OCR
Oxford Cambridge and RSA

Wednesday 7 June 2017 – Morning

AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4752/01
- 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 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.** If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 barcodes.
- 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 **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.

Section A (36 marks)

1 **(i)** Calculate $\sum_{r=1}^{5}(3r+2)$. **[2]**

(ii) An arithmetic progression (AP) has first term 4.2 and sixth term 1.8. Find the common difference of this AP. **[2]**

2 **(i)** Find $\int_1^5 4x\,\mathrm{d}x$. **[3]**

(ii) Find $\int 6x^{\frac{1}{2}}\,\mathrm{d}x$. **[2]**

3

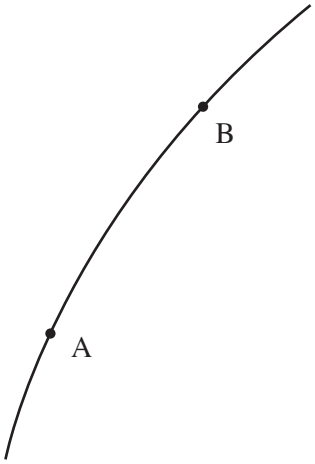

Fig. 3

Fig. 3 shows two points A and B on the curve $y = \log_{10}x$. At A, $x = 0.1$ and at B, $x = 0.2$.

(i) Calculate the gradient of the chord AB. **[2]**

(ii) The gradient of the chord AB gives an estimate for the gradient of the curve at A. On Fig. 3 in the answer book, mark a point C on the curve such that the gradient of the chord AC would give a better estimate. **[1]**

4 Find the equation of the normal to the curve $y = 2x^3$ at the point on the curve where $x = 2$. Give your answer in the form $ax + by = c$. **[5]**

5 **(i)** Describe fully the single transformation that maps the curve $y = x^2 + 3$ onto the curve $y = 2x^2 + 6$. **[2]**

(ii) Describe fully the single transformation that maps the curve $y = 2x^2$ onto the curve $y = 2(x-3)^2$. **[2]**

6 A curve passes through the point (2, 10) and has gradient $\frac{\mathrm{d}y}{\mathrm{d}x} = 12x^3 - 7$. Find the equation of the curve. **[5]**

7 **(i)** Sketch the curve $y = 2^x$. **[2]**

(ii) You are given that $\log_a w = 3 + \log_a x^5 - \log_a 2x + \log_a 6$. Find an expression for w in terms of x and a, giving your answer as simply as possible. **[3]**

8 You are given that $6\cos^2 x = 5 - \sin x$, where x is in radians. Show that $6\sin^2 x - \sin x - 1 = 0$. Solve this equation for $0 \leqslant x \leqslant 2\pi$. **[5]**

Section B (36 marks)

9 The standard formulae for the volume V and total surface area A of a solid cylinder of radius r and height h are

$$V = \pi r^2 h \text{ and } A = 2\pi r^2 + 2\pi rh.$$

You are given that $V = 400$.

(i) Show that $A = 2\pi r^2 + \frac{800}{r}$. **[2]**

(ii) Find $\frac{\mathrm{d}A}{\mathrm{d}r}$ and $\frac{\mathrm{d}^2A}{\mathrm{d}r^2}$. **[4]**

(iii) Hence find the value of r which gives the minimum surface area. Find also the value of the surface area in this case. **[4]**

