OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4755

Further Concepts for Advanced Mathematics (FP1)

QUESTION PAPER

Candidates answer on the printed answer book.

OCR supplied materials:
- Printed answer book 4755
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Friday 20 May 2011
Afternoon

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the printed answer book and the question paper.

- The question paper will be found in the centre of 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. 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.

INFORMATION FOR CANDIDATES

This information is the same on the printed answer book and the question paper.

- 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 **16** 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 destroyed.

Section A (36 marks)

1 **(i)** Write down the matrix for a rotation of 90° anticlockwise about the origin. **[1]**

(ii) Write down the matrix for a reflection in the line $y = x$. **[1]**

(iii) Find the matrix for the composite transformation of rotation of 90° anticlockwise about the origin, followed by a reflection in the line $y = x$. **[2]**

(iv) What single transformation is equivalent to this composite transformation? **[1]**

2 You are given that $z = 3 - 2\mathrm{j}$ and $w = -4 + \mathrm{j}$.

(i) Express $\dfrac{z + w}{w}$ in the form $a + b\mathrm{j}$. **[3]**

(ii) Express w in modulus-argument form. **[3]**

(iii) Show w on an Argand diagram, indicating its modulus and argument. **[2]**

3 The equation $x^3 + px^2 + qx + 3 = 0$ has roots α, β and γ, where

$$\alpha + \beta + \gamma = 4$$
$$\alpha^2 + \beta^2 + \gamma^2 = 6.$$

Find p and q. **[5]**

4 Solve the inequality $\dfrac{5x}{x^2 + 4} < x$. **[6]**

5 Given that $\dfrac{3}{(3r - 1)(3r + 2)} \equiv \dfrac{1}{3r - 1} - \dfrac{1}{3r + 2}$, find $\displaystyle\sum_{r=1}^{20} \dfrac{1}{(3r - 1)(3r + 2)}$, giving your answer as an exact fraction. **[5]**

6 Prove by induction that $1 + 8 + 27 + \ldots + n^3 = \frac{1}{4}n^2(n + 1)^2$. **[7]**

Section B (36 marks)

7 A curve has equation $y = \dfrac{(x+9)(3x-8)}{x^2-4}$.

(i) Write down the coordinates of the points where the curve crosses the axes. **[3]**

(ii) Write down the equations of the three asymptotes. **[3]**

(iii) Determine whether the curve approaches the horizontal asymptote from above or below for

(A) large positive values of x,

(B) large negative values of x. **[3]**

(iv) Sketch the curve. **[3]**

8 A polynomial $\mathrm{P}(z)$ has real coefficients. Two of the roots of $\mathrm{P}(z) = 0$ are $2 - \mathrm{j}$ and $-1 + 2\mathrm{j}$.

(i) Explain why $\mathrm{P}(z)$ cannot be a cubic. **[1]**

You are given that $\mathrm{P}(z)$ is a quartic.

(ii) Write down the other roots of $\mathrm{P}(z) = 0$ and hence find $\mathrm{P}(z)$ in the form $z^4 + az^3 + bz^2 + cz + d$. **[8]**

(iii) Show the roots of $\mathrm{P}(z) = 0$ on an Argand diagram and give, in terms of z, the equation of the circle they lie on. **[2]**

9 The simultaneous equations

$$\begin{aligned} 2x - y &= 1 \\ 3x + ky &= b \end{aligned}$$

are represented by the matrix equation $\mathbf{M}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 \\ b \end{pmatrix}$.

(i) Write down the matrix $\mathbf{M}$. **[2]**

(ii) State the value of k for which $\mathbf{M}^{-1}$ does not exist and find $\mathbf{M}^{-1}$ in terms of k when $\mathbf{M}^{-1}$ exists.

