FSMQ

Additional Mathematics

Unit **6993:** Paper 1

Free Standing Mathematics Qualification

OCR Report to Centres June 2018

About this Examiner Report to Centres

This report on the 2018 Summer assessments aims to highlight:

- areas where students were more successful

- main areas where students may need additional support and some reflection

- points of advice for future examinations

It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

The report also includes links and brief information on:

- A reminder of our **post-results services** including **reviews of results**

- Link to **grade boundaries**

- **Further support that you can expect from OCR**, such as our Active Results service and CPD programme

Reviews of results

If any of your students' results are not as expected you may wish to consider one of our reviews of results services. For full information about the options available visit the OCR website. If University places are at stake you may wish to consider priority service 2 reviews of marking which have an earlier deadline to ensure your reviews are processed in time for university applications: http://www.ocr.org.uk/administration/stage-5-post-results-services/enquiries-about-results/service-2-priority-service-2-2a-2b/

Grade boundaries

Grade boundaries for this, and all other assessments, can be found on the OCR website .

Further support from OCR

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.

It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres

- **Analyse results** at question and/or topic level

- **Compare your centre** with OCR national averages or similar OCR centres.

- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results/getting-started/

Attend one of our popular CPD courses to hear exam feedback directly from a senior assessors or drop in to an online Q&A session.

https://www.cpdhub.ocr.org.uk

CONTENTS

Additional Mathematics FSMQ (6993)

OCR REPORT TO CENTRES

Additional Mathematics – 6993

General

The paper this year was seen to be a little more challenging than usual and the mean mark was a little down on last year.

A significant part of the specification embraces topics that are tested in GCSE and in those topics in particular, candidates should be prepared to think carefully through the context of the question. The specification was drawn up specifically as an enrichment programme and so the clear intention is that GCSE topics are treated in a more contextual way. There were some questions that are tested in GCSE but which candidates found tricky. Generally, the new topics were done better.

Centres will be aware that in order to bring the content of this specification into line with the reformed GCSE and AS Level specifications, some revision has been undertaken. The style and standard is expected to remain constant but there are a few new topics to be taught. The new specification and the Sample assessment paper can be found on the OCR website for first teaching in September 2018 and first assessment in June 2019.

The following gives a brief summary of the responses seen to the questions.

Question 1

This standard opening question on a simple inequality was done well by the vast majority of candidates. There are some who rewrite the inequality as an equation, which they solve, and then insert the inequality sign at the end. This method is not to be advised since the majority of candidates that used this technique did not go back to the original inequality question to determine which inequality sign to insert and so did not obtain the correct final answer.

Question 2

This question was generally attempted successfully by the vast majority. There were some who lost the minus sign at some point and as a result obtained an incorrect c. Some confused the x and y values when substituting. Some lost the final mark by not expressing their equation correctly. A minority did not understand what was required and found the equation of a tangent.

Question 3

In part, (i) the intention was that candidates would simply write down the roots of the equation by scrutiny of the graph. "Write down" in a question is used when no work is required. Candidates who factorised the equation were not therefore "writing down" but "finding". The only penalty incurred by doing it this way was in time spent.

Part (ii) was more discriminating. If candidates identified the correct line, they were able to identify the roots with success. Some candidates solved algebraically to verify these answers or seemed to solve algebraically first and use this to infer the correct line. A large number of other candidates simply solved algebraically, thus earning no marks, or drew an incorrect line – most commonly $y = -3x - 3$ - or other variants on sign.

Question 4

Generally speaking, the insertion of the word "exact" into the demand of the question should trigger the understanding in the mind of the candidate that calculators should not be used. In this case, finding a value of θ to write down the other trigonometric ratios resulted in no marks. The

correct approach was to use Pythagoras to find the exact length of the third side of the triangle and hence the other ratios.

Question 5

There were no major problems in this question. Most knew to integrate and most got maximum marks. A few used incorrect limits of 3 and 1, or more obscure incorrect limits. As with other questions, the layout of answers was variable. Arithmetic and algebraic errors were seen, as well as differentiation instead of integration. Only a few used their calculators and simply wrote down the answer.