10 A field is to be turned into a car park, a pond and a meadow. Fig. 10 shows one possible design.

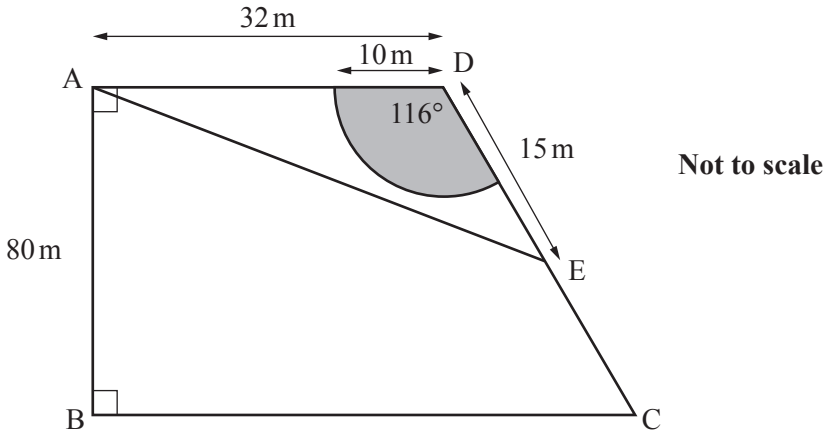

Fig. 10

The field ABCD is a trapezium, with sides AD and BC parallel. AD = 32 m, AB = 80 m, angle B = 90° and angle D = 116°. The pond, shown shaded, is a sector of a circle, centre D and radius 10 m. The point E is on DC, with DE = 15 m.

(i) Calculate the length of AE. **[2]**

(ii) Calculate the perpendicular distance of AE from D. Hence verify that the pond lies entirely within triangle ADE. **[3]**

The meadow is the triangle ADE except for the pond.

(iii) Calculate the area of the pond and the area of the meadow. **[4]**

(iv) Show that the car park, AECB, uses over 90% of the area of the field. **[4]**

11 A firm takes on two new employees, Arif and Bettina.

- Arif starts on an annual salary of £30 000, and his salary increases by £1000 each year after that.
- Bettina starts on an annual salary of £25 000, and her salary then increases by 5% each year after that. (So, for example, Bettina's salary in year 3 is 5% greater than her salary in year 2.)

(i) Show that Arif earns more than Bettina in year 10 of their employment, but Arif earns less than Bettina in year 11. **[4]**

(ii) Show that the total amounts earned by each of Arif and Bettina during their employment up to the end of year 17, correct to the nearest £100, are equal. **[4]**

(iii) At the end of year n, the total that Bettina has earned during this employment is greater than £M.

Show that $n > \dfrac{\log_{10}(M + 500\,000) - \log_{10} 500\,000}{\log_{10} 1.05}$.

Hence find in which year the total that Bettina has earned during this employment is first greater than £1.2 million. **[5]**

END OF QUESTION PAPER

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Wednesday 7 June 2017 – Morning

AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

OCR supplied materials:
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Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

* 4 7 5 2 0 1 *

* 6 8 6 3 2 0 7 4 6 7 *

Candidate forename		Candidate surname	

Centre number						Candidate number				

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Section A (36 marks)

1 (i)	
1 (ii)	
2 (i)	
2 (ii)	

3 (i)

3 (ii)

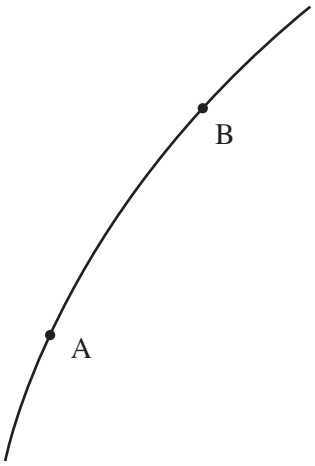

Fig. 3

4

5 (i)	
5 (ii)	
6	
7 (i)	

7 (ii)	
8	

Section B (36 marks)

9 (i)

9 (ii)

9 (iii)	

10 (i)	
10 (ii)	
10 (iii)	

10 (iv)	

11 (i)

11 (ii)

11 (iii)	

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4752**: Concepts for Advanced Mathematics

Advanced Subsidiary GCE

Mark Scheme for June 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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.

Annotations and abbreviations

Annotation in assessor	**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	(i)		$3\times1+2+3\times2+2+3\times3+2+3\times4+2+3\times5+2$ oe soi	B1	or $3\times\frac{1}{2}\times5\times(5+1)+2\times5$	or $\frac{5}{2}\left[2\times5+(5-1)\times3\right]$
			55	B1 [2]		**B2** for 55 unsupported
1	(ii)		$4.2 + 5d = 1.8$ soi	M1	or $(1.8-4.2)\div5$ oe	**M0** for $(4.2 – 1.8) \div 5$ if not recovered
			-0.48 or $-\frac{12}{25}$ isw	A1 [2]		**B2** for correct answer unsupported
2	(i)		$2x^2$ oe	B1		ignore + *c* for the first two marks
			F[5] – F[1]	M1	where F[*x*] = kx^2	
			48 cao	A1 [3]		no marks for 48 unsupported **A0** for 48 + *c*
2	(ii)		$kx^{\frac{1}{2}+1}$ seen	M1		
			$4x^{\frac{3}{2}}+c$ or $4\sqrt{x^3}+c$ or $4\left(\sqrt{x}\right)^3+c$ isw	A1 [2]		