Use $\mathbf{M}^{-1}$ to solve the simultaneous equations when $k = 5$ and $b = 21$. **[7]**

(iii) What can you say about the solutions of the equations when $k = -\frac{3}{2}$? **[1]**

(iv) The two equations can be interpreted as representing two lines in the x-y plane. Describe the relationship between these two lines

(A) when $k = 5$ and $b = 21$,

(B) when $k = -\frac{3}{2}$ and $b = 1$,

(C) when $k = -\frac{3}{2}$ and $b = \frac{3}{2}$. **[3]**

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE

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ADVANCED SUBSIDIARY GCE

MATHEMATICS (MEI) 4755

Further Concepts for Advanced Mathematics (FP1)

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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Friday 20 May 2011
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Duration: 1 hour 30 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

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Section A (36 marks)

1 (i)	
1 (ii)	
1 (iii)	
1 (iv)	

2 (i)	
2 (ii)	
2 (iii)	

3

4

5

5	**(continued)**

6

6	**(continued)**

Section B (36 marks)

7 (i)	
7 (ii)	
7 (iii)	

7 (iv)

8 (i)	
8 (ii)	

8 (ii)	(continued)

8 (iii)	

9 (i)	
9 (ii)	

9 (iii)	
9 (iv)	

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4755:** Further Concepts for Advanced Mathematics

Mark Scheme for June 2011

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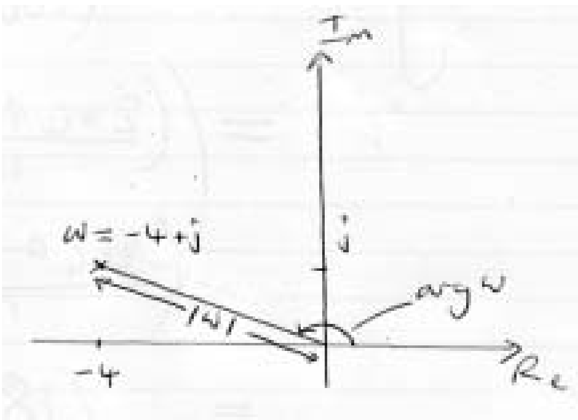
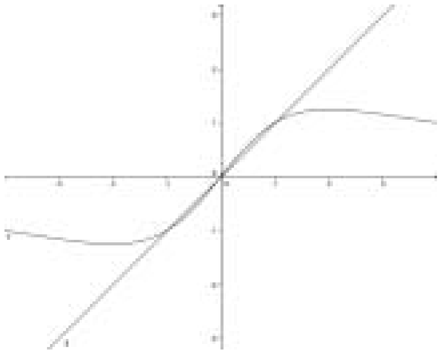
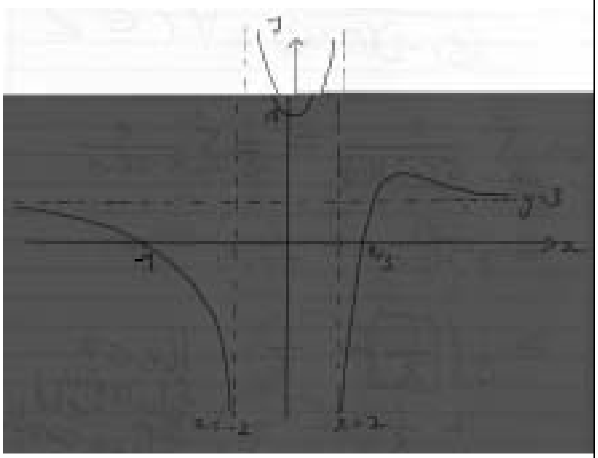
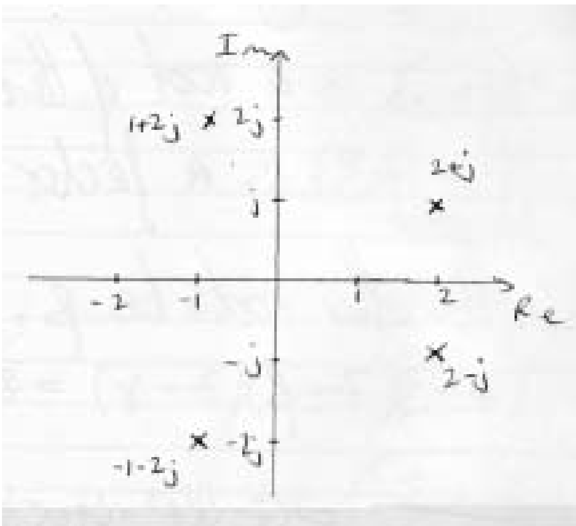
Qu	Answer	Mark	Comment
Section A			
1(i)	$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$	B1	Accept expressions in sin and cos
1(ii)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	B1	
1(iii)	$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}=\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	M1 A1ft	Ans (ii) x Ans (i) attempt evaluation
1(iv)	Reflection in the x axis	B1 **[5]**	
2(i)	$\frac{z+w}{w}=\frac{-1-\text{j}}{-4+\text{j}}\times\frac{-4-\text{j}}{-4-\text{j}}$ $=\frac{3+5\text{j}}{17}=\frac{3}{17}+\frac{5}{17}\text{j}$	M1 A1 A1 **[3]**	Multiply top and bottom by -4 - j Denominator = 17 Correct numerators
2(ii)	$\lvert w\rvert=\sqrt{17}$ $\arg w=\pi-\arctan\frac{1}{4}=2.90$ $w=\sqrt{17}\left(\cos 2.90+\text{j}\sin 2.90\right)$	B1 B1 B1 **[3]**	 Not degrees c.a.o. Accept $\left(\sqrt{17},\ 2.90\right)$ Accept 166 degrees
2(iii)		B1 B1 **[2]**	Correct position Mod w and Arg w correctly shown
3	$\alpha+\beta+\gamma=4=-p$ $p=-4$ $(\alpha+\beta+\gamma)^2=\alpha^2+\beta^2+\gamma^2+2(\alpha\beta+\alpha\gamma+\beta\gamma)$ $\Rightarrow 16=6+2q$ $\Rightarrow q=5$	M1 A1 M1 A1 A1 **[5]**	May be implied Attempt to use $(\alpha+\beta+\gamma)^2$ o.e. Correct c.a.o.

