GCE

Mathematics

Advanced Subsidiary GCE

Unit **4722:** Core Mathematics 2

Mark Scheme for January 2011

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

1 (i)	$(1+2x)^7 = 1 + 14x + 84x^2$	**B1**		Obtain $1 + 14x$	Needs to be simplified, so 1 not 1^7 and $14x$ not 7 x $2x$. B0 if other constant and/or x terms (from terms being sums not products). Must be linked by + sign, so 1, $14x$ is B0, but can still get M1A1 for third term.
		M1		Attempt third term	Needs to be product of 21 and an attempt at squaring $2x$ – allow even if brackets never seen, so $42x^2$ gets M1. No need to see powers of 1 explicitly.
		A1	**3**	Obtain $84x^2$	Coefficient needs to be simplified. Ignore any further terms, right or wrong. Can isw if they subsequently attempt 'simplification' eg dividing by 14, but they won't then get the ft mark in part (ii). If manually expanding brackets they need to consider all 7, but may not necessarily show irrelevant terms. If the expansion is attempted in descending powers, only giving the first three will gain no credit in (i), unless they subsequently attempt the relevant terms in (ii) when we will then give appropriate credit for the marks in (i). This only applies if no attempt at the required terms is made in (i). A full expansion with the required terms at the end is marked as per original scheme.
(ii)	$(2-5x)(1+14x+84x^2)$ coeff of $x^2 = -70 + 168$ $= 98$	**M1**		Attempt at least one relevant product	Could be just a single term, or part of a fuller expansion considering terms other than x^2 as well. Allow M1 even if second x^2 term isn't from a relevant product eg -70 + 84 gets M1 A0.
		A1ft		Obtain two correct unsimplified terms (not necessarily summed) – either coefficients or still with powers of x involved	Needs to come from two terms only, and can be awarded for unsimplified terms eg $-5x$ x $14x$… If fuller expansion then A0 if other x^2 terms, but ignore any irrelevant terms. If expansion is incorrect in (i) and candidate only gives a single final answer in (ii) then examiners need to check and award either M1 A1ft or M0.
		A1	**3** $\boxed{6}$	Obtain 98	Allow $98x^2$. Allow if part of a fuller expansion and not explicitly picked out. If clearly finding coefficient of x, allow as misread.

2 (i)	$u_1 = 5$, $u_2 = 8$, $u_3 = 11$	B1		Obtain at least one correct term	Just a list of numbers is fine, no need for labels.
		B1	2	Obtain all three correct terms	Ignore extra terms beyond u_3.
(ii)	arithmetic progression	B1	1	Any mention of arithmetic	Allow AP, but not description eg constant difference. Ignore extra description eg diverging as long as not wrong or contradictory.
(iii)	$S = {}^{100}/_2\,(305 + 602)$ or ${}^{100}/_2(2\text{x}305 + 99\text{x}3)$ $= 45{,}350$ (or $S_{200} - S_{100} = 60{,}700 - 15{,}350$)	M1		Attempt relevant S_n using correct formula	Must use correct formula to sum an AP – only exception is using $(\frac{1}{2}\,n - 1)d$ rather than $(n - 1)d$. Must use $d = 3$ (or their d from (i) as long as constant difference). If (i) is incorrect they can still get full marks in (iii) as independent. They need to be finding the sum of 99, 100, 101 or 200 terms and make a reasonable attempt at a value of a consistent with their n – if $n = 99$ then $a = 305$ / if $n = 100$ then $a = 5$ or $a = 305$ / if $n = 101$ then $a = 5$ / if $n = 200$ then $a = 5$. Allow slips on $a = 305$ as long as clearly intending to find u_{101}. If using $\frac{1}{2}\,n\,(a + l)$ then there also needs to be a reasonable attempt at l. Attempting to sum from $n = 101$ to $n = 200$ gets both method marks together (assuming that the attempt satisfies above conditions).
		M1		Attempt correct method to find required sum	$S_{200} - S_{101}$ is M0. M0 M1 is possible for correct method but with incorrect formula for S_N (but must be recognisable as attempt at sum of AP). Need to show subtraction to gain M1, just calculating two relevant sums is not yet enough. Still need $a = 5$ and $d = 3$.
		A1	3	Obtain 45,350	Answer only gets full marks.
			$\boxed{6}$		**SR:** if candidates attempt to manually add terms… **M1** Attempt to sum all terms from u_{101} to u_{200} **A2** Obtain 45,350

