OCR

Monday 16 June 2014 – Morning

AS GCE MATHEMATICS (MEI)

4776/01 Numerical Methods

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4776/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

1239422135

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book**. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

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- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

Section A (36 marks)

1 You are given that the equation

$$x^2 + \frac{1}{x} - 5 = 0$$

has one root, α, in the interval $(0.2, 0.3)$ and another root, β, in the interval $(2, 2.2)$.

(i) Use the method of false position with starting values 0.2 and 0.3 to find a first estimate of α. Apply false position again to find a second estimate of α.

A third application of the false position method gives 0.201 640 as an estimate of α. Give the value of α to the accuracy that appears to be justified. **[5]**

(ii) Suppose that β is to be found using the bisection method, starting with the interval (2, 2.2).

Write down the initial estimate of β and the associated maximum possible error.

Determine how many further steps of the bisection method would be required to find β with a maximum possible error of less than 0.005. (You are not required to carry out this bisection process.) **[3]**

2 The table shows several values of the mid-point rule (M) and trapezium rule (T) estimates of an integral for different values of h.

h	M	T
0.5	0.536 650	0.594 027
0.25		
0.125	0.555 282	0.558 599

(i) Calculate the missing values in the table. Calculate also three Simpson's rule estimates of the integral. **[7]**

(ii) Give the value of the integral to the accuracy that appears justified. **[1]**

3 In computer science, powers of 2 occur frequently. It is quite common to approximate 2^{10k} as 10^{3k}.

(i) Find the relative error in this approximation for each of $k = 1$, $k = 2$ and $k = 3$. **[4]**

(ii) You are reminded that if $X = x(1+r)$, where r is small, then $X^n \approx x^n(1+nr)$.

How does this result relate to your answers in part **(i)**? **[2]**

4 The function $\mathrm{f}(x)$ has the values shown in the table.

x	1.9	1.95	2	2.05	2.1
$\mathrm{f}(x)$	0.385 570	0.677 625	1	1.356 076	1.749 638

(i) Calculate two estimates of $\mathrm{f}'(2)$ using the forward difference method. **[2]**

(ii) Calculate two estimates of $\mathrm{f}'(2)$ using the central difference method. **[2]**

(iii) Give the value of $\mathrm{f}'(2)$ to the accuracy that appears justified, explaining your reasoning. **[2]**

5 The table gives some values of the function $\mathrm{g}(x)$ correct to 6 decimal places.

x	1	1.1	1.2
$\mathrm{g}(x)$	1.188 395	1.234 281	1.287 500

(i) Estimate $\mathrm{g}(1.14)$ using linear interpolation. **[2]**

(ii) Use Newton's forward difference interpolation formula to write down a quadratic approximation to $\mathrm{g}(x)$. You need not simplify your answer. **[4]**

(iii) Hence obtain a second estimate of $\mathrm{g}(1.14)$. **[2]**

Section B (36 marks)

6 You are given that the equation

$$6x^5 - 3x^2 - 2x + 1 = 0$$

has exactly 3 real roots. Let these roots be α, β, γ where $\alpha < \beta < \gamma$.

(i) Show that there is one root in the interval $(-1, 0)$ and two roots in the interval $(0, 1)$. **[3]**

(ii) Use the iteration

$$x_{r+1} = \left(\frac{1}{6}\left(3x_r^2 + 2x_r - 1\right)\right)^{\frac{1}{5}}$$

to find α correct to 2 decimal places. **[4]**

(iii) Use the iteration

$$x_{r+1} = \frac{1}{2}\left(6x_r^5 - 3x_r^2 + 1\right) \quad (*)$$

to verify that $\beta \approx 0.34$.

By considering a suitable derivative, show that the convergence of (*) to β will be slow. **[6]**

(iv) Use the Newton-Raphson method to find γ correct to 4 decimal places. **[5]**

7 A function $\mathrm{f}(x)$ is known to have the following values correct to 3 decimal places.

x	0	0.5	1	1.5
$\mathrm{f}(x)$	1.693	1.405	1.288	1.253

The value of the integral $I = \int_0^{1.5} \mathrm{f}(x)\,\mathrm{d}x$ is required.

You should give all numerical answers in this question correct to 5 decimal places.