4	$\frac{5x}{x^2+4} < x$ $\Rightarrow 5x < x^3 + 4x$ $\Rightarrow 0 < x^3 - x$ $\Rightarrow 0 < x(x+1)(x-1)$ $\Rightarrow x > 1, \ \ -1 < x < 0$ 	M1* A1 A1 M1dep* A1 A1 **[6]**	Method attempted towards factorisation to find critical values $x = 0$ $x = 1$, $x = -1$ Valid method leading to required intervals, graphical or algebraic $x > 1$ $-1 < x < 0$ SC B2 No valid working seen $x > 1$ $-1 < x < 0$
5	$\sum_{r=1}^{20} \frac{1}{(3r-1)(3r+2)} \equiv \frac{1}{3}\sum_{r=1}^{20}\left[\frac{1}{3r-1} - \frac{1}{3r+2}\right]$ $= \frac{1}{3}\left[\left(\frac{1}{2}-\frac{1}{5}\right)+\left(\frac{1}{5}-\frac{1}{8}\right)+....+\left(\frac{1}{59}-\frac{1}{62}\right)\right]$ $= \frac{1}{3}\left(\frac{1}{2}-\frac{1}{62}\right) = \frac{5}{31}$	M1 A1 A1 M1 A1 **[5]**	Attempt to use identity – may be implied Correct use of 1/3 seen Terms in full (at least first and last) Attempt at cancelling c.a.o.

6	When $n = 1$, $\frac{1}{4}n^2(n+1)^2 = 1$, so true for $n = 1$	B1	
	Assume true for $n = k$ $\sum_{r=1}^{k} r^3 = \frac{1}{4}k^2(k+1)^2$	E1	Assume true for k
	$\Rightarrow \sum_{r=1}^{k+1} r^3 = \frac{1}{4}k^2(k+1)^2 + (k+1)^3$	M1	Add $(k+1)$th term to both sides
	$= \frac{1}{4}(k+1)^2[k^2 + 4(k+1)]$	M1	Factor of $\frac{1}{4}(k+1)^2$
	$= \frac{1}{4}(k+1)^2[k^2 + 4k + 4]$		
	$= \frac{1}{4}(k+1)^2(k+2)^2$	A1	c.a.o. with correct simplification
	$= \frac{1}{4}(k+1)^2((k+1)+1)^2$ But this is the given result with $k + 1$ replacing k. Therefore if it is true for k it is true for $k + 1$.	E1	Dependent on A1 and previous E1
	Since it is true for $n = 1$, it is true for $n = 1, 2, 3$ and so true for all positive integers.	E1	Dependent on B1 and previous E1 and correct presentation
		[7]	
			Section A Total: 36