Question			Answer	Marks	Guidance	
3	(i)		$\frac{\log_{10} 0.2 - \log_{10} 0.1}{0.2 - 0.1}$ or eg $\frac{-0.7 - -1}{0.2 - 0.1}$ seen	M1	**NB** $\frac{\log_{10} 2}{0.1}$ or $\frac{0.3}{0.1}$ allow – 0.69 to – 0.7 for $\log_{10} 2$ in gradient formula for **M1**	condone omission of base 10;
			3.01 to 3.0103 isw or $10\log_{10} 2$ isw oe	A1		**B2** for 3.01… unsupported
				[2]		
3	(ii)		one point C marked on curve between A and B or before A	B1		condone omission of label of C
				[1]		
4			$\left[\frac{dy}{dx} =\right] kx^2$ soi	M1	$k > 0$	**NB** $6x^2$
			when $x = 2$, $\left[\frac{dy}{dx} =\right] 24$	A1		
			$-\frac{1}{their\ 24}$	M1	their 24 must come from evaluating their derivative	**M0** if their 24 from elsewhere eg integration
			$x = 2,\ y = 16$	B1	**NB** $y - 16 = -\frac{1}{24}(x - 2)$	
			$x + 24y = 386$ oe	A1	coefficients in any exact form eg $\frac{1}{24}x + y = \frac{193}{12}$ but not rounded or truncated decimals	
				[5]		
5	(i)		stretch	M1	do not allow "squash" or "enlargement"	**M0** if two transformations described
			parallel to y-axis oe, scale factor 2 oe	A1	both required	
				[2]		

Question			Answer	Marks	Guidance	
5	(ii)		translation (not "shift" or "move")	**M1**	if **M0** allow **SC1** for eg "shift 3 units in x-direction" but not "transformation 3 units in the x-direction"	**M0** if two transformations described
			of $\begin{pmatrix}3\\0\end{pmatrix}$, or 3 units parallel to x-axis oe	**A1**		
				[2]		
6			kx^4	**M1**	$k > 0$	must **not** follow from use of $y = mx + c$
			$3x^4$	**A1**	may be seen later	
			$-7x + c$	**B1**	must follow from integration	
			$10 = (\text{their } 3) \times 2^4 - 7 \times 2 + c$ oe	**M1**	must be 3 terms on RHS including term in x^4, term in x and "c";	must **not** follow from use of $y = mx + c$
			$y = 3x^4 - 7x - 24$	**A1**	or $y = 3x^4 - 7x + c$ and $c = -24$ stated isw	must see "$y =$" or "f(x) = " at some point for **A1**
				[5]		
7	(i)		curve of increasing gradient in 1st and 2nd quadrant which does not cut x-axis but tends towards it in 2nd quadrant	**M1**	**M0** if curves up in 2nd quadrant or back in 1st quadrant	condone touching x-axis
			through (0, 1)	**A1**	intercept may be identified in supporting commentary or on graph	condone axes not labelled
				[2]		

Question			Answer	Marks	Guidance	
7	(ii)		$\log_a\left(\frac{x^5\times 6}{2x}\right)$ oe	**B1**	**NB** $\log_a(3x^4)$ may be embedded in combining of all terms on RHS **NB** $\log_a(3a^3x^4)$	condone omission of base
			correct attempt to remove logs on both sides	**M1**	eg $w = a^{3+\log_a x^5-\log_a 2x+\log_a 6}$ may follow incorrect combination of log terms	condone omission of base, may be awarded before **B1**
			$[w =]3a^3x^4$ cao	**A1**		
				[3]		
8			$6(1-\sin^2 x)$ seen	**M1**		or $6(1-\cos^2 x)$ substituted in given result to obtain $6\cos^2 x = 5 - \sin x$ with at least one correct intermediate step
			eg $6-6\sin^2 x = 5-\sin x$		at least one correct intermediate step to obtain **given** answer	
			$6\sin^2 x - \sin x - 1 = 0$	**A1**		
			$\frac{1}{2}$ and $-\frac{1}{3}$ found	**B1**	both required; allow – 0.33 or better	
			$x = \pi/6, 5\pi/6$ [0.52 to 0.524, 2.61799 to 2.62] 3.48 to 3.48143, 5.94 to 5.9435	**B2**	**B1** for 2 correct, to 2 dp or more if **B0** allow **SC1** for all four answers in degrees with no extras: 30, 150, 340.5 – 341, 199 – 199.5	if **B2** deduct 1 mark for extra values in range; ignore extra values outside range
				[5]		