(i) Find the best estimate possible of I using just the trapezium rule. **[2]**

(ii) By drawing a suitable graph, determine whether your answer in part **(i)** is likely to be an underestimate or an overestimate. **[4]**

(iii) Obtain two further estimates of I, each of them using both the trapezium rule and Simpson's rule. With reference to your graph, explain which of these estimates seems likely to be more accurate. **[6]**

(iv) The integration rule

$$\int_0^{3h} \mathrm{f}(x)\,\mathrm{d}x \approx \frac{3h}{8}\left(\mathrm{f}(0) + 3\,\mathrm{f}(h) + 3\,\mathrm{f}(2h) + \mathrm{f}(3h)\right)$$

is designed to be used when 4 equally spaced values of a function are known.

Find the value of I given by this rule.

You should now assume that the value of I you have just calculated is correct to 3 decimal places. Find the approximate errors in your three earlier estimates of I, and hence determine whether your conclusions in parts **(ii)** and **(iii)** are confirmed. **[6]**

END OF QUESTION PAPER

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AS GCE MATHEMATICS (MEI)

4776/01 Numerical Methods

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

OCR supplied materials:
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- MEI Examination Formulae and Tables (MF2)

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Candidate forename		Candidate surname	

Centre number						Candidate number				

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Section A (36 marks)

1 (i)	
1 (ii)	

2 (i)

h	M	T
0.5	0.536 650	0.594 027
0.25		
0.125	0.555 282	0.558 599

2 (ii)

3 (i)	
3 (ii)	

4 (i)	
4 (ii)	
4 (iii)	

5 (i)

5 (ii)

5 (iii)

Section B (36 marks)

6 (i)	
6 (ii)	

6 (iii)

6 (iv)

7 (i)

7 (ii)

7 (iii)

7 (iv)

(answer space continued on next page)

7 (iv)	(continued)

Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4776**: Numerical Methods

Advanced Subsidiary GCE

Mark Scheme for June 2014

1. Annotations and abbreviations

Annotation in scoris	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining
U1	Mark for correct units
G1	Mark for a correct feature on a graph
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

2. Subject-specific Marking Instructions for GCE Mathematics (MEI) Pure strand

a Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E
A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise. Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figures often being the norm. Small variations in the degree of accuracy to which an answer is given (e.g. 2 or 4 significant figures where 3 is expected) should not normally be penalised, while answers which are grossly over- or under-specified should normally result in the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

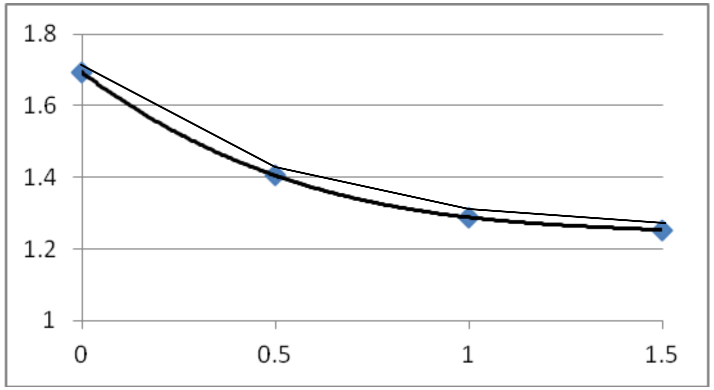
h For a *genuine* misreading (of numbers or symbols) which is such that the object and the difficulty of the question remain unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then applied; 1 mark is generally appropriate, though this may differ for some units. This is achieved by withholding one A mark in the question.

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance	
1	(i)		*a* *b* f(*a*) f(*b*) ***x*** f(*x*) 0.2 0.3 0.04 –1.57667 **0.202474** –0.02010 0.2 0.202474 0.04 –0.02010 **0.201647** 0.201 640 suggests that **0.2016** is secure, accept **0.20164**	M1A1 M1A1 B1 **[5]**	(Root is 0.201640 to 6 dp)	
1	(ii)		Initial estimate 2.1 with mpe 0.1 mpe: 0.05, 0.025, 0.0125, 0.00625, 0.003125 So 5 further steps required	B1 M1 A1 **[3]**	 soi cao	
2	(i)		*h* *M* *T* *S* 0.5 0.536650 0.594027 **0.555776** 0.25 **0.551860** **0.5653385** **0.556353** 0.125 0.555282 0.558599 **0.556388**	B1 M1A1 M1A1A1A1 **[7]**	Missing *T* Missing *M* S values	
2	(ii)		Agreement suggests 0.5564; extrapolation gives 0.556 39	B1 **[1]**	Accept either	
3	(i)		*k* exact approximate relative error 1 1024 1000 –0.0234375 2 1048576 1000000 –0.0463257 3 1073741824 1000000000 –0.0686774	B1 B1B1B1 **[4]**	For exact and approximate values Each relative error Condone consistent missing minus signs on this occasion	soi
3	(ii)		*k* = 2 and *k* = 3 represent the square and cube of value when *k* = 1 The relative errors have doubled and tripled respectively	E1 E1 **[2]**		

