reasoning' and 'determine' when they appear in questions. Justification of results is expected in these questions – full methods need to be seen to gain the maximum mark. See the note about Question 6 later.

i	**OCR support**	A summary guide of the A Level Maths command words can be downloaded for the qualification website: A Level Maths command words poster A4 size

The command word 'Find', used for example in Question 1(b), meant that a correct answer with no working shown would have gained full credit. However, to adopt this tactic could be considered a high risk strategy when there is more than one mark available since, as here, Method marks are available. Obviously they cannot be given when there is an incorrect answer presented with no method shown. It is always wise to show some evidence of how a result is obtained. Refer also to the comment below about results 'by calculator'. Note that 'find' was used in Question 3 and Question 6 with the instruction to show detailed reasoning, which now means evidence is vital.

i	**OCR support**	Summary guidance for the use of calculators in examinations can be downloaded for the qualification website: Maths calculator use poster A4 size

In Question 4(a) and Question 6(b) candidates were told what to use to solve the problem and so this solution route was required. Other methods were not acceptable here.

When sketching curves, candidate should take care to make the 'critical' behaviour of the curve clear. It is always a good idea to specify axes crossing points and draw asymptotic behaviour carefully. Force diagrams in Mechanics should be clear and, as in Question 9(b), show only the requested forces.

Too many candidates attempt to use constant acceleration formulae in situations where they are not applicable and fail to have the required number of forces when using Newton's second law. Such confusion almost always scores no marks.

Candidates who did well on this paper generally did the following:	*Candidates who did less well on this paper generally did the following:*
• Demonstrated a sound understanding of the required concepts in both sections of the paper. • Avoided careless calculation errors and gave answers to the required degree of accuracy. • Produced accurate algebra. • Wrote clear solutions.	• Struggled with the more difficult concepts. • Occasionally did not include sufficient working in their solutions. • Made calculation errors and did not follow the rubric in the accuracy of their answers. • Showed an uncertain grasp of basic algebra.

Section A overview

Questions tackled reasonably well : 1, 3, 5(a) and 6.

Questions found challenging : 2, 4, 5(b) and 7.

Comments on questions

Some brief comments on the 'challenging' questions.

Question 2

Part (a) - Candidates should draw their curves to 'fill' the axes and sketch asymptotes carefully. There should not be too big a 'gap' between the curve and the asymptote and there should not be significant movement away from the asymptote. $y = \ln x$ attempts were disappointing.

Part (b) - The connection between the given equation and $\ln x = k/x$ was not well appreciated or explained. Some were looking for an axis crossing point to justify one root.

Question 4

Part (a) - Long division was seen here, ignoring the request for the factor theorem. This gained no credit because of the instruction 'Use the factor theorem'. Note that only the statement f(½) = 0 so $k = -37$ was not enough working because of **DR** and **AG**.

Part (b) - **DR** so evidence for the factorisation was required. Candidates that just quoted their answer, possibly obtained from the polynomial solve function on the calculator scored M0.

Part (c) - Only candidates who did well on this paper seemed to understand what was required. NR was not uncommon.

Question 5

Part (b) - The translation was not well done or just ignored.

Question 7

Part (a) - $V = 2x^2y$ was seen and often the required result for the surface area was incorrect, although many candidates managed to find at least 3 correct faces and gain M1. Replacing y in V and the subsequent rationalising was rarely seen.

Part (b) - M1 A1 earned, with k often used, but few completed. Full credit could have been gained here even if no k had been obtained earlier. Second derivatives appeared sometimes.

Part (c) and (d) were commonly not attempted.

Section B overview

Questions tackled reasonably well : 8, 10(a) (b) and 11(b).

Questions found challenging : 9, 10(c) and 11(a) (c).

Comments on questions

Some brief comments on the 'challenging' questions.

Question 9

Part (a) - 9500 = 885*a* prevalent. Examiners really want to see the correct number of terms in Newton's second law, else it is regarded as a fundamental misunderstanding. Also, of course, weight and mass must not be confused.

Part (b) - This did not appear to be understood at all well by most candidates. Many candidates could not isolate the forces on the crate and display just those on a diagram. *R* often missing.

Part (c) - Much confusion with the use of Newton's second law ; 885 appearing in equations with *R*.

Question 10

Part (c) - Most just considered $t = 0$ to $t = 4$ without realising the importance of $t = 3$, even though (b) was almost always correct.

Question 11

Part (a) - $s = 16t$ used – the need for $t - 1.5$ was generally not understood. This then led to $t = 0$ and $t = 8$ from a two term quadratic and thus gained only M1 A1. Candidates did not seem to realise that $t = 0$ could not be one of the required times given the problem. $t + 1.5$ was seen in some working.

Part (c) - Most candidates made no useful progress with this part.

Common misconceptions

?	**Misconception**	In Question 1 either candidates had not taken in the instruction on the Question Paper about required accuracy or were confused about the difference between rounding to significant figures and decimal places. Many candidates did not use the required forces in their equations in Question 9(a) and (c).

Key teaching and learning points – comments on improving performance

The following, some of which have been mentioned in previous reports, remain pertinent.

1. Candidates should understand the implication of the 'In this question you must show detailed reasoning' instruction. Generally, this means examiners will expect to see how results have been obtained. So, for example, in Question 6 on this paper the method for solving the simultaneous equations was expected and those just doing it on the calculator earned M0 for this skill.

2. **BC** – a result achieved 'by calculator' – can encourage candidates to show little, if any, evidence of how their answer has been produced. To be fair, where this appears on the mark scheme (in Question 10) candidates generally adopted the 'old-fashioned' algebraic route but no doubt this will change over time. Inevitably examiners will find it difficult to know where an incorrect answer, presented alone, has come from and it may be hard to credit. It may be wise to encourage candidates to provide some evidence of what they are doing, especially in cases where more than one mark is available.

3. The front cover instructions state 'Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question.' This should be stressed – some final answers were correct to 2 significant figures only. This may result in a loss of accuracy marks.

4. A question may require units in an answer to gain full credit. It is best to make candidates aware of this and urge them to always include units in answers where relevant.

5. The front cover instruction state 'When a numerical value is needed use g = 9.8 unless a different value is specified in the question'. This now seems to be well recognised.

	**OCR support**	The exam hints produced for A Level Mathematics A - H240 is appropriate for students preparing for the AS papers, especially if they are planning to continue to the full A Level: Exam hints for students

Guidance on using this paper as a mock

This paper covers the following topics : Cosine rule, $\frac{1}{2}ab\sin C$ with area of a segment, curve sketching and interpretation of the algebraic solution of an equation graphically, finding the normal to a curve, the factor theorem and factorisation, quadratic functions and graphical transformations, properties of the circle and the circle equation, a maximisation problem with rationalising and algebraic manipulation, use of the laws of logarithms, forces in vector notation in equilibrium, Newton's second law, variable acceleration and *suvat* equation use.

The Pure section introduces the calculus and various other ideas which require a secure grasp of basic algebra and in the Mechanics section students need a sound understanding of kinematics with both uniform and non-uniform acceleration and Newton's laws.

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