Friday 18 May 2012 – Morning

AS GCE MATHEMATICS (MEI)

4752 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4752
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

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. 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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- 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 **8** 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.

Turn over

Section A (36 marks)

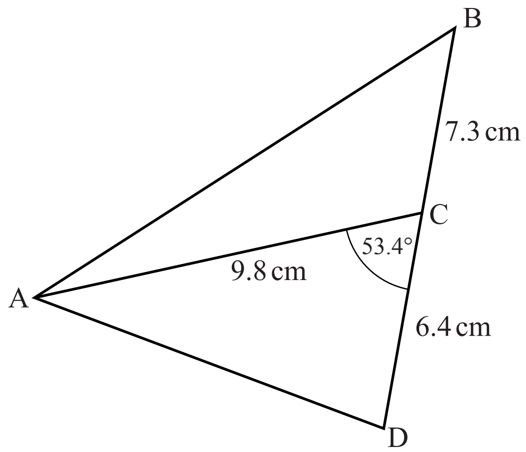
1 Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $y = \sqrt{x} + \frac{3}{x}$. **[3]**

2 Find the second and third terms in the sequence given by

$$u_1 = 5,$$
$$u_{n+1} = u_n + 3.$$

Find also the sum of the first 50 terms of this sequence. **[4]**

3



Not to scale

Fig. 3

In Fig. 3, BCD is a straight line. AC = 9.8 cm, BC = 7.3 cm and CD = 6.4 cm; angle ACD = 53.4°.

(i) Calculate the length AD. **[3]**

(ii) Calculate the area of triangle ABC. **[2]**

4 The point P (6, 3) lies on the curve $y = \mathrm{f}(x)$. State the coordinates of the image of P after the transformation which maps $y = \mathrm{f}(x)$ onto

(i) $y = 3\mathrm{f}(x)$, **[2]**

(ii) $y = \mathrm{f}(4x)$. **[2]**

5 A sector of a circle has angle 1.6 radians and area 45 cm^2. Find the radius and perimeter of the sector. **[5]**

6 Fig. 6 shows the relationship between $\log_{10} x$ and $\log_{10} y$.

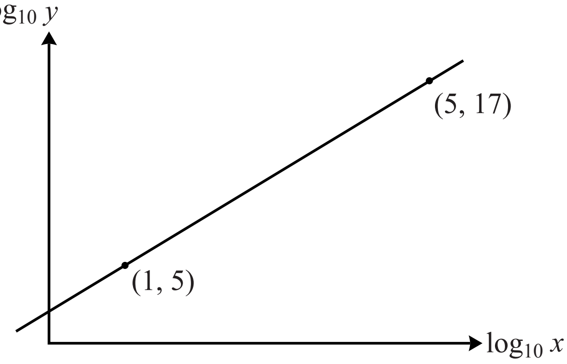


Fig. 6

Find y in terms of x. **[5]**

7 The gradient of a curve is given by $\frac{dy}{dx} = 6x^{\frac{1}{2}} - 5$. Given also that the curve passes through the point (4, 20), find the equation of the curve. **[5]**

8 Solve the equation $\sin 2\theta = 0.7$ for values of θ between 0 and 2π, giving your answers in radians correct to 3 significant figures. **[5]**

Section B (36 marks)

9 A farmer digs ditches for flood relief. He experiments with different cross-sections. Assume that the surface of the ground is horizontal.

(i)

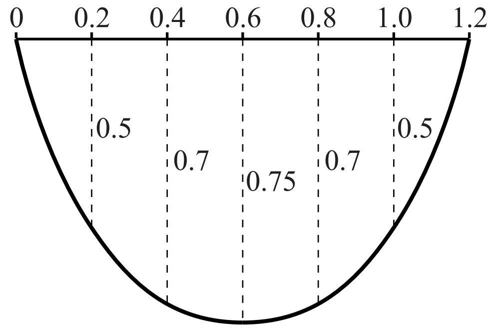


Fig. 9.1

Fig. 9.1 shows the cross-section of one ditch, with measurements in metres. The width of the ditch is 1.2 m and Fig. 9.1 shows the depth every 0.2 m across the ditch.

Use the trapezium rule with six intervals to estimate the area of cross-section. Hence estimate the volume of water that can be contained in a 50-metre length of this ditch. **[5]**

(ii) Another ditch is 0.9 m wide, with cross-section as shown in Fig. 9.2.

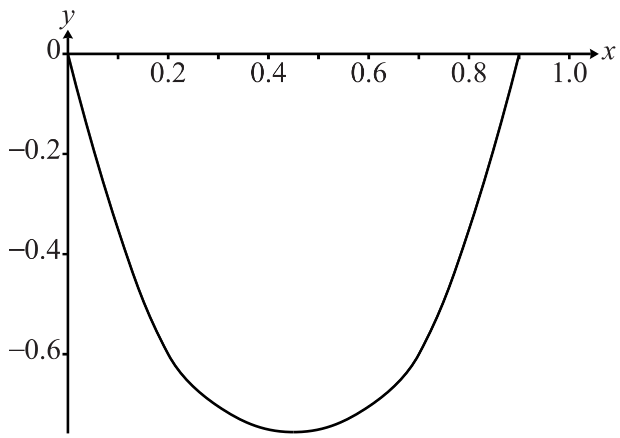


Fig. 9.2

With x- and y-axes as shown in Fig. 9.2, the curve of the ditch may be modelled closely by $y = 3.8x^4 - 6.8x^3 + 7.7x^2 - 4.2x$.

