OCR
Oxford Cambridge and RSA

FSMQ

Additional Mathematics

Unit **6993:** Paper 1

Free Standing Mathematics Qualification

OCR Report to Centres June 2015

This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates 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.

CONTENTS

Additional Mathematics FSMQ (6993)

OCR REPORT TO CENTRES

Additional Mathematics – 6993

It was pleasing to see that there were fewer candidates with very low marks. This specification is intended as an enrichment specification for able candidates and centres seem to have recognised this when entering candidates for this qualification.

The mean mark for this paper was 59%, a significant increase on previous years. However, comments on individual questions will indicate areas which were not tackled particularly well when considering that much of the material was GCSE material set in a rather more challenging context..

Comments on individual questions

Section A

Q1
It was rare to see the most efficient way of answering this question, as given in the mark scheme. As in many other places in the paper, candidates tended to go for a method which was rather longer and less efficient than the quickest method.

Q2(i)
This was often done well. The principal angle given on most calculators will be in the range $-180^{\circ} < a < 180^{\circ}$ and so the conversion was necessary. Some added 90º.

Q2(ii)
This equation had two roots. Candidates needed to be aware that in part (i) an angle, that is not wanted, is written down and then the correct angle is deduced. In this part it was sometimes difficult to discern whether the candidate was doing the same thing, i.e. from the given angle work out the correct answer, rather than give two answers.

Q3
Usually well done, but some candidates thought that they needed to do something with the gradient found, such as finding the negative reciprocal.

Q4(i)
The standard process of finding a definite integral seemed to be well understood, though there were many errors in the answer.

Q4(ii)
A geometrical interpretation, however, was done less well. Many candidates had no real understanding of the geometric significance, whilst others seemed to be incapable of writing down what they no doubt knew.

Q5(i)
The major failing here was to start with the constant acceleration formulae rather than showing by calculus (as the question required!) that the acceleration was constant.

Q5(ii)
The answers obtained by a variety of methods were accepted here, unless there was an arithmetic error.

Q6(i)
Nearly 10% of candidates failed to obtain the right answer for this part. A significant number of these were because they did not answer the question. This asked them to form an equation in *n* and solve it. Consequently, those who simply wrote 32, 33 and 34 had not answered the question.

Q6(ii)
Most of those who failed to obtain the quadratic in this part had misunderstood the word “product”.

Q7(i)
This was a standard question testing the ability to solve simultaneous equations where one is a quadratic. Some eliminated x to give a quadratic in y but most did it the expected way by eliminating y.

Q7(ii)
The interpretation of the result of (i) (coincident roots) that the line was a tangent to the curve was given by only around 10% of candidates. We accepted “touched” but not “intersected”.

Q8(i)
Many candidates did not use the factor theorem ($\mathrm{f}(-3) = 0$ gives the result very simply) but divided the cubic by ($x + 3$). Whilst many candidates obtained the right result, most floundered with the algebra and penalised themselves on time if not by marks. Some candidates factorised $\mathrm{f}(x)$ in this part in such a way that there was no x^2 term, in which case $a = -7$.

Q8(ii)
Some candidates found the result by trial, in some cases using the fact that the constant number being 6 limited the options, other candidates by more long division. A few failed to solve the equation, simply leaving their answer as $\mathrm{f}(x)$ in factorised form.

Q9(i)
Completing the square was not done particularly well.

Q9(ii)
Most candidates knew to substitute the coordinates into the equation for the circle, either in their form of (i) or in the original form given in the question. Interpretation of the result, however, was done less well.

Q10(i)
This question was on the cosine rule. It was disappointing to see so many candidates assumed that one of the angles was a right angle. (See comments on Q 13 for the opposite observation!)

Q10(ii)
This part was also on the cosine rule but with the side required not opposite the angle given. The net result is a quadratic equation in the unknown side in which the x coefficient was irrational. Most candidates who did it this way seemed to have been defeated by this and seemed to think that because the coefficients of the quadratic were not nice easy numbers that they must have made an error and did not attempt to solve.

The more successful candidates used the sine rule twice which was perfectly acceptable but a rather longer method.

Section B

Q11 (i)
The most popular method was the equating of the two functions, which usually led to the correct quadratic. Some candidates realised that they need to show the substitution to obtain their y values, but many lost the second mark by failing to do so and just stated the y value having obtained the x value.

Some candidates scored both marks from substituting for A and B in both equations. However, many who took this route lost the marks by substituting only for A in S_1 and for B in S_2 or vice versa.

Q11(ii)
This was quite often not attempted.

Many candidates read this as find length PQ from the graph and simply gave $7 – 3 = 4$.

Of those who attempted the subtraction of the functions, the most common error was finding QP, although a few lost the second mark by careless use of brackets.

A few candidates correctly used the formula for distance between two points to obtain the correct answer, but others could not make the substitution for y_1 and y_2.

Some candidates divided PQ by 2 and so were penalised later.

Q11 (iii)
Few candidates scored full marks on this part, and it was frequently left blank.
Many who attempted it scored the first two marks for $x = 2.5$, but then failed to substitute in their PQ.

A common error was the assumption that the gradients of both curves must be zero at the maximum length.