Question			Answer	Marks	Guidance	
4	(i)		fwd diff h est 0.1 7.49638 0.05 7.12152	M1 A1 **[2]**	Correct formula for either value Both values correct	
	(ii)		cent diff h est 0.1 6.82034 0.05 6.78451	M1 A1 **[2]**	Correct formula for either value Both values correct	
4	(iii)		6.8 looks secure Using central difference values (as the method is more accurate)	B1 E1 **[2]**	(Extrapolation gives 6.77...) Seen or implied	
5	(i)		$g(1.14) = 1.234\ 281 + 0.4\ (1.287\ 500 - 1.234\ 281) = 1.255\ 568\ 6$	M1A1 **[2]**	Accept 5-7 dp	
5	(ii)		1 1.188395 1.1 1.234281 0.045886 1.2 1.287500 0.053219 0.007333 $g(x) = 1.188395 + 0.045886\ (x - 1) / 0.1$ $+ 0.007333\ (x - 1)\ (x - 1.1) / ((0.1)^2\ 2!)$	B1 M1 A1A1 **[4]**	formula A1 for 2 terms, A1A1 for all 3	
5	(iii)		Substitute $x = 1.14$ to get $g(1.14) = 1.254\ 688\ 6$	M1A1 **[2]**	Accept 5-7 dp	

Question			Answer	Marks	Guidance	
6	(i)		Exhibit changes of sign, e.g. x –1 0 0.5 1 $f(x)$ –6 1 –0.5625 2	M1 A1 A1 **[3]**	Accept signs instead of numbers One interval Rest	
6	(ii)		E.g. starting at –0.5 iterates are: –0.73072 –0.67800 –0.69558 –0.69018 –0.69188 Root is –0.69 to 2 dp	M1A1A1 A1 **[4]**	M1 1st term, A1 next 2, A1 rest cao	
6	(iii)		Start at 0.34: 0.340231 0.340042 0.340197 0.340070 converging to a value close to 0.34 Derivative of RHS is $15x^4 – 3x$ At x = 0.34 this is –0.82 Approaching 1 in magnitude, hence slow convergence	M1A1 E1 B1 B1 E1 **[6]**		
6	(iv)		Req'd derivative is $30x^4 – 6x – 2$ Hence NR formula NR iterations eg 0.75 1.005222 0.911575 0.876798 0.872091 0.**8720**09 1 0.909091 0.876258 0.872074 0.872009 0.**8720**09	M1A1 A1A1A1 **[5]**	NR formula soi A1 2 it'ns, A1 rest, A1 0.8720	

Question			Answer	Marks	Guidance	
7	(i)		T = 2.08300	M1A1 **[2]**	Accept 2.083 or 2.0830	
7	(ii)		 Draw lines on graph. T will be an overestimate;	G1 G1 G1E1 **[4]**	Points Curve	
7	(iii)		$T + S$ = 0.77450 + 1.30167 = 2.07617 $S + T$ = 1.43350 + 0.63525 = 2.06875 Trapezium rule seems like a better fit over (1, 1.5) than (0, 0.5) So second estimate likely to be more accurate	M1A1 M1A1 E1 A1 **[6]**	A1 each new correct T or S value	
7	(iv)		4-point rule gives 2.06719 Errors: T only: 0.01581 so it is an overestimate $T + S$: 0.00898 $S + T$: 0.00156 so $S + T$ is more accurate than $T + S$	M1A1 A1E1 A1E1 **[6]**	Error soi Accept relative errors to 3dp.	