(A) The actual ditch is 0.6 m deep when $x = 0.2$. Calculate the difference between the depth given by the model and the true depth for this value of x. **[2]**

(B) Find $\int (3.8x^4 - 6.8x^3 + 7.7x^2 - 4.2x)\,dx$. Hence estimate the volume of water that can be contained in a 50-metre length of this ditch. **[5]**

10 **(i)** Use calculus to find, correct to 1 decimal place, the coordinates of the turning points of the curve $y = x^3 - 5x$. [You need not determine the nature of the turning points.] **[4]**

(ii) Find the coordinates of the points where the curve $y = x^3 - 5x$ meets the axes and sketch the curve. **[4]**

(iii) Find the equation of the tangent to the curve $y = x^3 - 5x$ at the point (1, –4). Show that, where this tangent meets the curve again, the x-coordinate satisfies the equation

$$x^3 - 3x + 2 = 0.$$

Hence find the x-coordinate of the point where this tangent meets the curve again. **[6]**

11 A geometric progression has first term a and common ratio r. The second term is 6 and the sum to infinity is 25.

(i) Write down two equations in a and r. Show that one possible value of a is 10 and find the other possible value of a. Write down the corresponding values of r. **[7]**

(ii) Show that the ratio of the nth terms of the two geometric progressions found in part **(i)** can be written as $2^{n-2} : 3^{n-2}$. **[3]**

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RECOGNISING ACHIEVEMENT

Friday 18 May 2012 – Morning

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4752 Concepts for Advanced Mathematics (C2)

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

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Other materials required:
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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	
2	

3 (i)	
3 (ii)	
4 (i)	
4 (ii)	

5

6

7	
8	

Section B (36 marks)

9 (i)	
9 (ii) (*A*)	

9 (ii) (*B*)	

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10 (i)	
10 (ii)	

10 (iii)	

11 (i)	

11 (ii)	

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RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4752:** Concepts for Advanced Mathematics

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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Annotations and abbreviations

Annotation in scoris	Meaning
✓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

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			$\frac{1}{2}x^{-\frac{1}{2}} - 3x^{-2}$ oe; isw	B3 **[3]**	need not be simplified B2 for one term correct ignore + c	if B0 allow M1 for either $x^{1/2}$ or x^{-1} seen before differentiation deduct one mark for extra term in x
2			(5), 8, 11, (14),…isw $a = 5$ and $d = 3$ soi $S_{50} = \frac{50}{2}(2\times5 + (50-1)\times3)$ oe 3925	B1 B1 M1 A1 **[4]**	if M0, SC1 for use of $a = 8$ and obtaining 4075	if M0, award B2 if 3925 is obtained from summing individual terms or if unsupported
3	(i)		$9.8^2 + 6.4^2 - 2\times9.8\times6.4\times\cos 53.4$ $9.8^2 + 6.4^2 - 74.79...$ [= 62.2...] 7.887… or 7.89 or 7.9	M1 M1 A1 **[3]**	for evidence of correct order of operations used; may be implied by correct answer if M0, B3 for 7.89 or more precise www	6.89 implies M0 262.4368 implies M1 (calc in radian mode), (NB √262.436..=16.199…) NB 9.8sin53.4 = 7.87
3	(ii)		½ × 9.8 × 7.3 × sin (180 – 53.4) oe seen 28.716…or 28.72 or 28.7 or 29 isw	M1 A1 **[2]**	or sin 53.4 used; may be embedded if M0, B2 for 28.7 or more precise www	may be split into height = 9.8 × sin 53.4 then Area = ½ × 7.3 × height
4	(i)		(6, 9)	2 **[2]**	1 for each co-ordinate	SC0 for (6, 3)
4	(ii)		(1.5, 3)	2 **[2]**	1 for each co-ordinate	SC0 for (6, 3)
5			$45 = ½\, r^2 \times 1.6$ oe $r^2 = 90/1.6$ oe $r = 7.5$ or exact equivalent cao (their 7.5) × 1.6 27	M1 M1 A1 M1 A1 **[5]**	$45 = \pi r^2 \times \frac{91.673...}{360}$ or B3 www $2\pi \times (\text{their } r) \times \frac{91.673...}{360}$ or B2 www	allow recovery to 7.5 if working in degrees, but A0 for (eg) 7.49 12 implies M1