Question			Answer	Marks	Guidance	
9	(i)		correct rearrangement of $400 = \pi r^2 h$ seen, where h is not in the denominator	**B1**	eg $h = \frac{400}{\pi r^2}, rh = \frac{400}{\pi r}, \pi rh = \frac{400}{r}$ or $2\pi rh = \frac{2\times 400}{r}$	allow embedded versions of these
			substitution seen to obtain given answer $A = 2\pi r^2 + \frac{800}{r}$ not from wrong working	**B1** **[2]**	if **B0B0** allow **SC2** for eg $400 = \pi r^2 h$ used $\frac{800}{r} = \frac{2\times 400}{r}\left(\text{or } \frac{2V}{r}\right) = \frac{2\times \pi r^2 h}{r}$ used to obtain $A = 2\pi r^2 + 2\pi rh$	must see all the steps if starting from $A = 2\pi r^2 + \frac{800}{r}$
9	(ii)		$\left(\frac{dA}{dr} =\right) 4\pi r - \frac{800}{r^2}$ oe	**B1** **B1**	for first term for second term	A maximum of **B1B0B1B0** is available if 2nd term left in terms of h
			$\left(\frac{d^2A}{dr^2} =\right) 4\pi + \frac{1600}{r^3}$ oe	**B1** **B1** **[4]**	**FT** to give non-zero first term **FT** negative power of r to give non-zero second term	
9	(iii)		their $\frac{dA}{dr} = 0$ seen	**M1**		
			$r = \sqrt[3]{\frac{200}{\pi}}$ or 3.99...isw	**A1**	**A0** for two or more values eg r = 0, 3.99 or ± 3.99	**NB** 3.99294542466
			$\frac{d^2A}{dr^2} > 0$ justified so minimum oe or check gradient either side of *their* positive r	**B1**	eg $4\pi > 0$ and $\frac{1600}{r^3} > 0$ **NB** 12π or 37.699… to 38	simply stating that second derivative is positive is insufficient
			A = 300 to 301	**A1** **[4]**	**NB** 300.530027931	ignore units

Question			Answer	Marks	Guidance	
10	(i)		$[AE^2 =] 32^2 + 15^2 - 2 \times 32 \times 15 \times \cos 116$	**M1**	**NB** 1669.836301 implies **M1**	**NB** 2181.72…or 46.709 implies **M1** (radians)
			AE = 40.86…to two or more s.f. isw	**A1**		
				[2]		
10	(ii)		$\frac{\sin A}{15} = \frac{\sin 116}{their\ 40.86}$ or $\frac{\sin E}{32} = \frac{\sin 116}{their\ 40.86}$	**M1***	$\cos A = \frac{32^2 + their\ 40.86^2 - 15^2}{2 \times 32 \times their\ 40.86}$ or $\cos E = \frac{15^2 + their\ 40.86^2 - 32^2}{2 \times 15 \times their\ 40.86}$	A = 19.3 and E = 44.7
			h = 32× *their* sin A or 15×*their* sin E	**M1dep***	or $\sqrt{32^2 - their\ AX^2}$ or $\sqrt{15^2 - their\ EX^2}$	X is the foot of the perpendicular from D to AE
			h = 10.5 to 10.6 isw	**A1**		**NB** 30.2 and 10.7
			Alternatively			
			$\frac{1}{2} \times 32 \times 15 \times \sin 116 = \frac{1}{2} \times their\ 40.86 \times h$	**M1**		
			$h = \frac{32 \times 15 \times \sin 116}{their\ 40.86}$	**M1**		
			h = 10.5 to 10.6 isw	**A1**		
				[3]		

Question			Answer	Marks	Guidance	
10	(iii)		$\frac{116}{360}\times\pi\times10^2$	M1	or $\frac{1}{2}\times10^2\times\frac{29\pi}{45}$ oe	**NB** $\frac{29\pi}{45}=2.02458...$ **M0** for ½×10²×116
			101 or 101.2 to 101.23	A1		
			$\frac{1}{2}\times32\times15\times\sin116$ soi	M1	or $\frac{1}{2}\times$ *their* AE $\times$ *their h* ; may be implied by 215.7 to 216	
			114 to 115 [m²]	A1 [4]		
10	(iv)		$\tan26=\frac{x}{80}$ or $\tan64=\frac{80}{x}$ or $\frac{x}{\sin26}=\frac{80}{\sin64}$ oe soi	M1	(*x* is length CF where F is foot of perpendicular from D to BC or length DG where G is foot of perpendicular from C to AD produced) **NB** *x* = 39(.0186070853) or BC = 71.(0…) may imply **M1**	*alternatively* **B3** for (area AEH) awrt 260 and (area HECB) 3640 – 3650 where H is the foot of the perpendicular from E to AB, or **B2** for one of these *Alternatively* **B3** for (area AEC) awrt 1060 and (area ABC) awrt 2840 or **B2** for one of these
			(area of field =) 80 × 32 + ½ × 80 × *their* 39.0 or $\frac{80}{2}\left[32+\left(32+\textit{their}\ \ 39.0\right)\right]$	M1	or 80 × [32 + *their* 39.0] – ½ × 80 × *their* 39.0	
			4120 to 4121	A1	**NB** 4120.74428341	allow **B3** for 4120 to 4121 not from wrong working
			area of ADE is 5.2 to 5.24% isw of area of ADCB	B1 [4]	or area of AECB is 94.76 to 94.8% isw of area ADCB	or 3905 > 3709 (area of car park > 90% of field)

Question			Answer	Marks	Guidance	
11	(i)		[year 10]			**B0** for any which are wrongly attributed
			A : 39 000	**B1**		
			B : 38 783.205…isw r.o.t. to 6 or more significant figures	**B1**	or 38 800 or 38 780 or 38 783	
			[year 11]			
			A : 40 000	**B1**		
			B : 40 722.365…isw r.o.t. to 6 or more significant figures	**B1**	or 40 700 or 40 720 or 40 722	
				[4]		
	(ii)		A: $\frac{17}{2}(2\times 30000+16\times 1000)$ or $\frac{17}{2}(30000+46000)$	**M1**	if **M0** and **B0** allow **SC1** for 30 000 + 31 000 +…+ 46 000 = 646 000	if **M0** then **B2** for complete sum written out and correct answer obtained
			= 646 000	**A1**	646 000 unsupported is **M0A0**	
			B: $\frac{25000(1.05^{17}-1)}{1.05-1}$	**M1**	if **M0** and **B0** allow **SC1** for 25 000 + 25 000 × 1.05 + …+ 25 000 × 1.05^{16} = 646 009.15…	if **M0** then **B2** for complete sum written out and correct answer obtained
			= 646 009.15…r.o.t. to 6 significant figures or more	**A1**	646 009…unsupported is **M0A0** **A0** for 646 000 only after award of **M1**	
				[4]		

Question	Answer	Marks	Guidance	
(iii)	$\frac{25000(1.05^n - 1)}{1.05 - 1} > M$	**M1**	allow eg $\frac{25000(1 - 1.05^n)}{-0.05} > M$	condone = or <
	$1.05^n > \frac{M + 500000}{500000}$ www oe	**A1**	at least one correct intermediate step to obtain correct inequality with 1.05^n isolated on LHS	
	$\log_{10} 1.05^n > \log_{10}\left(\frac{M + 500000}{500000}\right)$ oe eg $n \log_{10} 1.05 > \log_{10}(M + 500000) - \log_{10} 500000$	**A1**		condone omission of brackets on RHS and/or omission of base
	$n > \frac{\log_{10}(M + 500000) - \log_{10} 500000}{\log_{10} 1.05}$ www 26 cao	**A1**	following at least one correct intermediate step	
	Alternatively $\frac{25000(1.05^n - 1)}{1.05 - 1} > M$	**B1** **M1**	**NB** $n > 25.08\ldots$	**B0** for $n > 26$
	$\log_{10}(500\,000 \times 1.05^n) > \log_{10}(M + 500\,000)$ oe	**A1**	following at least one correct intermediate step	
	$\log_{10}(1.05^n) > \log_{10}(M + 500\,000) - \log_{10}500\,000$ oe	**A1**	following at least one correct intermediate step	
	$n > \frac{\log_{10}(M + 500000) - \log_{10} 500000}{\log_{10} 1.05}$ www	**A1**		
	26 cao	**B1** **[5]**	**NB** $n > 25.08\ldots$	**B0** for $n > 26$

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

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553

4752 Concepts for Advanced Mathematics (C2)

General Comments:

The paper was accessible to most candidates, but the questions contained enough stretch and challenge material to discriminate across the full ability range. Some candidates demonstrated a good understanding of the syllabus material and proficiency in the appropriate techniques, but lost a significant number of marks through poor (GCSE level) algebra and arithmetical slips.

A number of candidates still lose marks through working with prematurely rounded values, and then over-specifying the final result.

"Show that" requests are often not treated with sufficient rigour and a failure to show sufficient detail can often prove costly.

Most candidates presented their work neatly and clearly, but in a few cases work was very difficult to follow, with evidence of mistakes introduced when the candidate had misread their own work, perhaps because a minus sign was not clear or because a figure had been scribbled so casually as to be almost illegible. Candidates should understand the importance of presenting a clear mathematical argument, especially when there is a "show that" request in the question.

Comments on Individual Questions:

Question No. 1
Part (i)
This was very done well. A small minority of candidates failed to score, usually through misusing formulae associated with arithmetic or geometric progressions. A small number of candidates demonstrated the correct method, but slipped up with arithmetic.
Part (ii)
This was done very well, too. However, some candidates failed to appreciate that *d* had to be negative, and a few interchanged *a* and *d.*

Question 2
Part (i)
Most candidates successfully integrated and went on to obtain the correct answer. A few spoiled this by leaving "+ *c*" in the final answer, and a small number either differentiated or simply evaluated the integrand.
Part (ii) Nearly all candidates achieved the method mark by integrating, but a surprising number omitted the constant of integration thereby losing an easy mark.

Question 3
Part (i)
Most knew what to do, but many slipped up by making a sign error in the numerator or by working with a rounded or truncated value of $\log_{10}0.2$, thus losing the accuracy mark.
Part (ii)
Nearly all candidates correctly identified a suitable point on the curve. A few guessed wrongly and placed C to the right of B, and a very small number placed C off the curve altogether.

Question 4
Most candidates were familiar with this sort of question and obtained the first four marks without difficulty. A few slipped up with the arithmetic, and a similar number found the equation of the tangent. A very small number of candidates integrated or went straight to working with $y = mx + c$.

Question 5
Part (i)
This caused difficulties for many. Far too many candidates did not seem to be familiar with the correct terminology, and attempted to describe what was going on by using an equation or by a (usually long-winded) sentence. “Enlargement”, “transformation” and “translation” were often seen. Similarly, a significant number of candidates ignored the request for a single transformation and described two, usually a stretch and a translation.
Part (ii)
As with part (i), many candidates opted for more general explanations. Slightly more candidates were successful with part (ii) than part (i), but once again many candidates ignored the request for a single transformation.

Question 6
The vast majority of candidates tackled this question successfully. A few slipped up with the arithmetic in finding c, and a small minority worked with $y = mx + c$ with $m = 12x^3 – 7$ and failed to score.

Question 7
Part (i)
Most candidates scored full marks with this part of the question, although the quality of the sketches were variable. A few drew $y = 2x$ or $y = x^2$, and some candidates marked the y-intercept as (0, 2), losing an easy mark.
Part (ii)
Over half the candidates failed to score on this question, with difficulties seen by candidates attempting to combine the logarithms successfully. In attempting to make w the subject, candidates sometimes “divided by $\log_a$” or raised both sides to the power 10, and only a minority earning the method mark.

Question 8
This was done well by most candidates. A few slipped up with the first part, making sign or bracket errors, but most went on to find the correct values of $\sin x$. Nearly all worked with radians and found $\frac{\pi}{6}$ and $\frac{5\pi}{6}$ successfully. Some gave the other two values in terms of π and lost accuracy, and a small number of candidates decided that the values associated with $\sin^{-1}(–⅓)$ had to be outside the range.

Question 9
Part (i)
Most candidates scored full marks here, but poor algebra let some candidates down. A wide variety of solutions were seen, some of which very elaborate.
Part (ii)
In spite of the correct expression being given in part (i), some candidates worked with an expression involving h, which inhibited much further progress. Some candidates worked with 800^{-r} and some disregarded π or treated it as a variable. The majority, however, differentiated successfully to obtain full marks.
Part (iii)
A sizeable minority of candidates failed to score any marks in this part, beginning with an inequality in the second derivative. A good number of candidates started on the right track by setting the first derivative to zero, but then failed to make progress. Only rarely did candidates successfully find r and A and then use the second derivative correctly to establish that they had indeed found the minimum surface area.

Question 10
Part (i)
This was very well done. A few candidates worked in radians and lost the accuracy mark. A small minority misquoted the Cosine Rule or mis-used Pythagoras.
Part (ii)

Over half of the candidates failed to score on this part. Most worked with a perpendicular from D to AE and presumed that by doing so they were either bisecting angle ADE or the length AE. Those who correctly worked with the Sine Rule to find angle DAE or angle DEA generally went on to score full marks, although a few found the base of their triangle instead of the height.

Part (iii)

Most candidates knew what to do here and successfully found the area of the triangle and the area of the sector. A minority left it at that or slipped up with the subtraction and lost an easy mark. A few candidates used $\theta = 116$ radians, thus losing the first two marks, or converted to radians and then worked with their rounded decimal value, thus losing the accuracy mark.

Part (iv)

A significant number of candidates were unable to marshal the information to form a coherent strategy for solving this problem, and thus failed to score.

A wide variety of approaches were seen, with many opting for convoluted methods which were often partially successful, but usually lost accuracy towards the end. Some candidates clearly knew that the best approach was to find the length BC, but even though this only involved GCSE level maths, were unable to do so.

Question 11

Part (i)

The majority of candidates gained full marks on this question. A few candidates listed all the terms and lost accuracy on the way, and a few misused the formulae.

Part (ii)

This part of the question was also very well done, but some candidates did not give enough detail to “show that” Arif and Bettina earned the same amount to the nearest £100. A common mistake was to write down Bettina’s earnings as £646 000 without showing the value before rounding.

Part (iii)

A minority of candidates presented clear, concise solutions to derive the inequality, and went on to obtain the correct value of n. Many candidates, however, did not attempt the derivation or started with the final statement. A few went on to obtain the correct value of n, although 25 was a common wrong answer.

Unit level raw mark and UMS grade boundaries June 2017 series

For more information about results and grade calculations, see www.ocr.org.uk/ocr-for/learners-and-parents/getting-your-results

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 (AS)	Raw	72	63	58	53	49	45	0
			UMS	100	80	70	60	50	40	0
4752	01	C2 – MEI Concepts for advanced mathematics (AS)	Raw	72	55	49	44	39	34	0
			UMS	100	80	70	60	50	40	0
4753	01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	54	49	45	41	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
			UMS	100	80	70	60	50	40	0
4754	01	C4 – MEI Applications of advanced mathematics (A2)	Raw	90	67	61	55	49	43	0
			UMS	100	80	70	60	50	40	0
4755	01	FP1 – MEI Further concepts for advanced mathematics (AS)	Raw	72	57	52	47	42	38	0
			UMS	100	80	70	60	50	40	0
4756	01	FP2 – MEI Further methods for advanced mathematics (A2)	Raw	72	65	58	52	46	40	0
			UMS	100	80	70	60	50	40	0
4757	01	FP3 – MEI Further applications of advanced mathematics (A2)	Raw	72	64	56	48	41	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
			UMS	100	80	70	60	50	40	0
4761	01	M1 – MEI Mechanics 1 (AS)	Raw	72	57	49	41	34	27	0
			UMS	100	80	70	60	50	40	0
4762	01	M2 – MEI Mechanics 2 (A2)	Raw	72	56	48	41	34	27	0
			UMS	100	80	70	60	50	40	0
4763	01	M3 – MEI Mechanics 3 (A2)	Raw	72	58	50	43	36	29	0
			UMS	100	80	70	60	50	40	0
4764	01	M4 – MEI Mechanics 4 (A2)	Raw	72	53	45	38	31	24	0
			UMS	100	80	70	60	50	40	0
4766	01	S1 – MEI Statistics 1 (AS)	Raw	72	61	55	49	43	37	0
			UMS	100	80	70	60	50	40	0
4767	01	S2 – MEI Statistics 2 (A2)	Raw	72	56	50	45	40	35	0
			UMS	100	80	70	60	50	40	0
4768	01	S3 – MEI Statistics 3 (A2)	Raw	72	63	57	51	46	41	0
			UMS	100	80	70	60	50	40	0
4769	01	S4 – MEI Statistics 4 (A2)	Raw	72	56	49	42	35	28	0
			UMS	100	80	70	60	50	40	0
4771	01	D1 – MEI Decision mathematics 1 (AS)	Raw	72	52	46	41	36	31	0
			UMS	100	80	70	60	50	40	0
4772	01	D2 – MEI Decision mathematics 2 (A2)	Raw	72	53	48	43	39	35	0
			UMS	100	80	70	60	50	40	0
4773	01	DC – MEI Decision mathematics computation (A2)	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	58	53	48	43	37	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
			UMS	100	80	70	60	50	40	0
4777	01	NC – MEI Numerical computation (A2)	Raw	72	55	48	41	34	27	0

		UMS	100	80	70	60	50	40	0
4798	01 FPT - Further pure mathematics with technology (A2)	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 Statistics 1 MEI (Z1)	Raw	72	61	55	49	43	37	0
		UMS	100	80	70	60	50	40	0
G242	01 Statistics 2 MEI (Z2)	Raw	72	55	48	41	34	27	0
		UMS	100	80	70	60	50	40	0
G243	01 Statistics 3 MEI (Z3)	Raw	72	56	48	41	34	27	0
		UMS	100	80	70	60	50	40	0

GCE Quantitative Methods (MEI)

			Max Mark	a	b	c	d	e	u
G244	01 Introduction to Quantitative Methods MEI	Raw	72	58	50	43	36	28	0
G244	02 Introduction to Quantitative Methods MEI	Raw	18	14	12	10	8	7	0
		UMS	100	80	70	60	50	40	0
G245	01 Statistics 1 MEI	Raw	72	61	55	49	43	37	0
		UMS	100	80	70	60	50	40	0
G246	01 Decision 1 MEI	Raw	72	52	46	41	36	31	0
		UMS	100	80	70	60	50	40	0

Level 3 Certificate and FSMQ raw mark grade boundaries June 2017 series

For more information about results and grade calculations, see www.ocr.org.uk/ocr-for/learners-and-parents/getting-your-results

Level 3 Certificate Mathematics for Engineering

			Max Mark	a*	a	b	c	d	e	u
H860	01	Mathematics for Engineering	This unit has no entries in June 2017							
H860	02	Mathematics for Engineering								

Level 3 Certificate Mathematical Techniques and Applications for Engineers

				Max Mark	a*	a	b	c	d	e	u
H865	01	Component 1	Raw	60	48	42	36	30	24	18	0

Level 3 Certificate Mathematics - Quantitative Reasoning (MEI) (GQ Reform)

				Max Mark	a	b	c	d	e	u
H866	01	Introduction to quantitative reasoning	Raw	72	54	47	40	34	28	0
H866	02	Critical maths	Raw	60*	48	42	36	30	24	0
		*Component 02 is weighted to give marks out of 72	Overall	144	112	97	83	70	57	0

Level 3 Certificate Mathematics - Quantitive Problem Solving (MEI) (GQ Reform)

				Max Mark	a	b	c	d	e	u
H867	01	Introduction to quantitative reasoning	Raw	72	54	47	40	34	28	0
H867	02	Statistical problem solving	Raw	60*	41	36	31	27	23	0
		*Component 02 is weighted to give marks out of 72	Overall	144	103	90	77	66	56	0

Advanced Free Standing Mathematics Qualification (FSMQ)

				Max Mark	a	b	c	d	e	u
6993	01	Additional Mathematics	Raw	100	72	63	55	47	39	0

Intermediate Free Standing Mathematics Qualification (FSMQ)

				Max Mark	a	b	c	d	e	u
6989	01	Foundations of Advanced Mathematics (MEI)	Raw	40	35	30	25	20	16	0