4776 Numerical Methods (Written Examination)

General Comments:

Broadly speaking, candidates showed a sound grasp of the theory and methods required in this paper. Numerical accuracy was generally good.

It remains the case, however, that some candidates work in very inefficient ways. Scattering calculations about the page makes working more difficult to follow. This in turn means that candidates are more likely to make mistakes, and there is a danger that poor presentation will make it difficult for the examiner to identify correct work.

Numerical methods lend themselves to a tabular layout, as would be obtained from a spreadsheet. Setting out working like this, and clearly identifying answers, is much the best approach to adopt.

A handful of candidates answered questions in the wrong part of the answer book. Examiners will always do their best to deal with such situations, but candidates should realise that this is a risky behaviour. Sometimes it is simply not possible to tell, from looking at a few numbers, which question is being answered. So answers should be written in the space provided or in an additional answer book.

Comments on Individual Questions:

Question No. 1

Part (i) was frequently done well, though a sizable minority of candidates confused the method of false position with the secant method. These two methods are distinct: false position works with two values that bracket the root, while the secant method works with the two most recent values which may not bracket the root.

Part (ii) was done well by most.

Question No. 2

This was a test of knowledge about the relationships between the various integration rules. Almost everyone could obtain the second T value, but there many who couldn't work backwards from the third M and T values to get the second M value. Obtaining the S values was very straightforward, though a small minority of candidates appeared not to know how S is related to M and T.

Question No. 3

Part (i) was found to be easy, though some candidates confused the exact and approximate values in calculating the relative error, thereby losing a mark.

Part (ii) was found hard. Very few candidates spotted that squaring and cubing gave double and triples the relative errors.

Question No. 4

This question was answered well by most candidates. The two different methods were understood, and in part (iii) the majority of candidates were able to comment that the central difference method is more accurate than the forward difference method. A few candidates, however, compared all four estimates and so gave a very low precision answer.

Question No. 5

The linear interpolation in part (i) proved a little more difficult than it should. It seems that candidates who know how to do higher order interpolation sometimes fail to realise that linear interpolation can be done the same way. They therefore rely on 'first principles' methods; that is fine if they get it right.

Parts (ii) and (iii) were straightforward for many. However, some did not know the correct formula and so omitted this part or used the Lagrange formula instead thereby gaining no marks.

Question No. 6

Candidates knew pretty much what to do in this question, but some lost marks or took excessive time through not following instructions carefully.

In part (i), some candidates argued that as the function is positive at 0 and at 1 there must be two roots in the interval. This is not sufficient of course. It is necessary to show that the function is negative at some point between 0 and 1.

Part (ii) was generally well done, though some appeared to have keyed the iterative formula into their calculators incorrectly.

In part (iii), candidates were expected to start with 0.34 and show that the next couple of iterates are close to 0.34. However, many chose to start some distance away from 0.34 and iterate a large number of times to get close to 0.34. The second request in this part required finding the derivative of the function on the right of the iterative formula and evaluating at 0.34. The value obtained is, in modulus, close to 1 so the iteration will be slow.

Part (iv) was straightforward for most.

Question No. 7

Part (i), using the trapezium rule, was done well.

In part (ii) candidates should have drawn a smooth curve through the given points and then drawn in the straight lines that represent the trapezium rule. In very many cases the sketches were so poor that it was not possible to distinguish the straight lines from the curve. Despite that, most candidates deduced correctly that the trapezium rule is likely to be an overestimate.

Part (iii) defeated almost everyone. The intended idea was to use the trapezium rule on (0, 0.5) and Simpson's rule on (0.5, 1.5), then Simpson's rule on (0, 1) and the trapezium rule on (1, 1.5). Most candidates floundered and it was common to see invented integration rules or additional values being read off the graph.

In part (iv) the supplied rule was used correctly by most, though a common error was to misread the last term in the brackets as 3f(3*h*). Candidates were able to confirm their conclusions from part (ii), but not from part (iii) for the reasons indicated.