3 (i)	$0.5\times0.5\times\left\{\sqrt{0}+2\left(\sqrt{0.5}+\sqrt{1}+\sqrt{1.5}\right)+\sqrt{2}\right\}$ =1.82	M1		Attempt at least 4 correct y-coords, and no others	If first term of 0 not explicit then other 4 terms need to be seen. Could be implied by eg $\sqrt{}(4-3)$, or implied by a table with correct x-coords in one column and attempts at y-coords in second column. Allow rounded or truncated decimals. Allow an error in rearrangement eg $\sqrt{x} - \sqrt{3}$.
		M1		Attempt correct trapezium rule, any h, to find area between $x = 3$ and $x = 5$.	Correct structure ie 0.5 x (any h) x (first + last + 2 x middles) – no omissions allowed. The first y-coord should correspond to attempt when $x = 3$ (though may not be shown explicitly), and last to $x = 5$. It could be implied by using y_0 etc in rule, when these have already been attempted elsewhere and clearly labelled. It could use other than 4 strips, but these must be at equal widths. Using just one strip is M0. The 'big brackets' must be seen, or implied by later working (omission of these can lead to 3.41 or 1.91 or 6.21…). If ½ x k seen at start of rule then assume that ½ is part of a correct rule and the k is an incorrect strip width.
		M1		Use correct h (soi) for their y-values – must be at equal intervals	Must be in attempt at the trapezium rule, not Simpson's rule. Allow if muddle over placing y-values. Allow if one y-value missing (including first or last) or extra. Allow if ½ missing. Using $h = 2$ with only one strip is M0.
		A1	4	Obtain 1.82, or better	More accurate solution is 1.819479… Answer only is 0/4. Using integration is 0/4. Using trapezium rule on the result of an integration attempt is 0/4. Using 4 separate trapezia can get full marks. If other than 4 trapezia, mark as above.
(ii)	Underestimate as tops of trapezia are below curve	B1*		State underestimate	Ignore any reasons given.
		B1d*	2 $\boxed{6}$	Convincing reason referring to trapezia being below curve	Referring to gaps between curve and trapezia can get B1. Could use sketch with brief explanation (but sketch alone is B0) – must show more than one trapezium (but not nec 4) or imply this in the text. Trapezia must show clear intention to have top vertices on the curve. Sketching rectangles is B0. Triangle is B0. Explanation that refers to calculated area from integration is B0. Only referring to concave / convex is B0. Can get B1 for 'rate of change of gradient (or second derivative) is negative', but not for 'gradient is decreasing'.

4 (a)	$\log 5^{x-1} = \log 120$ $(x-1)\log 5 = \log 120$ $x - 1 = 2.97$ $x = 3.97$	**M1***		Introduce logarithms throughout (or $\log_5 120$ / $\log_{120} 5$) & drop power	Don't need to see base if taking logs on both sides, though if shown it must be the same base. If taking logs on one side only base must be explicit.
		A1		Obtain $(x-1)\log 5 = \log 120$, or equiv (eg $x - 1 = \log_5 120$)	Condone lack of brackets ie $x - 1 \log 5 = \log 120$, as long as clearly implied by later working.
		M1d*		Attempt to solve	Attempt at correct process ie ${}^{\log 120}/_{\log 5} \pm 1$ or equiv ${}^{(\log 120 + \log 5)}/_{\log 5}$. Allow M1 if ${}^{\log 120}/_{\log 5} \pm 1$ subsequently becomes $\log 24 \pm 1$, but M0 if log 24 appears before -1 is dealt with. Allow M1 if processing slips when evaluating ${}^{\log 120}/_{\log 5}$ eg 2.23 from incorrect brackets.
		A1	**4**	Obtain 3.97, or better	Allow more accurate solution, such as 3.975 and then isw if rounded to 3.98. However, 3.98 without more accurate answer seen is A0. Answer only is 0/3. Trial and improvement is 0/3.
(b)	$\log_2 x + \log_2 9 = \log_2(x+5)$ $\log_2(9x) = \log_2(x+5)$ $9x = x + 5$ $x = {}^5/_8$	**B1**		State or imply $2 \log 3 = \log 9$ or $\log 3^2$	Could be done at any stage. Must be correct statement when done, so LHS becoming $\log_2(x+9)$ in one step is B0. Condone lack of base throughout question.
		M1		Use $\log a + \log b = \log ab$, or equiv	Must be used to combine 2 (or more) terms of $\log x + \log k = \log (x+5)$, with k most typically (but not exclusively) 6, 8 or 9. Could move $\log_2 x$ and/or $\log_2 9$ across to RHS and then use $\log a - \log b$, but must still be $\log_2(x+5)$ as single term.
		A1		Obtain correct equation with single log term on each side (or single log = 0)	$\log_2 (9x) = \log_2 (x+5)$, $\log_2 x = \log_2 {}^{(x+5)}/_9$, $\log_2 9 = \log_2 {}^{(x+5)}/x$, $\log_2 {}^{(x+5)}/_{9x} = 0$. Allow A1 for correct equation with logs removed if several steps run together.
		A1	**4**	Obtain $x = {}^5/_8$	Allow 0.625
			$\boxed{8}$		

5 (i)	$4a = \frac{a}{1-r}$	M1		Equate $\frac{a}{1-r}$ to $4a$, or substitute $r = \frac{3}{4}$ into S_∞	S_∞ must be quoted correctly. Allow $4ar^0$ for $4a$. Initially using a numerical value for a is M0. Once equation in a is seen ie $4a = \frac{a}{1-r}$ assume that a has been cancelled if this subsequently becomes $4 = \frac{1}{1-r}$. If initial equation in a is never seen then assume that a =1 is being used and mark accordingly.
	$1 - r = \frac{1}{4}$	M1		Attempt to find value for r or evaluate S_∞	Need to get as far as attempting r. Need to see at least one extra line of working between initial statement and given answer. Substituting numerical value for a is M0 (so M1 M0 possible depending at what stage the substitution happens).
	$r = \frac{3}{4}$	A1	3	Obtain $r = \frac{3}{4}$ (or show $S_\infty = 4a$)	Allow $r = 0.75$.
(ii)	$\left(\frac{3}{4}\right)^2 a = 9$	M1*		Attempt use of ar^2	Must use $r = ¾$ not their incorrect value from (i). Must be clearly intended as ar^2, so $(^{3a}/_4)^2 = 9$ is M0, unless correct expression previously seen. Can use equivalent method with ratio of $^4/_3$ ie 9 x $(^4/_3)^2$.
	$a = 16$	M1d*		Equate to 9 and attempt to find a	Must get as far as attempting value for a.
		A1	3	Obtain $a = 16$	Answer only gets full credit.
(iii)	$S_{20} = \frac{16\left(1 - \frac{3}{4}^{20}\right)}{1 - \frac{3}{4}}$	M1		Attempt use of correct sum formula for a GP	Must be correct formula, with a = their (ii), $r = ¾$ and $n = 20$.
	$= 63.8$	A1	2	Obtain 63.8, or better	More accurate answer is 63.79704… **NB** using $n - 1$ rather than n in the formula gives 63.729 (M0), and using $n + 1$ gives 63.848 (M0). Must be decimal, rather than exact answer with power of ¾ .
			$\boxed{8}$		

6(a)	$\int \frac{x^3 + 3x^{\frac{1}{2}}}{x} \mathrm{d}x = \int \left(x^2 + 3x^{-\frac{1}{2}} \right) \mathrm{d}x$	M1		Simplify and attempt integration	Need to attempt to divide both terms by x, or multiply entire numerator by x^{-1} – allow if intention is clear even if errors when simplifying, or one term doesn't actually change. Need to simplify each of the two terms as far as x^n before integrating. For integration attempt, need to increase power by 1 for at least one term.
	$= \frac{1}{3}x^3 + 6x^{\frac{1}{2}} + c$	A1		Obtain at least one correct term	Allow unsimplified terms.
		A1		Obtain $\frac{1}{3}x^3 + 6x^{\frac{1}{2}}$	Coefficients must now be simplified. Could be $6\sqrt{x}$ for second term.
		B1	4	Obtain $+ c$	Not dependent on previous marks as long as no longer original function. B0 if integral sign or dx still present in answer. Ignore anything that appears on LHS of an equation eg $y = \ldots$, d$x = \ldots$ or even $\int = \ldots$
(b)(i)	$\int_2^a 6x^{-4} \mathrm{d}x = \left[-2x^{-3} \right]_2^a$	M1		Obtain integral of the form kx^{-3}	Any k, as long as numerical, including unsimplified. Allow $+ c$. Condone integral sign or dx still present.
	$= \frac{1}{4} - 2a^{-3}$	M1		Attempt F(a) – F(2)	Must be correct order and subtraction. $-2a^{-3} - {}^2/_8$ is M0 unless clear evidence suggesting that there was an intention to subtract and that this is a sign error. Not dependent on first M mark, so substituting into their integration attempt (eg kx^{-5}) can still get M1, but using kx^{-4} is M0.
		A1	3	Obtain $\frac{1}{4} - 2a^{-3}$	Allow ${}^2/_8$ for ¼ , but not – (${-}^2/_8$), but want 2 not ${}^6/_3$. A0 if $+ c$, integral sign or dx still present. isw any subsequent work, usually equating to 0 or writing as inequality.
(b)(ii)	$\frac{1}{4}$	B1ft	1 $\boxed{8}$	State $\frac{1}{4}$, following their **(i)**	Allow ${}^2/_8$. Do not allow 0 + ¼ . Must appreciate that limit is required not inequality so $<$, $\approx$, tends to ¼ , → ¼ etc are all B0. Picking large number for a and then concluding correctly is B1. Condone denominator changing from ∞ to 0 (or even 0 being used as top limit) if final answer correct. For the ft mark their (i) must be of form $a \pm bx^{-n}$, with $n \neq 4$. If solution in (i) is incorrect but candidate restarts in (ii) and produces ¼ oe with no wrong working then allow B1.

7(i)	$\tan 2x = \frac{1}{3}$ $2x = 18.4^\circ, 198.4^\circ$ $x = 9.22^\circ, 99.2^\circ$	**M1**		Attempt correct solution method	Attempt $\tan^{-1}(^1/_3)$ and then halve answer.
		A1		Obtain one of 9.22° or 99.2°, or better	Allow radian equiv (0.161 or 1.73).
		A1ft	**3**	Obtain second correct angle	Maximum of 2 marks if angles not in degrees. A0 if extra solutions in given range, but ignore extra outside range If M1 A0 given, award A1ft for adding 90° or $^\pi/_2$ to their angle. **SR:** if no working shown then allow B1 for each correct solution. Maximum of B1 if in radians, or extra solutions in given range. **SR:** if using tan $2x$ identity then… **M1** Attempt to find x from solving quadratic equation in tan $2x$, derived from correct tan $2x$ identity. **A1** Obtain at least one of 9.22° or 99.2°, or better (or radian equiv) **A1** Obtain second correct angle
(ii)	$3(1 - \sin^2 x) + 2\sin x - 3 = 0$ $3\sin^2 x - 2\sin x = 0$ $\sin x\,(3\sin x - 2) = 0$ $\sin x = 0$, $\sin x = ^2/_3$ $x = 0^\circ, 180^\circ$ $x = 41.8^\circ, 138^\circ$	**M1**		Use $\cos^2 x = 1 - \sin^2 x$, aef	Must be used not just stated. Must be used correctly, so $1 - 3\sin^2 x$ is M0.
		A1		Obtain $3\sin^2 x - 2\sin x = 0$	Allow aef, but must be simplified (ie no constant term; allow 0).
		M1		Attempt to solve equation to find solutions for x	Not dependent on first M1 so could get M0 M1 if $\cos^2 x = \sin^2 x - 1$ previously used. Must be quadratic in sin$x$ (must have sin$x$ term), but can still get M1 if constant term in their quadratic as well. Candidates need to be solving for x, so need to $\sin^{-1}$ at least one of the solutions to their quadratic. Must be acceptable method – if factorising then it must give correct lead term and one other on expansion (inc $c = 0$), if using formula then allow sign slips but no other errors. **SR** If solving the quadratic involves cancelling by sin x rather than factorising then M0, but give B1 if both 41.8° and 138° found (or radian equivs)
		A1		Obtain two of 0°, 180°, 41.8°, 138°	Must come from correct factorisation of correct quadratic equation ie $\sin x\,(3\sin x + 2) = 0$ leading to $\sin x = 0$ and hence $x = 0^\circ, 180^\circ$ is A0. Allow radian equivs – 0, π (or 3.14), 0.73, 2.41.
		A1	**5** $\boxed{8}$	Obtain all four angles	Must now all be in degrees, with no extra in given range (ignore any outside range). **SR** If no working out seen, then allow B1 for each of 41.8° and 138°, and B1 for both 0° and 180°. Maximum of B2 if in radians or extra solutions in given range.

8(i)	½ x 5^2 x sin θ = 8 sin θ = 0.64 θ = π – 0.694 = 2.45	**M1***		Attempt to solve (½)r^2sin θ = 8 to find a value for θ	Allow M1 if using r^2sin θ = 8. Need to get as far as attempting θ (acute or obtuse).
		M1d*		Attempt to find obtuse angle from their principal value.	ie π – θ in radians, or 180° – θ in degrees (eg 140.2°).
		A1	**3**	Obtain θ = 2.45, or better	Allow answer rounding to 2.45 with no errors seen. Must be in radians, and clearly intended as only final solution (eg underlined if acute angle still present). A0 if angle then becomes 2.45π ie this is not isw.
(ii)	½ x 5^2 x 2.447 = 30.6 hence area = 30.6 – 8 = 22.6 cm^2	**M1***		Attempt area of sector using (½)$r^2\theta$	Allow M1 if using $r^2\theta$. θ must be numerical and in radians, but allow if incorrect from their attempt at (i) eg 2.45π . Allow equivalent method using fraction of circle – must be $^{\theta}/_{2\pi}$ if using radians or $^{\theta}/_{360}$ if using degrees . Can get M1 if using an acute angle from (i) (gives 8.68 from 0.694 or 8.625 from 0.69). Using an angle of 0.64 is M0 – this is sin θ not θ. However, could still get M1 if using other angle clearly associated with θ in (i).
		M1d*		Attempt area of segment	Subtract 8 from their sector area. Allow M1 if new attempt made at area of triangle, even if their area isn't 8, eg could attempt ½ r^2 (θ – sin θ), with incorrect θ.
		A1	**3**	Obtain area of segment as 22.6	Allow more sig fig as long as it rounds to 22.6 with no errors seen. Units not needed, and ignore if incorrect.
(iii)	arc = 5 x 2.447 = 12.2	**B1ft**		State or imply arc length is 5θ	θ must be numerical and in radians, or equiv method in degrees. ft on their angle in (i), including acute angle – calculation may not be shown explicitly so examiners will need to check.
	chord = 2 x 5sin1.22 = 9.40 or $AB^2 = 5^2 + 5^2 - 2\times5\times5\times\cos 2.447$ or $^{AB}/_{\sin 2.45} = {^5}/_{\sin 0.347}$ or ½ x 5 x AB x sin 1.22 = 8	**M1**		Attempt length of chord AB	Any reasonable method, and allow radian / degree muddle when evaluating. If using cosine rule, then must be correct formula even if slip when evaluating. Need to get as far as a^2 = … but not nec √ . If using right-angled trig then must use ½ θ to find relevant side, and double it. Could use sine rule or area of a triangle with angle of ½ (π – θ).
		A1		Obtain 9.40 (allow 9.41)	Allow any answer in range 9.40 ≤ AB ≤ 9.41 (before rounding), including more sig fig, with no errors seen.
	perimeter = 12.2 + 9.40 = 21.6 cm	**A1**	**4**	Obtain perimeter as 21.6 (allow 21.7)	Allow any answer in range 21.6 ≤ perimeter ≤ 21.7 (before rounding), inc more sig fig, with no errors seen.
			$\boxed{10}$		

9(i)	$f(3) = -108 + 81 + 30 - 3 = 0$ hence $(x-3)$ is a factor	**B1**		Show that f(3) = 0, detail required	Substitute $x = 3$ and confirm f(3) = 0 – must show detail of substitution rather than just state f(3) = 0. Allow $f(3) = -4 \times 3^3 + 9 \times 3^2 + 10 \times 3 - 3 = 0$ for B1.
		B1	**2**	State $(x-3)$ as factor (allow $(3-x)$ as the factor)	Not dependent on first B1. Must be seen in (i) so no back credit from (ii). Allow if not explicitly stated as factor (and allow $f(x) = x - 3$). Ignore other factors if also given at this stage.
(ii)	$f(x) = (x-3)(-4x^2 - 3x + 1)$ or $f(x) = (3-x)(4x^2 + 3x - 1)$ or $f(x) = (x+1)(-4x^2 + 13x - 3)$ or $f(x) = (-x-1)(4x^2 - 13x + 3)$ or $f(x) = (1-4x)(x^2 - 2x - 3)$ or $f(x) = (4x-1)(-x^2 + 2x + 3)$	**M1**		Attempt complete division by $(x-3)$, or equiv (allow division by $(3-x)$)	Must be a full attempt to find three term quadratic. Can use inspection, but must be a reasonable attempt at middle term, with first and last correct. Can use coefficient matching, but must be full method with reasonable attempts at all 3 coefficients. Allow M1 if actually factorising $-f(x)$.
		A1		Obtain $-4x^2 - 3x + c$ or $-4x^2 + bx + 1$ (or the negative of these if dividing by $(3-x)$)	c, b non-zero constants. First option is likely to come from division, second option from inspection. Coefficient matching could lead to either. Allow A1 for negative of either of these from factorising $-f(x)$.
		A1	**3**	Obtain $(x-3)(-4x^2 - 3x + 1)$ (or $(3-x)(4x^2 + 3x - 1)$)	Needs to be written as a product as per request in question paper. Allow $-(x-3)(4x^2 + 3x - 1)$, but $(x-3)(4x^2 + 3x - 1)$ is A0. A0 if now 3 linear factors and product of linear and quadratic never seen. If using one of the other two correct factors then all three marks are available, and apply mark scheme as above ie M1 for full attempt at division or equiv, A1 for lead term plus one other correct and A1 for product of linear and quadratic. **SR:** If candidates initially state three linear factors and then expand to get the product of a linear and quadratic as requested award **B3** if fully correct and simplified otherwise **B0**.
(iii)	$-4x^2 - 3x + 1 = 0$ $(1-4x)(x+1) = 0$ $x = ¼$, $x = -1$	**M1**		Attempt to solve quadratic	If factorising, needs to give two correct terms when brackets expanded. If using formula allow sign slips only – need to substitute and attempt one further step. If completing the square must get to $(x + p) = \pm\sqrt{q}$, with reasonable attempts at p and q.
		A1	**2**	Obtain (¼ , 0), (–1, 0)	Condone only x values given rather than coordinates. Allow if $x = 3$ is still present as well.

(iv)	$\int f(x)dx = -x^4 + 3x^3 + 5x^2 - 3x$	**B1**		Obtain $-x^4 + 3x^3 + 5x^2 - 3x$	Allow unsimplified coefficients. Condone + c.
	$F(3) - F(\frac{1}{4}) = (36) - (^{-101}/_{256}) = 36^{101}/_{256}$ $F(\frac{1}{4}) - F(-1) = (^{-101}/_{256}) - (4) = -4^{101}/_{256}$	**M1***		Attempt F(3) – F(¼) or F(¼) – F(-1)	Allow use of incorrect limits from their (iii). Limits need to be in correct order, and subtraction. Allow slips when evaluating but clear subtraction attempt must be seen or implied at least once. If minimal method shown then it must appear to be a plausible attempt eg F(3) = 198 or even F(3) – F(¼) = 198.4.
		A1		Obtain at least one correct area, including decimal equivs	Obtain $36^{101}/_{256}$ or $^{9317}/_{256}$ or 36.4 or $-4^{101}/_{256}$ or $-^{1125}/_{256}$ or – 4.4 Can get A1 if both areas attempted and one is correct but the other isn't.
		M1d*		Attempt full method to find total area including dealing correctly with negative area	Need to see modulus of negative integral from attempt at F(¼) – F(-1) (just changing sign from –ve to +ve is sufficient). If values incorrect in (iii) then can only get this mark if their integral gives negative value. Need to have positive integral from F(3) – F(¼).
	Hence area = $36^{101}/_{256} + 4^{101}/_{256} = 40^{101}/_{128}$	**A1**	**5** $\boxed{12}$	Obtain $40^{101}/_{128}$ or $^{5221}/_{128}$ or 40.8	Allow exact fraction (including unsimplified ie $^{10442}/_{256}$), or decimal answer to 3dp or better (rounding to 40.8 with no errors seen) **SR:** If candidate attempts F(3) – F(¼) **and** F(-1) – F(¼) as an alternative method for dealing with negative area then mark as **B1** correct integral **M2** complete method **A1** obtain one correct area **A1** obtain correct total area Any attempts using this method must be fully supported by evidence of intention, especially -1 as top limit and ¼ as bottom limit used consistently throughout integration attempt. It should not be awarded if candidate appears to have simply confused their order of subtraction.

Guidance for marking C2

Accuracy
Allow answers to 3sf or better, unless an integer is specified or clearly required.
3sf is sometimes explicitly specified in a question - this is telling candidates that a decimal is required rather than an exact answer eg in logs, and more than 3sf should not be penalised unless stated in mark scheme.
If more than 3sf is given, allow the marks for an answer that rounds to the one in the mark scheme, with no obvious errors.

Extra solutions
Candidates will usually be penalised if an extra, incorrect, solution is given. However, in trigonometry questions only look at solutions in the given range and ignore any others, correct or incorrect.

Solving equations
With simultaneous equations, the method mark is given for eliminating one variable allowing sign errors, addition / subtraction confusion or incorrect order of operations. Any valid method is allowed ie balancing or substitution for two linear equations, substitution only if at least one is non-linear.

Solving quadratic equations
Factorising - candidates must get as far as factorising into two brackets which, on expansion, would give the correct coefficient of x^2 and at least one of the other two coefficients.
Completing the square - candidates must get as far as $(x + p) = \pm \sqrt{q}$, with reasonable attempts at p and q.
Using the formula - candidates need to substitute values into the formula and do at least one further step. Sign slips are allowed on b and $4ac$, but all other aspects of the formula must be seen correct, either algebraic or numerical. If the algebraic formula is quoted then candidates are allowed to make one slip when substituting their values. Condone not dividing by $2a$ as long as it has been seen earlier.

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

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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Head office
Telephone: 01223 552552
Facsimile: 01223 552553