OCR
RECOGNISING ACHIEVEMENT

Tuesday 17 January 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.

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 **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 Find $\sum_{r=3}^{6} r(r+2)$. **[2]**

2 Find $\int \left(x^5 + 10x^{\frac{3}{2}}\right) \mathrm{d}x$. **[4]**

3 Find the set of values of x for which $x^2 - 7x$ is a decreasing function. **[3]**

4 Given that $a > 0$, state the values of

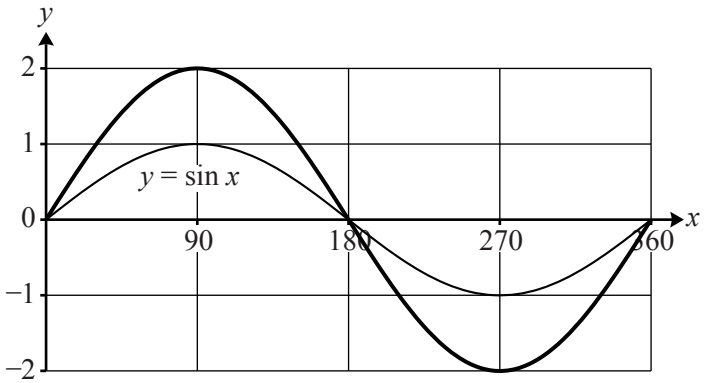
(i) $\log_a 1$, **[1]**

(ii) $\log_a (a^3)^6$, **[1]**

(iii) $\log_a \sqrt{a}$. **[1]**

5 Figs. 5.1 and 5.2 show the graph of $y = \sin x$ for values of x from 0° to 360° and two transformations of this graph. State the equation of each graph after it has been transformed.

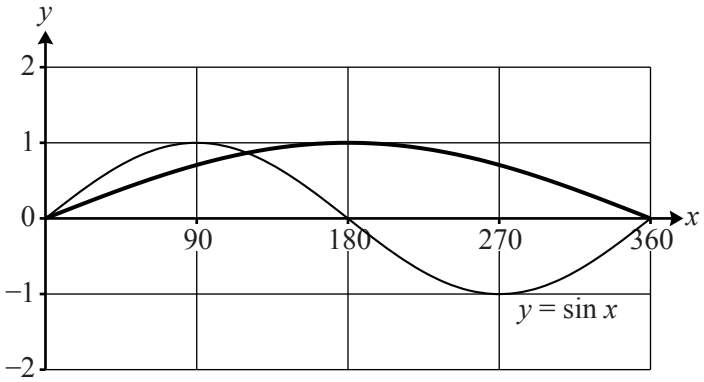
(i)



[1]

Fig. 5.1

(ii)



[2]

Fig. 5.2

6 Use logarithms to solve the equation $235 \times 5^x = 987$, giving your answer correct to 3 decimal places. **[3]**

7 Given that $y = a + x^b$, find $\log_{10} x$ in terms of y, a and b. **[3]**

8 Show that the equation $4 \cos^2 \theta = 1 + \sin \theta$ can be expressed as

$$4 \sin^2 \theta + \sin \theta - 3 = 0.$$

Hence solve the equation for $0° \leqslant \theta \leqslant 360°$. **[5]**

9 A geometric progression has a positive common ratio. Its first three terms are 32, b and 12.5.

Find the value of b and find also the sum of the first 15 terms of the progression. **[5]**

10 In an arithmetic progression, the second term is 11 and the sum of the first 40 terms is 3030. Find the first term and the common difference. **[5]**

Section B (36 marks)

11 The point A has x-coordinate 5 and lies on the curve $y = x^2 - 4x + 3$.

(i) Sketch the curve. **[2]**

(ii) Use calculus to find the equation of the tangent to the curve at A. **[4]**

(iii) Show that the equation of the normal to the curve at A is $x + 6y = 53$. Find also, using an algebraic method, the x-coordinate of the point at which this normal crosses the curve again. **[6]**

12 The equation of a curve is $y = 9x^2 - x^4$.

(i) Show that the curve meets the x-axis at the origin and at $x = \pm a$, stating the value of a. **[2]**

(ii) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

Hence show that the origin is a minimum point on the curve. Find the x-coordinates of the maximum points. **[6]**

(iii) Use calculus to find the area of the region bounded by the curve and the x-axis between $x = 0$ and $x = a$, using the value you found for a in part **(i)**. **[4]**