Unit level raw mark and UMS grade boundaries June 2014 series
AS GCE / Advanced GCE / AS GCE Double Award / Advanced GCE Double Award

GCE Mathematics (MEI)

		Max Mark	a	b	c	d	e	u
4751/01 (C1) MEI Introduction to Advanced Mathematics	Raw	72	61	56	51	46	42	0
	UMS	100	80	70	60	50	40	0
4752/01 (C2) MEI Concepts for Advanced Mathematics	Raw	72	57	51	45	39	33	0
	UMS	100	80	70	60	50	40	0
4753/01 (C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	58	52	47	42	36	0
4753/02 (C3) MEI Methods for Advanced Mathematics with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4753/82 (C3) MEI Methods for Advanced Mathematics with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4753 (C3) MEI Methods for Advanced Mathematics with Coursework	UMS	100	80	70	60	50	40	0
4754/01 (C4) MEI Applications of Advanced Mathematics	Raw	90	68	61	54	47	41	0
	UMS	100	80	70	60	50	40	0
4755/01 (FP1) MEI Further Concepts for Advanced Mathematics	Raw	72	63	57	51	45	40	0
	UMS	100	80	70	60	50	40	0
4756/01 (FP2) MEI Further Methods for Advanced Mathematics	Raw	72	60	54	48	42	36	0
	UMS	100	80	70	60	50	40	0
4757/01 (FP3) MEI Further Applications of Advanced Mathematics	Raw	72	57	51	45	39	34	0
	UMS	100	80	70	60	50	40	0
4758/01 (DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	63	56	50	44	37	0
4758/02 (DE) MEI Differential Equations with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4758/82 (DE) MEI Differential Equations with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
4758 (DE) MEI Differential Equations with Coursework	UMS	100	80	70	60	50	40	0
4761/01 (M1) MEI Mechanics 1	Raw	72	57	49	41	34	27	0
	UMS	100	80	70	60	50	40	0
4762/01 (M2) MEI Mechanics 2	Raw	72	57	49	41	34	27	0
	UMS	100	80	70	60	50	40	0
4763/01 (M3) MEI Mechanics 3	Raw	72	55	48	42	36	30	0
	UMS	100	80	70	60	50	40	0
4764/01 (M4) MEI Mechanics 4	Raw	72	48	41	34	28	22	0
	UMS	100	80	70	60	50	40	0
4766/01 (S1) MEI Statistics 1	Raw	72	61	53	46	39	32	0
	UMS	100	80	70	60	50	40	0
4767/01 (S2) MEI Statistics 2	Raw	72	60	53	46	40	34	0
	UMS	100	80	70	60	50	40	0
4768/01 (S3) MEI Statistics 3	Raw	72	61	54	47	41	35	0
	UMS	100	80	70	60	50	40	0
4769/01 (S4) MEI Statistics 4	Raw	72	56	49	42	35	28	0
	UMS	100	80	70	60	50	40	0
4771/01 (D1) MEI Decision Mathematics 1	Raw	72	51	46	41	36	31	0
	UMS	100	80	70	60	50	40	0
4772/01 (D2) MEI Decision Mathematics 2	Raw	72	46	41	36	31	26	0
	UMS	100	80	70	60	50	40	0
4773/01 (DC) MEI Decision Mathematics Computation	Raw	72	46	40	34	29	24	0
	UMS	100	80	70	60	50	40	0
4776/01 (NM) MEI Numerical Methods with Coursework: Written Paper	Raw	72	54	48	43	38	32	0
4776/02 (NM) MEI Numerical Methods with Coursework: Coursework	Raw	18	14	12	10	8	7	0
4776/82 (NM) MEI Numerical Methods with Coursework: Carried Forward Coursework Mark	Raw	18	14	12	10	8	7	0
4776 (NM) MEI Numerical Methods with Coursework	UMS	100	80	70	60	50	40	0
4777/01 (NC) MEI Numerical Computation	Raw	72	55	47	39	32	25	0
	UMS	100	80	70	60	50	40	0
4798/01 (FPT) Further Pure Mathematics with Technology	Raw	72	57	49	41	33	26	0
	UMS	100	80	70	60	50	40	0

GCE Statistics (MEI)

		Max Mark	a	b	c	d	e	u
G241/01 (Z1) Statistics 1	Raw	72	61	53	46	39	32	0
	UMS	100	80	70	60	50	40	0
G242/01 (Z2) Statistics 2	Raw	72	55	48	41	34	27	0
	UMS	100	80	70	60	50	40	0
G243/01 (Z3) Statistics 3	Raw	72	56	48	41	34	27	0
	UMS	100	80	70	60	50	40	0