Question			Answer	Marks	Guidance	
6			gradient = 3 seen	B1	may be embedded	
			$\log_{10} y - 5 =$ (their 3)($\log_{10} x - 1$) or using (5, 17)	M1	or $\log_{10} y = 3 \log_{10} x + c$ and substitution of (1, 5) or (5, 17) for $\log_{10} x$ and $\log_{10} y$	condone omission of base throughout NB may recover from eg $Y = 3X + 2$
			$\log_{10} y = 3 \log_{10} x + 2$ oe	A1		
			$y = 10^{3\log_{10} x+2}$ oe	M1	or $\log_{10} y = \log_{10} x^3 + \log_{10} 100$	or $\log_{10} \frac{y}{x^3} = 2$ or $\log_{10} y = \log_{10} 100x^3$
			$y = 100x^3$	A1 **[5]**		
7			$\frac{6x^{\frac{3}{2}}}{3/2}$	M1*		
			$4x^{\frac{3}{2}}$	A1	may appear later	
			$-5x + c$	B1	B0 if from $y = (6x^{\frac{1}{2}} - 5)x + c$	condone "+ c" not appearing until substitution
			substitution of (4, 20)	M1dep*		
			[y =] $4x^{1.5} - 5x + 8$ or $c = 8$ isw	A1 **[5]**		
8			0.775397.. soi	M1	or 44.427..°	
			0.388, 1.18, 3.53, 4.32	A4	A1 each value	if any of final answers not given to three sf deduct 1 mark from total A marks
			in degrees: 22.2, 67.8, 202, 248*		if A0 then B1 for at least two of 2.366…, 7.058…, 8.649…for 2θ or all of 135.57…, 404.427…, 495.57…	*if final answers in degrees deduct 1 from total A marks ignore extra values outside range if four correct answers in degrees or radians, deduct 1 for extra values in range
				[5]		

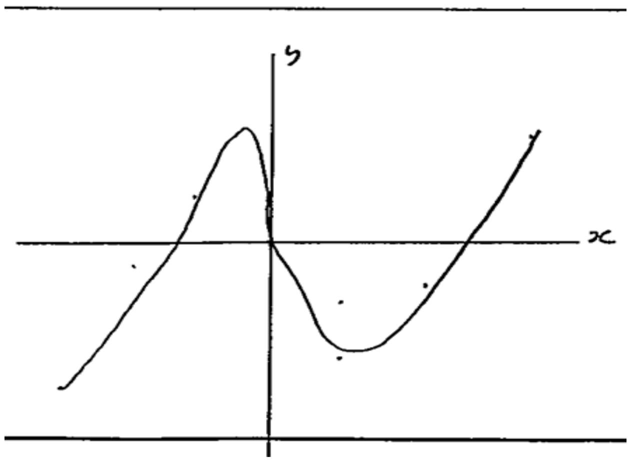
Question			Answer	Marks	Guidance	
9	(i)		½ × 0.2 (0 + 0 + 2(0.5 + 0.7 + 0.75 + 0.7 + 0.5)) [=0.63] (their 0.63) × 50 31.5	M3 M1 A1 **[5]**	M2 if one error, M1 if two errors condone omission of zeros or M3 for 0.05 + 0.12 + 0.145 + 0.145 + 0.12 + 0.05 may be unsimplified, must be summed	basic shape of formula must be correct must be 6 strips M0 if brackets omitted, but allow recovery M0 if h = 1 or 1.2 Area = 6.3 and 0.53 imply M0
9	(ii)	(*A*)	$3.8\times0.2^4 - 6.8\times0.2^3 + 7.7\times0.2^2 - 4.2\times0.2$ 0.01968 cao isw	M1 A1 **[2]**	±0.58032 implies M1 or B2 if unsupported	condone one sign error allow – 0.01968
9	(ii)	(*B*)	$\frac{3.8x^5}{5} - \frac{6.8x^4}{4} + \frac{7.7x^3}{3} - \frac{4.2x^2}{2} + c$ F(0.9) [– F(0)] 50 × their ±F(0.9) 24.8 to 24.9 cao	M2 M1* M1dep* A1 **[5]**	M1 for two terms correct excluding c condone omission of c as long as at least M1 awarded	accept 2.56 to 2.57 for coefficient of x^3 allow M1 if all signs reversed NB F(0.9) = – 0.496...