13

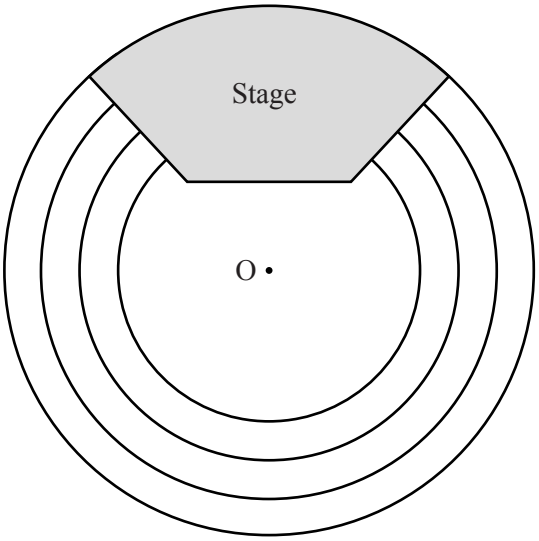


Fig. 13.1

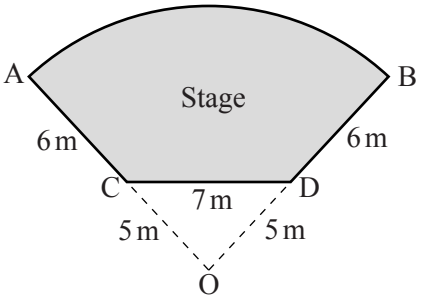


Fig. 13.2

In a concert hall, seats are arranged along arcs of concentric circles, as shown in Fig. 13.1. As shown in Fig. 13.2, the stage is part of a sector ABO of radius 11 m. Fig. 13.2 also gives the dimensions of the stage.

(i) Show that angle COD = 1.55 radians, correct to 2 decimal places. Hence find the area of the stage. **[6]**

(ii) There are four rows of seats, with their backs along arcs, with centre O, of radii 7.4 m, 8.6 m, 9.8 m and 11 m. Each seat takes up 80 cm of the arc.

(*A*) Calculate how many seats can fit in the front row. **[4]**

(*B*) Calculate how many more seats can fit in the back row than the front row. **[2]**

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4752 Concepts for Advanced Mathematics (C2)

PRINTED ANSWER BOOK

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OCR supplied materials:
- Question Paper 4752 (inserted)
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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	

4 (i)	
4 (ii)	
4 (iii)	
5 (i)	
5 (ii)	
6	

7	
8	

9

10

Section B (36 marks)

11 (i)	
11 (ii)	

11 (iii)	

12 (i)

12 (ii)

12 (iii)	

13 (i)	

PLEASE DO NOT WRITE IN THIS SPACE

13 (ii) (*A*)

13 (ii) (*B*)

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OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4752:** Concepts for Advanced Mathematics

Mark Scheme for January 2012

Oxford Cambridge and RSA Examinations

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Any enquiries about publications should be addressed to:

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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			3 × (3+2) + 4 × (4+2) + 5 × (5+2) + 6 ×(6+2) 122 www	M1 A1 **[2]**	oe	B2 for 122 unsupported
2			$\frac{x^6}{6} + kx^{\frac{5}{2}}$ $k = 4$ + c	M2 A1 A1 **[4]**	M1 for each term if at least M1 earned	
3			$\frac{dy}{dx} = 2x - 7$ *or* $(x\text{-}3.5)^2$ [$– 3.5^2$] $x = 3.5$ $x < 3.5$ www cao	M1 M1 A1 **[3]**	M2 for $x = 3.5$ identified (for example, from symmetry) allow $x \leq 3.5$	mark the final answer
4	(i)		0	1 **[1]**		
4	(ii)		18	1 **[1]**		
4	(iii)		$\frac{1}{2}$ or 0.5	1 **[1]**		
5	(i)		[y =] 2sin x oe	1 **[1]**		
5	(ii)		[y =] sin (0.5x) oe	2 **[2]**	M1 for [y =] sin (2x)	
6			log235 + log5^x = log987 $[x =] \frac{\log 987 - \log 235}{\log 5}$ oe 0.892 cao	M1 M1 A1 **[3]**	$\log 5^x = \log\left(\frac{987}{235}\right)$ $[x =] \log_5\left(\frac{987}{235}\right)$	