Candidates who wrote a "model" answer such as below rarely made any error.

$$A = \int_0^3 y \, dx = \int_0^3 \left(6x^2 - 2x^3 \right) dx = \left[2x^3 - \frac{x^2}{2} \right]_0^3$$

Question 6

This was another standard GCSE question and part (i) was answered well. The geometrical interpretation in part (ii), however, was not so good. Any straight lines intersecting in the positive quadrant, one with a negative gradient and other with a positive gradient earned the first mark, but the intersection as the solution to part (i) needed to be labelled for the second mark. This was either by drawing a sketch in which there were clear scales on the axes or simply stating the (2, 3) was the point of intersection.

Question 7

In part, (i) most candidates knew that they should equate the equations to form a quadratic in x, which then had to be solved, and the resulting two values substituted to find the corresponding value for y. It was pleasing to note that very few candidates did not connect the x and y values.

In part (ii) many of the explanations were too thin to earn the marks. The gradient function of the curve was found and the value of the gradient of the tangent at the points found in part (i) were found. However, simply stating that these values meant that the line was not a normal at either point was not good enough – candidates needed to use the condition for perpendicular lines with the value of 7 (the gradient of the line) or to find the perpendicular gradient to show that they were not equal.

Question 8

(i) This caused problems for those who were unable to work with fractions. The most common error was to successfully add the fractions with a common denominator of $4x$ but then multiply throughout by $4x$ giving $4x \times 0 = 4x$. The other fundamental error was to "cancel" the $4x$ in the numerator and denominator.

Many were subsequently able to attempt to complete the square to obtain either $(x+1)^2$ or $(x-1)^2$ but often forgot about the 1 that needed to be subtracted.

Many did not answer part (ii) even if part (i) had been done successfully. Of those who did many used = or < incorrectly. Candidates tended to miss the principle that for $(x+p)^2 = q$ to have roots it is necessary for $q \geq 0$.

Once again, many candidates did not follow the instruction to use their answer to part (i) in part (iii) including those who had obtained a correct result. Those who went their own way usually used the formula to solve their quadratic.

Question 9

Part (a) was particularly well answered. The overwhelming majority were successful at dealing with the binomial expansion. A small minority made errors in their calculator – whilst showing the correct method – and a much smaller minority had no idea on how to proceed with the question.

Candidates found part (b) difficult to answer. Most focussed on the context rather than conditions for the binomial to be valid and many simply repeated the conditions of the question (eg that there were 10 candidates chosen). A particular problem was that many candidates thought that there were three outcomes to this particular problem, whereas the condition for the binomial to be valid was that there were only two outcomes. (ie left handed or not left handed; comments about not allowing any candidate to be ambidextrous were therefore not appropriate).

Question 10

Parts (i) and (ii) for this question depended on standard properties of the circle. In part (i) most were able to say, abet not particularly concisely, that P was the midpoint of GX and so the three lengths were equal meaning that P was the centre of the circle that went through G, A and X. However, the corollary to that, namely that the triangle GAX was in a semicircle, meaning that the angle at A was 90^0, was missed by the majority of candidates and so very few earned the mark in part (ii).

Most candidates found real difficulty with part (iii). Those that found the distance of Y below the horizontal upper line AX and subtracted from 200 (ie 200 – 200sin50) with an answer obtained in one line probably wondered why there were so many marks for this part. Others struggled to find the various lengths, using combinations of the sine rule and cosine rule, (even in right angled triangles) and finding lengths such as YB, which were not necessary, though many did come out in the end with the right answer.

Question 11

This question proved to be challenging. Part (i) was usually done well and most gained the marks, as they understood the equation of a circle. Some candidates made algebraic errors when expanding the squared bracket. Others were unsure about which form of the equation of a circle to use, and just tried substituting points on the circle into the equation given to find the value of *k*.