Question			Answer	Marks	Guidance	
10	(i)		$y' = 3x^2 - 5$ their $y' = 0$ (1.3, − 4.3) cao (− 1.3, 4.3) cao	M1 M1 A1 A1 **[4]**	 or A1 for $x = \pm\sqrt{\frac{5}{3}}$ oe soi allow if not written as co-ordinates if pairing is clear	 ignore any work relating to second derivative
10	(ii)		crosses axes at (0, 0) and ($\pm\sqrt{5}$, 0) sketch of cubic with turning points in correct quadrants and of correct orientation and passing through origin x-intercepts $\pm\sqrt{5}$ marked	B1 B1 B1 B1 **[4]**	condone x and y intercepts not written as co-ordinates; may be on graph ±(2.23 to 2.24) implies $\pm\sqrt{5}$ may be in decimal form (±2.2…)	See examples in Appendix must meet the x-axis three times B0 eg if more than 1 point of inflection
10	(iii)		substitution of $x = 1$ in $f'(x) = 3x^2 - 5$ -2 $y - -4 =$ (their $f'(1)$) × $(x - 1)$ oe $-2x - 2 = x^3 - 5x$ and completion to given result www use of Factor theorem in $x^3 - 3x + 2$ with -1 or ± 2 $x = -2$ obtained correctly	M1 A1 M1* M1dep* M1 A1 **[6]**	 or $-4 = -2\times(1) + c$ or any other valid method; must be shown	sight of − 2 does not necessarily imply M1: check $f'(x) = 3x^2 - 5$ is correct in part (i) eg long division or comparing coefficients to find $(x - 1)(x^2 + x - 2)$ or $(x + 2)(x^2 - 2x + 1)$ is enough for M1 with both factors correct NB M0A0 for $x(x^2 - 3) = -2$ so $x = -2$ or $x^2 - 3 = -2$ oe

Question			Answer	Marks	Guidance	
11	(i)		$ar = 6$ oe	B1	must be in a and r	
			$\frac{a}{1-r} = 25$ oe	B1	must be in a and r	
			$25 = \frac{a}{1-6/a}$	M1	or $\frac{6}{r} = 25(1-r)$	NB assuming $a = 10$ earns M0
			$a^2 - 25a + 150$ [= 0]	A1	or $25r^2 - 25r + 6$ [= 0]	All signs may be reversed
			$a = 10$ obtained from formula, factorising, Factor theorem or completing the square	A1	$r = 0.4$ and $r = 0.6$	
			$a = 15$	A1	$a = 15$	if M0, B1 for $r = 0.4$ **and** 0.6 and B1 for $a = 15$ by trial and improvement mark to benefit of candidate
			$r = 0.4$ and 0.6	A1	$a = \frac{6}{0.6} = 10$ oe	
				[7]		
11	(ii)		$10 \times (3/5)^{n-1}$ and $15 \times (2/5)^{n-1}$ seen	M1		
			$15 \times 2^{n-1} : 10 \times 3^{n-1}$ or $3 \times \frac{2^{n-1}}{5^{n-1}} : 2 \times \frac{3^{n-1}}{5^{n-1}}$	M1	may be implied by $3 \times 2^{n-1} : 2 \times 3^{n-1}$	condone ratio reversed
			$3 \times 2^{n-1} : 2 \times 3^{n-1}$	A1	and completion to given answer www	condone ratio reversed
				[3]		

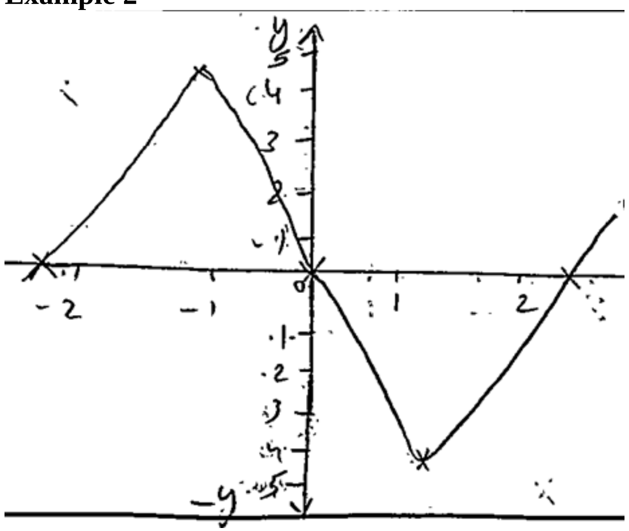
Appendix: examples for Question 10(ii)