Question			Answer	Marks	Guidance	
7			$y - a = x^b$ $\log_{10}(y - a) = b \log_{10} x$ $[\log_{10} x =] \frac{\log_{10}(y-a)}{b}$	M1 M1 A1 **[3]**	 if M0 earned, allow SC1 for $b \log_{10} x$ term seen SC2 for correct answer without working	condone omission of base of log
8			$4(1 - \sin^2\theta) = 1 + \sin\theta$ at least one interim step to $4\sin^2\theta + \sin\theta - 3 = 0$ $[\theta =]$ 270°, 48.59...°, 131.4...°	M1 A1 B1B1B1 **[5]**	 to nearest degree or better	 ignore extra values outside range; if B3 awarded, minus 1 if extra values in range.
9			$\frac{b}{32} = \frac{12.5}{b}$ oe $b = 20$ $r = 0.625$ soi $\frac{32(1-0.625^{15})}{1-0.625}$ oe or ft their r 85.259... to 3 s.f. or more	M1 A1 A1 M1 A1 **[5]**	or $r^2 = 12.5/32$ M0 if directly summed, but B2 if correct answer obtained to 3 s.f. or better	 B3 for both r and b www; B2 for one of these
10			(i) $a + d = 11$ oe $20(2a + 39d) = 3030$ oe correct initial step in solving simultaneously $d = 3.5$ oe $a = 7.5$ oe	M1* M1* M1dep* A1 A1 **[5]**	 eg $20(2(11 - d) + 39d) = 3030$ oe, SC1 if either of first two marks not awarded SC1 if either of first two marks not awarded	 may be implied by correct answers mark to benefit of candidate mark to benefit of candidate

Question			Answer	Marks	Guidance	
11	(i)		sketch of parabola the right way up cutting y-axis at 3 and *either* x-axis at 1 and 3 only *or* minimum value at (2, -1)	B1 B1 **[2]**	 intersections must be marked on graph or shown worked out next to sketch	
11	(ii)		$y' = 2x - 4$ at A $y' = 6$ at A $y = 8$ soi y – their $8 = 6(x - 5)$ or substitution of (5, their 8) into $y = 6x + c$ and evaluation of c	M1* A1 B1 M1dep* **[4]**	 must be obtained by calculus implied by $y = 6x - 22$; M0 if value of y' not y used	
11	(iii)		$m = \dfrac{-1}{their 6}$ $y - 8 = -1/6\ (x - 5)$ oe and interim step completing to given answer $\dfrac{53 - x}{6} = x^2 - 4x + 3$ oe $x^2 - \frac{23}{6}x - \frac{35}{6}[= 0]$ oe $(x - 5)(6x + 7)$ $x = -\frac{7}{6}$ oe isw (accept –1.17 or better)	M1 A1 M1* A1 M1dep* A1 **[6]**	 NB answer $x + 6y = 53$ given must be three terms or correct substitution in quadratic formula or correct completion of square previous M1 implied by correct answer	M0 if clearly obtained from $x + 6y = 53$ if quadratic in y, then B2 for $y = \dfrac{325}{36}$ = 9.0277… B2 for $x = -\frac{7}{6}$ oe obtained from correct value for y

Question			Answer	Marks	Guidance	
12	(i)		$x^2(9 - x^2) = 0$ soi	B1	$9\times0^2 - 0^4 = 0$	B0 in each case if correct answer appears from clearly incorrect working
			$x = 0$ and ± 3, [so $a = 3$ or $a = -3$]	B1	$9\times3^2 - 3^4 = 0$ *and* $9\times(-3)^2 - (-3)^4 = 0$	$a = \pm 3$ without working does not score
				[2]		
12	(ii)		$y' = 18x - 4x^3$	B1		
			$y'' = 18 - 12x^2$ or ft	B1		
			their $y' = 0$ soi	M1		
			$2x\,(9 - 2x^2) = 0$ so $x = 0$ oe	A1	or $18\times0 - 4\times0^3 = 0$ oe	
			$x = 0$, $y'' = 18$ cao so minimum	B1	or evaluation of y' at $\pm h$ oe where $h < \sqrt{4.5}$	
			$x = \pm\sqrt{4.5}$ oe eg $\pm\dfrac{3\sqrt{2}}{2}$	A1	accept 2.12 or better for $\sqrt{4.5}$	
				[6]		
12	(iii)		$\int_0^3 \left(9x^2 - x^4\right)\mathrm{d}x$ soi or ft	M1	condone omission of, or wrong limits	
			$3x^3 - 0.2x^5$	A1	correct answer implies M1	ignore + c
			F[their positive a] [– F[0]]	M1	dependent on at least one term correct	M0 if neither of the limits is 0
			or (not **and**) F[0] – F[their negative a]			M0 for F[0] – F[their positive a]
						M0 for use of Trapezium Rule
			32.4 oe cao	A1		
				[4]		

Question			Answer	Marks	Guidance	
13	(i)		sin (½ COD) = 3.5/5	M1	$\cos(COD) = \frac{5^2 + 5^2 - 7^2}{2 \times 5 \times 5}$	
			½ COD = 0.7753(97496...)	M1	COD = $\cos^{-1}$(1/50) (or = 1.550….)	must see $88.85 \times \frac{\pi}{180}$ if working in degrees (88.85 or better)
			so COD = 1.55			
			area of sector = ½ × 11^2 × 1.55(07..) [= 93.8m^2 to 3 sf]	M1*	or equivalent in degrees	
			area of triangle = ½ × 5^2 × sin 1.55(07..) or ½×7×3.57…	M1*	or ½ × 7 × 5 × cos (½ COD) oe 12.497… implies M1	M0 for area of triangle = ½ × 5^2
			their 93.8 – their 12.497 soi	M1dep*		
			81 to 81.4 m^2	A1		
				[6]		
13	(ii)	(A)	sector angle = 2π – 1.55 soi	M1*	may be embedded in circumference – removed arc	= 4.73 to 3sf
			7.4 × their 4.73(...) soi	M1dep*		≈ 35 m
			their arc ÷ 0.8	M1	may be implied by answer 43.78...	arc length must be dimensionally correct, and must be an arc, not a radius.
			43 cao	A1		
				[4]		
13	(ii)	(B)	11 × 4.73(...) ÷ 0.8	M1	or $\frac{11}{7.4} \times 43.7...$	or $\frac{2\pi \times 11 - 1.55 \times 11}{0.8} = \frac{69.16 - 17.05}{0.8}$
			22 cao	A1		
				[2]		

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4752 Concepts for Advanced Mathematics

General Comments

Solutions were often concise and clearly set out, and by and large excellent use was made of electronic calculators. Nevertheless, some candidates lost easy marks by showing insufficient detail of their working, particularly when responding to a "show that" request, or by misquoting standard formulae.

Comments on Individual Questions

1 The overwhelming majority of candidates scored full marks on this question. A small minority either began summing from 1, or went as far as 8, and did not score. A few simply listed the terms and did not score, and a tiny fraction made errors with the arithmetic. A very small number of candidates tried to use formulae for arithmetic progressions or for geometric progressions.

2 This question was done very well, with many candidates obtaining full marks. Some lost an easy mark because they failed to simplify 10 ÷ 2.5. Careless mistakes included the omission of "+ c" and 10 ÷ 2.5 = 25. A more surprising error was arriving at $4^{2.5}/2.5$. A small number of candidates differentiated instead of integrating.

3 A significant minority of candidates factorised the expression and concluded that $0 < x < 7$, thus failing to score. The most common approach was to differentiate and most went on to obtain 3.5. The majority gave the correct answer, but some spoiled earlier work by giving answers such as $-3.5 < x < 3.5$ or $0 < x < 3.5$. A few candidates made sign errors and lost the last mark.

4 (i) Most candidates gave the correct answer. The most common error was $\log_a 1 = 1$.

4 (ii) Not quite so many were successful with this part. $\log_a a = 1$ and $1^{18} = 1$ was a surprisingly common error, 9 and 729 were even more common.

4 (iii) Most obtained the correct answer. 1 or 0 were the most common incorrect responses.

5 (i) This was done very well. Of those who were unsuccessful, nearly all realised that "2" was relevant, giving the answer as $\sin 2x$ or $\frac{1}{2}\sin x$.

5 (ii) Again, this was very well done. A few unsuccessful candidates gave the answer as $\sin 2x$ or $\sin \frac{1}{4}x$. Occasionally $\frac{1}{2}\sin x$ or $2 \sin x$ were seen.

6 Many candidates made the correct initial move and went on to correctly find the answer to the required precision. Only a few lost the accuracy mark due to inappropriate rounding (usually 2 d.p.) or poor calculator work. A surprisingly large number of candidates started with $\log 235 \times \log 5^x$, and didn't score any marks. A few made the double error $\log 235 \times \log 5^x = \log 987$ so $\log 5^x = \log 987 - \log 235$, and went on to fortuitously obtain 0.892 for no marks. Other mistakes included $1180^x = 987$ and $\log 235 + 5^x = \log 987$.

7 The vast majority of candidates made the wrong initial move and obtained $\log y = \log a + \log x^b$. Of those who did earn the first method mark for $x^b = y - a$, a disappointing proportion failed to progress, writing either $\log x^b = \log y - a$ or $\log y - \log a$. Most earned a SC1 for $b\log x$ appearing at some point.

8 The vast majority of candidates were comfortable with substituting $\sin^2\theta = 1 - \cos^2\theta$ and successfully derived the required result. Many went on to obtain all three roots correctly, although weaker candidates struggled to solve the quadratic equation; and $\sin\theta = 1$ and $\sin\theta = ¾$ were occasionally seen. 270° was the most frequently missed root, and occasionally 90 + 48.6 instead of 180 – 48.6 was presented. Very few candidates found extra values in the range; even fewer worked in radians.

9 This was done very well indeed, with many candidates obtaining full marks. A few candidates rounded prematurely and obtained $r = 0.63$ and $b = 20.2$, and an even smaller proportion inverted r to obtain 1.6. A few candidates found r and neglected to find b. Nearly all candidates used the formula for the sum of the first 15 terms correctly. Occasionally $1 - r^{15}$ was used in the numerator, along with $r - 1$ in the denominator, and sometimes 2 was substituted instead of 15. Very few candidates resorted to summing all fifteen terms directly.

10 Most candidates identified two correct equations and went on to solve them simultaneously – and were generally successful. $a + 10d = 11$ was quite a common error, as was $3030 = 20(2a + 19d)$. Those who were only able to identify one equation correctly occasionally resorted to trial and improvement, and were usually unsuccessful.

11 (i) Most candidates were awarded both marks, but a surprising number were unable to convince the examiners that what they were drawing was a parabola, and some drew curves which were clearly cubic. Some marked the correct intercepts, and then tried to make their curve fit, often with disastrous results. Too many candidates failed to indicate the x and y intercepts, thus losing an easy mark.

11 (ii) This was very well done indeed, with most candidates scoring full marks. Occasionally $2x - 4 = 0$ so gradient = 2 was seen, and there were occasional errors in finding the value of y.

11 (iii) Most knew what to do here and made it clear that they were working with the negative reciprocal of the gradient of the tangent, and showed sufficient detail of the working in obtaining the correct equation. Many went on to obtain the correct quadratic equation, although occasionally sign errors led to an incorrect term (usually $– 25x$ instead of $– 23x$). Most were able to solve their quadratic successfully – although a surprising number resorted to using the formula (and sometimes slipped up) instead of using the fact that one of the roots was already known and factorising. A small minority of candidates made extra work by finding and solving a quadratic in y and then substituting back for x. Not all were successful.

12 (i) Many candidates did not adopt the expected approach. Rather they substituted $x = 0$ and then tried a variety of other values. This rarely earned both marks, as – 3 was usually missed. A good proportion did factorise, but were then unable to complete the answer successfully, making errors such as $x^2 = -9$ or $x = \pm 9$.

12 (ii) Nearly all candidates found the first and second derivatives successfully: the next move was often to substitute $x = 0$ into the second derivative to confirm the nature of the turning point. Often candidates ran out of steam at this point. Of those who set $\mathrm{d}y/\mathrm{d}x$ equal to 0, many either missed the negative root, or missed the root $x = 0$ or missed both.

12 (iii) On the whole this was done very well. A few candidates used the function from question 11, and some integrated from – 3 to 3 instead of from 0 to 3. A tiny number differentiated instead of integrating, or integrated their first derivative from part (ii).

13 (i) The Cosine Rule was by far the most popular approach, and most candidates were successful in deriving the required result. Most were successful in finding the correct area of the sector, although a few used a radius of 5 or 6 instead of 11. The majority correctly applied $\frac{1}{2}ab\sin C$ to find the area of the triangle. Common errors were ½×5×5 or ½×7×5. Many who found the correct perpendicular height were successful in finding the area, but some made slips such as finding the area of either half or double the required triangle.

13) (ii)(A) There were many excellent responses to this question. A few candidates rounded up to 44 instead of truncating to 43. A significant minority simply used 7.4 × 1.55 for the arc length, but generally went on to earn the method mark for dividing by 0.8. A few candidates worked with areas, or used $r\theta$ with θ in degrees, and didn't score.

13) (ii)(B) The majority of those who were successful in part (A) went on to be successful in this part.