Section B			
7(i)	$(0, 18)$	B1	
	$(-9, 0)$, $\left(\frac{8}{3}, 0\right)$	B1 B1 **[3]**	
7(ii)	$x = 2, x = -2$ and $y = 3$	B1 B1 B1 **[3]**	
7(iii)	Large positive x, $y \to 3^+$ from above Large negative x, $y \to 3^-$ from below	B1 B1	
	(e.g. consider $x = 100$, or convincing algebraic argument)	M1 **[3]**	Must show evidence of working
7(iv)		B1 B1 B1 **[3]**	3 branches correct Asymptotes correct and labelled Intercepts correct and labelled

8(i)	Because a cubic can only have a maximum of two complex roots, which must form a conjugate pair.	E1 **[1]**	.
8(ii)	$2+\mathrm{j},\ -1-2\mathrm{j}$	B1 B1	
	$\mathrm{P}(z)=\left(z-(2-\mathrm{j})\right)\left(z-(2+\mathrm{j})\right)\left(z-(-1+2\mathrm{j})\right)\left(z-(-1-2\mathrm{j})\right)$	M1	Use of factor theorem
	$=\left((z-2)^2+1\right)\left((z+1)^2+4\right)$	M1	Attempt to multiply out factors
	$=\left(z^2-4z+5\right)\left(z^2+2z+5\right)$ $=z^4-2z^3+2z^2-10z+25$	A4	-1 for each incorrect coefficient
	OR		
	$\alpha+\beta+\gamma+\delta=2\Rightarrow a=-2$ $\alpha\beta+\alpha\gamma+\alpha\delta+\beta\gamma+\beta\delta+\gamma\delta=2\Rightarrow b=2$ $\alpha\beta\gamma+\alpha\beta\delta+\alpha\gamma\delta+\beta\gamma\delta=10\Rightarrow c=-10$ $\alpha\beta\gamma\delta=25\Rightarrow d=25$ $\Rightarrow \mathrm{P}(z)=z^4-2z^3+2z^2-10z+25$	M2 B1 A3	M1 for attempt to use all 4 root relationships. M2 for all correct *a* = -2 *b*, *c*, *d* correct -1 for each incorrect -1 for P(*z*) not explicit, following A4 or B1A3
		[8]	
8(iii)		B1	All correct with annotation on axes or labels
	$\lvert z\rvert=\sqrt{5}$	B1 **[2]**	

Qu	Answer	Mark	Comment
Section B (continued)			
9(i)	$\mathbf{M} = \begin{pmatrix} 2 & -1 \\ 3 & k \end{pmatrix}$	B2 **[2]**	- 1 each error
9(ii)	$\mathbf{M}^{-1}$ does not exist for $2k+3=0$	M1	May be implied
	$k = \frac{-3}{2}$	A1	
	$\mathbf{M}^{-1} = \frac{1}{2k+3}\begin{pmatrix} k & 1 \\ -3 & 2 \end{pmatrix}$	B1	Correct inverse
	$\frac{1}{13}\begin{pmatrix} 5 & 1 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} 1 \\ 21 \end{pmatrix}$	M1	Attempt to pre-multiply by their inverse
	$= \begin{pmatrix} 2 \\ 3 \end{pmatrix}$	A1ft A1	Correct matrix multiplication c.a.o.
	$\Rightarrow x = 2,\ y = 3$	A1ft **[7]**	At least one correct
9(iii)	There are no unique solutions	B1 **[1]**	
9(iv)	(A) Lines intersect (B) Lines parallel (C) Lines coincident	B1 B1 B1 **[3]**	
			Section B Total: 36
			Total: 72

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4755: Further Concepts for Advanced Mathematics

General Comments

There were many scripts showing good understanding and ability. The majority of candidates were well prepared, and most had sufficient time to cover all the questions. There were some surprising lapses in elementary algebraic work, not confined to the lower-scoring candidates. On the whole solutions were clearly written, if not always fully logical. Diagrams were sometimes difficult to decipher. After scanning, alterations can make the intention obscure. Pencil for diagrams is really essential, together with a quality eraser, in case of mistakes.