Example 1



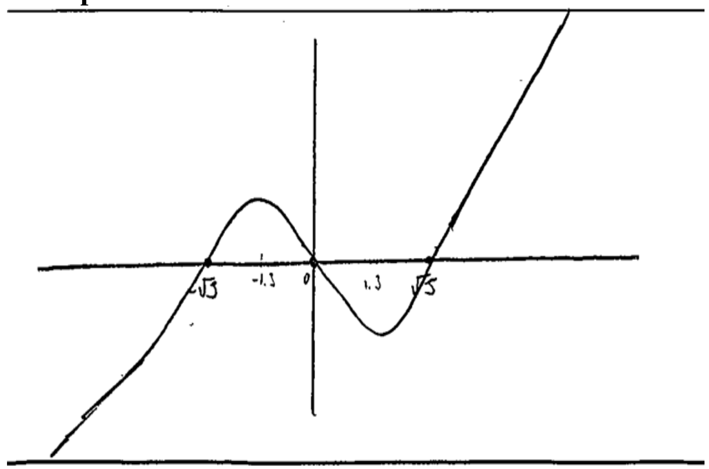
3rd B1 BOD inflection

Example 2



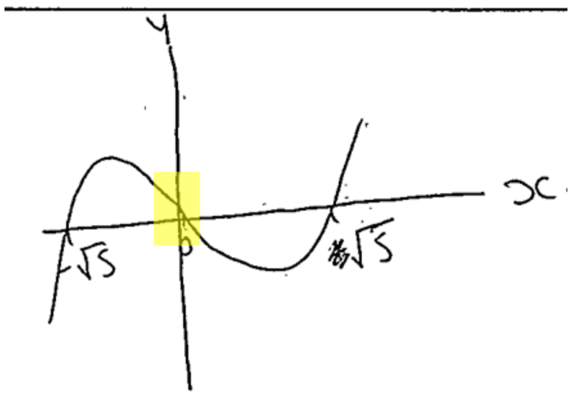
3rd B1 BOD Shape

Example 3



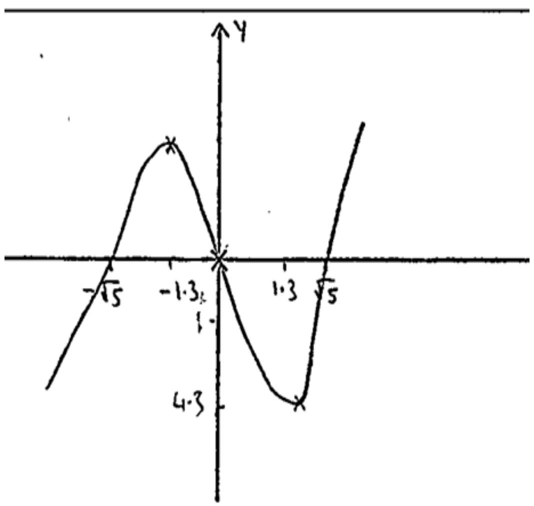
3rd B1 BOD Point of inflection on left

Example 4



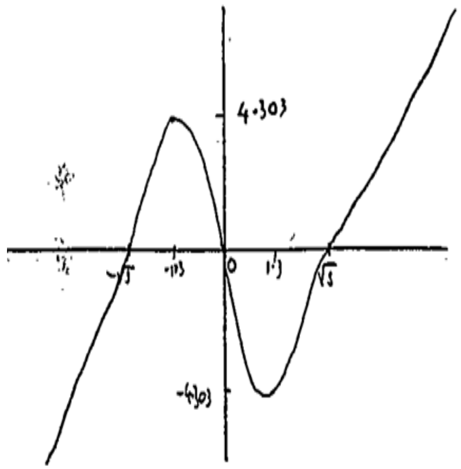
Clearly does not pass through origin
3rd B0