A few candidates attempted a solution by completing the square and maximising their result, perhaps failing to read the question sufficiently carefully.

Q11 (iv)
Most candidates had clearly had extensive practice on this type of question. Many sprang to life to produce successful attempts, following blank responses in earlier parts, as they had not realised that there was a connection between the parts to help them.

Some candidates who had failed to find PQ earlier, suddenly discovered it (or QP) for this part of the question, although subtracting the separate integrands was more popular.
The application of limits seemed to cause few problems and some used the y values for the limits of integration.

Many wisely delayed the decision on which way to subtract their integrands until they had correctly calculated their values, thus avoiding the www stipulation. An unfortunate few, however, lost the second M mark, reversing their stated correct order after arithmetical errors had led to their $S_1 > S_2$.

Those who chose to use the integral of PQ often didnot score full marks due to an inaccurate expression for PQ due to a misuse of brackets earlier and so the candidates who started again were more successful.

Q12

This was generally well done. All but the very weakest candidates recognised this as a question on the Binomial Distribution. It was pleasing to see far more correct answers on this topic this year than in previous years. Most candidates were able to get the correct fractions of each type of bulb of ¼ and ¾ from the ratio in the question, and in the correct order, with very few using 1/3 and 2/3, following from a misunderstanding of ratio.

The 3 sf requirement lost some candidates more marks than they maybe ought to have lost. Candidates should be made aware of the rubric on this point.

Q12 (a) (i)

This part was relatively straightforward and most candidates got the correct answer. Candidates should be reminded that accuracy is required to 3 sf as many with the correct working only wrote the answer 0.016 and so lost a mark. This common mistake suggests confusion between three decimal places and three significant figures, especially as many candidates giving 0.016 would then go on to give the next two parts to 3 sf correctly.

Q12 (a) (ii)

Many candidates gained the mark for $(3/4)^{10}$ and realised the need to subtract this probability from 1. It was uncommon to see students trying to add all 10 terms rather than subtracting from 1.

Q12 (b)

As expected, this question differentiated well. ${}^{20}C_3$ proved to be a very quick and easy 5 marks. Unfortunately, it was not uncommon to see this correct method then replaced with the lengthier method, and marks lost due to lack of understanding on how to combine the probabilities, or calculation and premature approximation errors creeping in. It is assumed that the replacement was done because candidates felt that the succinct method did not warrant 5 marks, nor take up enough space on the page! This is another part where some lateral thinking resulted in a very easy solution to the question.

Q13

Generally, this question was found to be the most demanding question on the paper. Many candidates were hampered by not using clear diagrams; those who took the trouble to produce good, labelled diagrams seemed to fare better.

It was disappointing to see so many candidates use the sine rule and cosine rule within right angled triangles. This must have had an adverse effect on the time available to do the remainder of the paper.

Q13(i)

Generally, this part was well done, although some candidates struggled to use Pythagoras' Theorem properly. Many realised that OA was 0.5 (although 0.25 was a common incorrect value) and were able to find OV correctly. Some wasted time by calculating one of the non-right angles and applying trigonometry again to find the required length.

Q13(ii)

This was also done relatively well. Inaccurate final values were reasonably common due to premature approximation in their working. Many realised the angle needed (although some found the angle made by a cane with the vertical), and applied their values correctly. It was curious to see some answers with OV greater than the hypotenuse – candidates should have questioned this for themselves.

Q13(iii)
Angles between planes is a concept beyond many candidates and many chose the wrong triangle – the sloping face, triangle ABV, was commonly used , as was the triangle they used for part (ii), leading to candidates giving the same answer again!

Those who made progress realised that OM and/ or VM was needed and this was usually done correctly. Had their diagrams been better labelled (or, in some cases, present) they would have not made careless errors (for example, selecting the wrong length or using a hybrid of values from different triangles) when finding the angle.

Q13(iv)
This differentiated well and many candidates left the part unanswered. Only the very best used a ratio approach based on the vertical heights of the similar figures. Greater special awareness would have led them to realise that the length of the wire was the same proportion of the base length as the heights of the shapes. A common error made by those who chose to find a scale factor was to take the wire 1m up a sloping edge rather than 1m vertically above the ground.

Some candidates used long-winded methods (usually only partial methods) which relied heavily on trigonometry.

Q14(i)
This was another interpretation question in which candidates were generally unable to express themselves well enough to earn the marks. x and y stood for the number of bottles of X and Y respectively and the inequality represents the restriction on the quantity of A. A fair amount of scribbling and crossings out in order to have a second go made it hard to discern whether candidates had got the essential details.

Q14(ii)
Nearly 90% of candidates wrote down the correct inequality.

Q14(iii)
The dimensions of the grid were chosen so that the feasible region was large enough to be able to read coordinates of points on it. That meant that while both lines intersected the y axis, they did not both intersect the x axis. This meant an extra step in working out that the line passed through the point (30,6) and a few candidates were thrown by this difficulty.

Q14(iv)
The majority of candidates obtained the right results in this part.

Q14(v)
The major failing here was not identifying all the points which satisfied the restriction. Some candidates did not read the question carefully to note that it asked for *all* the combinations, clearly implying that there was more than one.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
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