Comments on Individual Questions

1 Generally this question was well done.

(i) A surprising number of candidates did not obtain the correct matrix for this rotation. Several candidates had learned the general form for a rotation, and wrote it in terms of sin 90 and cos 90, unsimplified, but usually correct. Some errors in signs occurred.

(ii) This was usually correctly answered, but there were instances when the identity matrix was given, which should have rung alarm bells in part (iii).

(iii) Follow through marking here allowed some recovery from earlier errors, but there were many instances of matrices written in the wrong order.

(iv) It was not essential to answer this from the result of (iii), and possible to check the previous result by thinking through the transformations. Some candidates thought that the description was achieved by writing down the matrix again.

2 This question was also well answered by many.

(i) A good response. Nearly all candidates knew how to use the complex conjugate, but some obtained 15 instead of 17 in the denominator.

(ii) The modulus of w was usually correct, but the argument was often found from arctan 0.25 or arctan(-0.25) without adjustment. Several candidates gave their argument in degrees, and some rounded it inappropriately. Not all candidates wrote down the required form for w after finding these components.

(iii) The mark for placing w at (-4, 1) was often the only one scored here, and sometimes this was lost through the lack of adequate annotation. It was not uncommon for the argument to be wrongly shown, and sometimes two angles were indicated, with the choice left for the examiner. A few diagrams showed the locus $\arg(z - w) = \arg w$, and had nothing available with which to indicate the modulus.

3 Almost all scored two marks for p, although some gave the wrong sign. Most candidates attempted $(\alpha+\beta+\gamma)^2$ in order to find q, but often with errors. A few candidates assumed that the roots were 1, 1 and 2, which satisfied the two equations given but did not fit with the constant term in the cubic.

4 This question was not well answered, except by a very few. Most candidates chose to try to solve the equation $\frac{5x}{(x^2+4)} = x$, but errors were frequent, for example $x^3 + 4x + 5x$ or $x^3 + 4x - 5$ instead of $x^3 + 4x - 5x$. The critical value of $x = 0$ was often lost because of division by x. It was also common to see $x^2 + 4$ factorised to $(x - 2)(x + 2)$ and asymptotes drawn when a sketch was attempted. Even when the correct critical values were found, many candidates could not follow a coherent method to obtain the intervals required.

5 This question was well answered. The main mistake was to forget to multiply by 1/3. Some multiplied by 3. Some candidates gave the sum of n terms without substituting $n = 20$. A small minority summed twenty fractions with their calculators which did not demonstrate familiarity with the specification. A smaller minority thought that the standard results for $\sum r$ and $\sum r^2$ could be used in the denominator.

6 Many good, carefully worded answers were seen. It is a shame when otherwise good work is spoiled by lack of attention to details, for example $\sum_{r=1}^{k} n^3$ or $\sum_{r=1}^{k} k^3$, or even the statement that $k^3 = \frac{1}{4}k^2(k+1)^2$. There are still candidates who do not use the formal "if…then…" statement in the concluding stages of the argument, and also those who do not appreciate that answering the question requires rather more than a sketchy indication of working.

Candidates who could not factorise the expression $\frac{1}{4}k^2(k+1)^2 + (k+1)^3$ and multiplied out gained credit if they also showed that this matched the expansion of the target expression, but some candidates lost marks by failing to show how the quartic they obtained then factorised to the target, quoting the result without working.

7 Overall this question was well done.

(i) When asked for co-ordinates, some candidates cannot bring themselves to write down pairs of numbers in brackets.

(ii) Some candidates do not like to write down clearly three separate equations.

(iii) Clear methods were usually shown, where working or a result of a calculation was needed beyond a statement of extreme values for x. Some candidates thought that "positive" or "negative" was enough to show how the curve approached y=3.

(iv) Many good carefully drawn sketches showed the salient features with full annotation. However, some candidates believed that "correct" scales were needed, which is not necessary. Through lack of space, in many cases this led to the curves not showing clearly the approaches to the asymptotes nor the precise values of x and y where the axes were crossed and the asymptotes positioned. Some diagrams suffered from alterations which were difficult to interpret.

8 (i) Most candidates had the right idea but many could not express it clearly. A full explanation needed to refer to complex conjugates, more than just "pairs". It was also important to make some mention of the number of roots. Although it may not have forfeited the mark, quite a lot of candidates believed that P(z), as yet unspecified, would have only four roots, rather than a minimum of four roots.

(ii) Candidates who used the factors and expanded were usually more successful than those who used the root relationships. Factors with incorrect signs were seen in some scripts. In both methods, there were commonly mistakes in multiplications, for example writing $(2j)^2$ as $2j^2$ and then obtaining -2. When the root relationships were used some candidates failed to use all six terms in $\sum\alpha\beta$.

(iii) Most candidates were able to show the positions of the four roots but a few gave no indication of scale. Again, alterations were sometimes confusing. Not many candidates were able to give the correct circle equation.

9 This question was well done by many but some candidates were probably running out of time.

(i) Generally well answered.

(ii) Most candidates gave the correct value of *k*, a few failed to get the right sign.

Some candidates gave $\mathbf{M}^{-1}$ using $k = 5$ instead of "in terms of *k*". Most candidates obtained the values of *x* and *y* through the correct method, with $\mathbf{M}^{-1}$ in the right place. A few lost marks through using another method.

(iii) A number of candidates wrote "no solution" or "can't be solved", without the other possibility.

(iv) The first situation (A) was usually correctly described, but (B) and (C) were often confused. A number of answers referred to equations instead of describing lines. There were several instances of "no response".

GCE Mathematics (MEI)

			Max Mark	a	b	c	d	e	u
4751/01	(C1) MEI Introduction to Advanced Mathematics	Raw	72	55	49	43	37	32	0
		UMS	100	80	70	60	50	40	0
4752/01	(C2) MEI Concepts for Advanced Mathematics	Raw	72	53	46	39	33	27	0
		UMS	100	80	70	60	50	40	0
4753/01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	54	48	42	36	29	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	63	56	50	44	38	0
		UMS	100	80	70	60	50	40	0
4755/01	(FP1) MEI Further Concepts for Advanced Mathematics	Raw	72	59	52	45	39	33	0
		UMS	100	80	70	60	50	40	0
4756/01	(FP2) MEI Further Methods for Advanced Mathematics	Raw	72	55	48	41	34	27	0
		UMS	100	80	70	60	50	40	0
4757/01	(FP3) MEI Further Applications of Advanced Mathematics	Raw	72	55	48	42	36	30	0
		UMS	100	80	70	60	50	40	0
4758/01	(DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	63	57	51	45	39	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	60	52	44	36	28	0
		UMS	100	80	70	60	50	40	0
4762/01	(M2) MEI Mechanics 2	Raw	72	64	57	51	45	39	0
		UMS	100	80	70	60	50	40	0
4763/01	(M3) MEI Mechanics 3	Raw	72	59	51	43	35	27	0
		UMS	100	80	70	60	50	40	0
4764/01	(M4) MEI Mechanics 4	Raw	72	54	47	40	33	26	0
		UMS	100	80	70	60	50	40	0
4766/01	(S1) MEI Statistics 1	Raw	72	53	45	38	31	24	0
		UMS	100	80	70	60	50	40	0
4767/01	(S2) MEI Statistics 2	Raw	72	60	53	46	39	33	0
		UMS	100	80	70	60	50	40	0
4768/01	(S3) MEI Statistics 3	Raw	72	56	49	42	35	28	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	45	39	33	27	0
		UMS	100	80	70	60	50	40	0
4772/01	(D2) MEI Decision Mathematics 2	Raw	72	58	53	48	43	39	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	62	55	49	43	36	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