Example 5



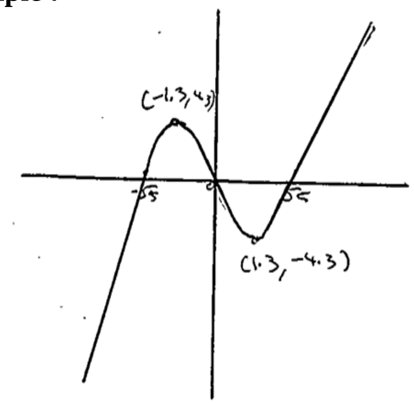
3rd B1

Example 6



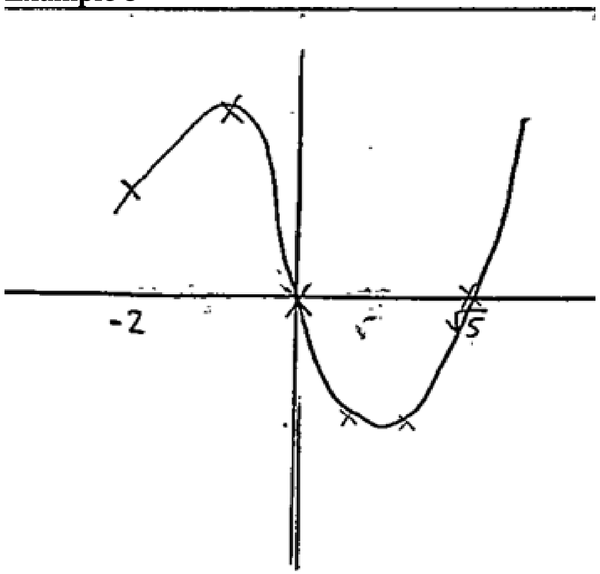
3rd B1 condone RHS

Example 7



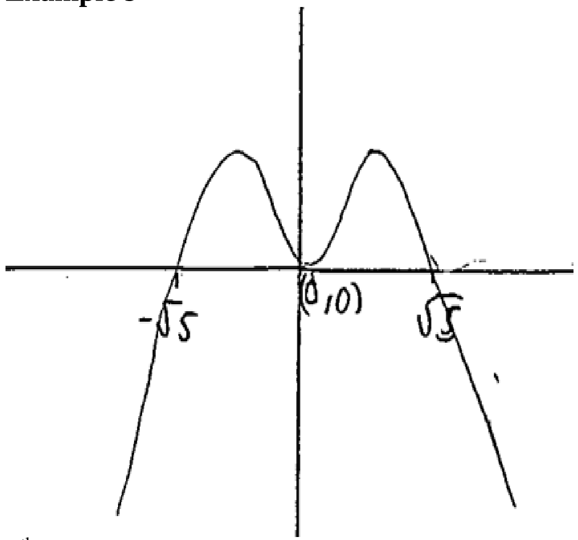
3rd B1 condone extreme ends ruled

Example 8



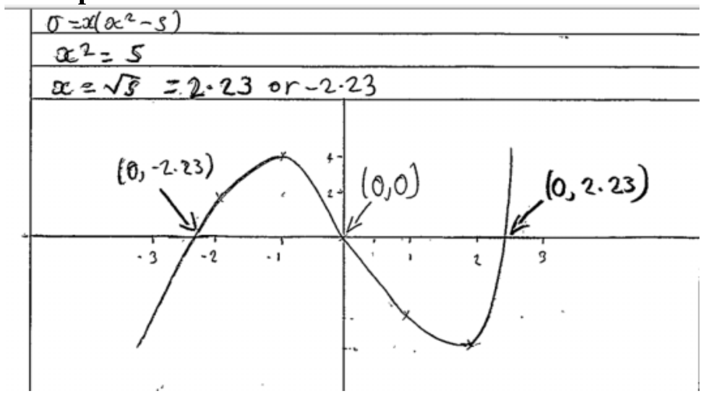
3rd B0 doesn't meet *x*- axis 3 times

Example 9



4th B1is earned in spite of the curve not being a cubic

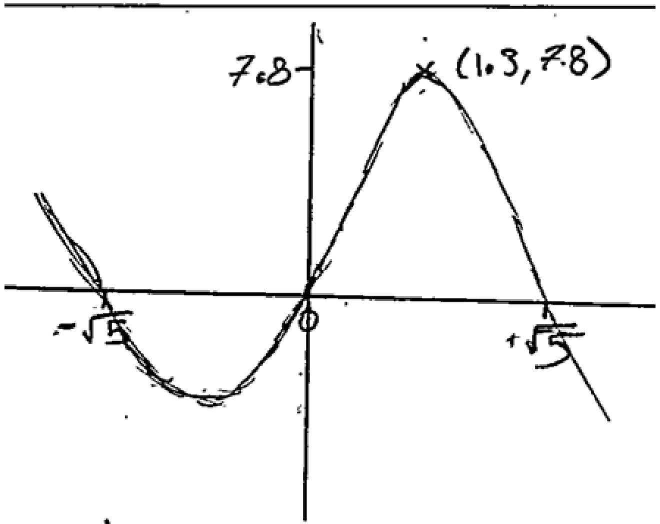
Example 10



x-intercepts: co-ordinates reversed but condone this as candidates who write –2.23 , 2.23 only would not be penalised

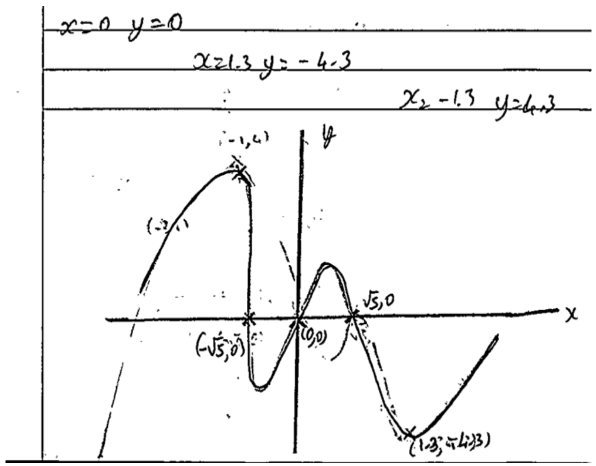
4th B1

Example 11



(3rd B0: incorrect orientation) 4th B1

Example 12



4th B1 earned.

4752 Concepts for Advanced Mathematics (C2)

General Comments

The paper was accessible to the majority of candidates and there was a full range of responses. Many candidates set out their work clearly, logically and succinctly. Most worked with calculator figures and rounded their answers at the end of the question. However, some candidates lost easy marks by working with prematurely rounded answers and a surprising number lost accuracy marks by ignoring specific requests such as “give your answers correct to one decimal place”. Some lost marks by keeping their calculator in radian mode when degrees were specified or vice versa. A small minority of candidates presented little or no working – just an answer - in responding to some questions. In some cases, particularly where calculus was specifically requested, a penalty was incurred. When faced with a request to “show that”, a significant proportion of candidates still opt for a verification approach, which does not score.

Comments on Individual Questions

1) There were many fully correct responses to this question. However, not all were able to resolve both terms into index form correctly. The second term was sometimes written as x^{-3} or occasionally 3^{-x}, 3^{-1} or just plain $3x$ were seen. The first term was sometimes “differentiated” as $x^{3/2}$, and x^{-3} was occasionally “differentiated” to $-3x^{-2}$ and $-3x^{-1}$ to $-3x^{0}$.

2) The majority of candidates obtained full marks. A small minority of candidates interpreted $u_n + 3$ as $n + 3$, thus obtaining 5 and 6 as the second and third terms. Similarly, a few candidates omitted to state the second and third terms. A few made mistakes with the formula for the sum to n terms, such as $\frac{50}{2}(10+24\times3)$, $\frac{50}{2}(10\times49\times3)$ or $\frac{50}{2}(10+49)\times3$ and a small number of candidates used the formula for the sum of the terms of a geometric progression. Some simply found the fiftieth term.

3) (i) This was very well done, with most candidates scoring full marks. A small number lost the last mark because they worked in radians or through premature rounding. Others lost the second mark by evaluating $(6.4^2 + 9.8^2 - 2\times6.4\times9.8)\cos53.4°$, and a small number failed to score because they assumed the triangle to be right angled and used Pythagoras or calculated 9.8sin53.4°. Occasionally candidates used the sine ratio instead of cosine in the correct formula; similarly a few candidates attempted to use the Sine Rule.

(ii) There were many correct answers to this question, but a significant minority used the correct formula with CD instead of BC, thus failing to score. Similarly, some candidates found the area of ABD instead of ABC. As with part (i), some candidates worked in radians, although some worked in degrees in part (i) and radians in part (ii) and vice versa. Similarly, a significant minority assumed a right angle and calculated ½× base × height. Of those who found the area of ABD and subtracted the area of ACD, only a tiny fraction successfully obtained the correct answer. Some candidates lost the second mark through poor rounding.

4) (i) By and large this was done well. The most common errors were (18, 9), (18, 3), (6, 6), $(6,\frac{3}{4})$ and (6, 1). Occasionally candidates hedged their bets and gave the answer (6, 3), which didn’t score at all.

(ii) This was generally well done. The most common error was (24, 3), but occasionally (24, 12) and (6, 12) were seen.

5) There were many completely correct answers to this question. The majority were comfortable working in radians, but some of those who converted to degrees did so successfully and managed to convert back without losing accuracy. A few candidates simply stopped when they had found the radius, and some thought they had found the perimeter when all they had done was find the arc length. A few candidates used the wrong formula initially: $\frac{1}{2}r\theta$, $\frac{1}{2}r\,\theta^2$, $r^2\theta$ and $\pi r^2\theta$ were all seen. Often they were able to go on and earn the final method mark. A small number of candidates thought the angle was 1.6π, and a few converted to degrees and worked with $\frac{1}{2}\times r^2\times 91.7$.

6) Only the best candidates managed full marks here. The most common approach was to find the gradient (nearly everyone managed this) and then work towards $\log y = 3\log x + 2$. Many went wrong, usually through substituting in log5 and log1 instead of 5 and 1. A significant minority gave the answer as $y = 3x + 2$, and of those who did obtain the correct equation in logarithmic form, most stopped. Some did manage to obtain $y = 10^{3\log x + 2}$, but then stopped or went astray. A small number of candidates realised that a straight line relationship between $\log y$ and $\log x$ implies a relationship of the form $y = kx^n$, with n = gradient and k = $\log y$ intercept. Many of these candidates successfully found the correct equation by substitution.

7) This was very well done, with many candidates obtaining full marks. A few candidates substituted $x = 4$ to obtain gradient = 7, and thus arrived at $y = 7x – 8$, and others went straight to $y = (6x^{\frac{1}{2}} – 5)x + c$. A few made mistakes in resolving the fraction, or with substitution of (20, 4). A small number omitted "+ c" and then floundered.

8) Many candidates divided by 2 before using the inverse sine function, and thus failed to score. A few made an initial step of $\theta = 0.7 \div \sin 2$, and others multiplied by 2 having correctly found arcsin0.7. Many worked in degrees and then lost marks either by failing to convert back to radians, or through premature rounding. Only a few were able to obtain all four angles in the correct form to the specified accuracy. Having found 0.388 correctly, many gave the next answer as 1.18 (or surprisingly often) 2.75 and stopped. A few candidates found one or more correct values and then multiplied them all by π.

9) (i) Given that the formula for the Trapezium Rule is in the data booklet, this question attracted a high proportion of poor responses. Many candidates were unable to reproduce the correct basic shape of the formula, with omission of the outer brackets being the most common error in this regard. The instruction to use six strips was often disregarded; many candidates seemed put off by the fact that both end ordinates were zero. Some candidates substituted the x-values, and $h = 1.2$ was fairly common. A number of candidates substituted all the correct values in the formula, but with one exception: one of the zeros was replaced with 1.2. A few candidates calculated the area of each individual trapezium: about half did so successfully. Most knew that the volume was found by multiplying the area of the cross-section, but often multiplied by (50÷1.2) and missed an easy mark (or two).

(ii)A Most candidates scored at least one mark, but many lost the accuracy mark through premature rounding. A few substituted an incorrect value (such as 0.45, 0.9 or 0.6), and a small number of candidates differentiated or integrated before substitution, and didn't score.

(ii)B Most integrated correctly: the most common error was to give the last term as either 4.2, or $\frac{4.2^2}{2}$. A common mistake was to then evaluate F[50] – F[0]; less common was F[0.2] – F[0]. A significant minority of those who knew the correct limits evaluated F[0] – F[0.9]. Most knew to multiply their result by 50, but a surprising number gave a negative answer or multiplied by (50÷0.9). A number of candidates lost the accuracy mark at the end due to writing the coefficient of x^3 as 2.56 or 2.57.

10) (i) Most successfully differentiated and set the derivative equal to zero. A surprising number then resorted to the quadratic formula and made mistakes or were unable to solve the equation directly. Many missed the negative root, and many neglected to find the *y*-values. Only a minority found both sets of co-ordinates successfully and gave the answers to the specified accuracy. A small number of candidates simply wrote down the correct co-ordinates, more often than not with the explanation that a graphical calculator had been used. It was made clear in the question that calculus was required, so this approach did not score.

(ii) Most candidates realised that the curve passes through the origin, and tried to factorise in order to find the other intercepts. As with part (i), the negative root was often missed, which resulted in candidates trying to fit a cubic of correct orientation to two *x*-intercepts instead of three. Although there were many correct answers, all too often marks were lost due to sloppiness such as failing to mark the intercepts or drawing the graph carelessly so that it didn't pass through the origin. Occasionally a cubic with the correct intercepts but of the wrong orientation was seen, as were parabolas and curves which were clearly not functions.

(iii) Most candidates correctly obtained the given result, although a few made sign errors or slipped up with the substitution in the derivative. Occasionally there were sign errors or exponent errors in the final statement, so an easy mark was lost. The last two marks proved more problematic. A surprising number of candidates made the initial step $x(x^2 – 3) = – 2$ so $x = – 2$ or $x^2 = 3$, which didn't score, or attempted to apply the quadratic formula, which also didn't work. Many opted for long division, but often went astray. Surprisingly few candidates tested the factors of 2 in the Factor theorem.

11 (i) Some candidates ignored the request for two equations in *a* and *r*, and either just wrote down one equation (usually $25 = \frac{a}{1-r}$) and then substituted 10 and 0.6, or went straight to two equations with $a = 10$ already substituted. A trial and improvement approach thereafter sometimes yielded the other correct pair of values. Some candidates gave the denominator as $r – 1$, and occasionally gave the second term as ar^5. Of those who did make the correct initial steps, a minority were unable to eliminate one of the variables successfully and then resorted to trial and improvement. The majority, however, successfully eliminated to obtain an equation (more often than not) in *r*, which was successfully solved. This usually led to full marks, although occasionally candidates lost one mark for failing to show that $a = 10$ – either the value was simply stated or the value was obtained from an initial verification.

(ii) Many candidates made no attempt to answer this question. Of those that did, many opted for a verification approach, which did not score. Some candidates were able to write down the correct n^{th} terms but most made no further progress. However, a variety of elegant approaches was seen from the best candidates.

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GCE Mathematics (MEI)

			Max Mark	a	b	c	d	e	u
4751/01	(C1) MEI Introduction to Advanced Mathematics	Raw	72	57	50	44	38	32	0
		UMS	100	80	70	60	50	40	0
4752/01	(C2) MEI Concepts for Advanced Mathematics	Raw	72	54	48	42	36	31	0
		UMS	100	80	70	60	50	40	0
4753/01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	60	53	47	41	34	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	65	57	50	43	36	0
		UMS	100	80	70	60	50	40	0
4755/01	(FP1) MEI Further Concepts for Advanced Mathematics	Raw	72	63	56	49	42	35	0
		UMS	100	80	70	60	50	40	0
4756/01	(FP2) MEI Further Methods for Advanced Mathematics	Raw	72	61	53	46	39	32	0
		UMS	100	80	70	60	50	40	0
4757/01	(FP3) MEI Further Applications of Advanced Mathematics	Raw	72	54	47	40	34	28	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	58	50	42	34	27	0
		UMS	100	80	70	60	50	40	0
4762/01	(M2) MEI Mechanics 2	Raw	72	58	51	44	38	32	0
		UMS	100	80	70	60	50	40	0
4763/01	(M3) MEI Mechanics 3	Raw	72	63	56	50	44	38	0
		UMS	100	80	70	60	50	40	0
4764/01	(M4) MEI Mechanics 4	Raw	72	56	49	42	35	29	0
		UMS	100	80	70	60	50	40	0
4766/01	(S1) MEI Statistics 1	Raw	72	54	46	38	30	23	0
		UMS	100	80	70	60	50	40	0
4767/01	(S2) MEI Statistics 2	Raw	72	61	55	49	43	38	0
		UMS	100	80	70	60	50	40	0
4768/01	(S3) MEI Statistics 3	Raw	72	58	51	44	38	32	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	53	47	42	37	32	0
		UMS	100	80	70	60	50	40	0
4772/01	(D2) MEI Decision Mathematics 2	Raw	72	56	50	44	39	34	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	50	44	38	33	27	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