Many struggled to find an appropriate route to solve part (ii); the condition for a line intersecting a curve to be a tangent has been asked in previous years. A significant number of candidates obtained the quadratic equation in *x* but then did not make the discriminant to be zero, the condition for the roots to be coincident.

A few decided that the intersection of the tangents with the circle occurred on the line through the centre of the circle parallel to the *x*-axis, namely (3, 3) and (-3, 3). This resulted in incorrect answers to (ii) but also to (iii). In this last part, the property that a diameter is perpendicular to the tangent at the point of intersection, meaning that this was a 3-4-5 triangle, was also missed.

Question 12
In part (i) the answer was given so there were a number of candidates who lost marks through careless algebraic manipulation, and/or performing too many steps together meaning that they did not 'show that' the the perimeter was in fact $16x + 2y$. The majority knew that they needed to use Pythagoras but lack of brackets meant that expressions such as $3x^2 + 4x^2 = 25x^2$ were often seen. It needs to be made clear to candidates that when an answer is given that every step must be shown clearly and correctly.

In part (ii), most were able to establish that the area was $6xy + 12x^2$ but the *x* in $12x^2$ was not always squared. The substitution was not done well and many fudged the given answer with careless algebra often in evidence.

The expected method by calculus for part (iii) was often seen and usually resulted in a very swift award of 6 marks. However, there were a disappointingly large number who adopted more basic methods, which were not intended. These generally fell into two categories. There were those who adopted a series of integer trials with no clear strategy but nevertheless often managed to obtain correct answers. The problem is that by this method the value of the area at x = 4 is not established as the maximum value, even though it is the highest value of the points tried. Consequently, these got very little credit. However, full credit was available for those who were able to clearly establish the symmetry of the situation.

Question 13
Nearly all candidates identified the need for the cosine rule in part (i) and substituted correctly (although a small number used 130 instead of 40). Again, there were issues for some candidates when calculating this and a disappointing number of candidates did not round to the correct degree of accuracy, leaving the answer as 3.69 or 3.7. Candidates should remember that the norm is for 3 significant figures unless the question demands otherwise. In this case, the number of significant figures was emphasised, but some still did not write down their answer as required.

Part (ii) was also well answered. Students used a variety of units when working, 1hr40, 100 minutes, or 1.6667 hours and all of these gained the required result with success.
Part (iii) proved very difficult and very few candidates had any success here. Most used the ratio of 2:3 but not in connection with the sine rule. Even those candidates that recognised this often paired the angles with the incorrect ratio. Candidates who did correctly implement the sine rule often only gave one angle and corresponding bearing rather than both. Candidates should be aware that the ambiguous case may be tested. The cosine rule was often used once but such efforts were usually incomplete.

Question 14

In part (a)(i) a variety of incorrect answers were seen though $s = \dfrac{1}{2} \times 2t^2$ was accepted. Some candidates wrote down the formula but did not use it.

In part (a)(ii) a number of candidates ignored the mixed units while others attempted to convert one of the given values to give consistent units unsuccessfully. When dealing with speed, distance and time, units of measurement are essential, and transformations between them may be anticipated. Very few were able to arrive at the correct answer when changing the acceleration rather than the velocity.

Part (b) involved variable acceleration and candidates might have expected this. In part (i) many candidates did not realise they had to integrate to find expressions for velocity and displacement. It is essential to keep the distinction between uniform acceleration and non-uniform acceleration in mind. In the former case the equations of uniform acceleration may be used; in the latter not, and calculus methods ought to be applied. In part (b)(ii) a number of candidates used the wrong set of formulae.

About OCR

OCR (Oxford Cambridge and RSA) is a leading UK awarding body. We provide qualifications which engage people of all ages and abilities at school, college, in work or through part-time learning programmes.

As a not-for-profit organisation, OCR's core purpose is to develop and deliver general and vocational qualifications which equip learners with the knowledge and skills they need for their future, helping them achieve their full potential.

© OCR 2018

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored