RECOGNISING ACHIEVEMENT

GCE

Mathematics

Advanced Subsidiary GCE

Unit **4722:** Core Mathematics 2

Mark Scheme for January 2012

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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.

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Annotations

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

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 or B 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)		perimeter = (4.2 × 12) + (2 × 12) = 74.4 cm	M1*	Use $s = 12\theta$	Allow equiv method using fractions of a circle If working in degrees, must use 180 and π (or 360 and 2π) to find angle M0 if 12θ used with θ in degrees M0 if 4.2π used instead of 4.2 M1 if attempting arc of minor sector (12 × 2.1 (or better))
				M1d*	Attempt perimeter of sector	Add 24 to their attempt at 12θ M0 if using minor sector
				A1 [3]	Obtain 74.4	Units not required Allow a more accurate answer that rounds to 74.4, with no errors seen (poss resulting from working in degrees)
1	(ii)		area = $\frac{1}{2} \times 12^2 \times 4.2$ = 302.45 cm^2	M1	Use $A = (\frac{1}{2})12^2\theta$	Condone omission of $\frac{1}{2}$, but no other error Allow equiv method using fractions of a circle M0 if $(\frac{1}{2})12^2\theta$ used with θ in degrees M0 if 4.2π used instead of 4.2 M1 if attempting area of minor sector
				A1 [2]	Obtain 302, or better	Units not required Allow 302 or a more accurate answer that rounds to 302.4, with no errors seen (could be slight inaccuracy if using fractions of a circle)

Question			Answer	Marks	Guidance	
2	(i)		$0.5 \times 1.5 \times \{\lg 9 + 2(\lg 12 + \lg 15 + \lg 18) + \lg 21\}$ $= 6.97$	**B1**	State, or use, y-values of lg9, lg12, lg15, lg18 and lg21	B0 if other y-values also found (unless not used in trap rule) Allow decimal equivs (0.95, 1.08, 1.18, 1.26, 1.32 or better)
				M1	Attempt correct trapezium rule, any h, to find area between $x = 4$ and $x = 10$	Correct structure required, including correct placing of y-values The 'big brackets' must be seen, or implied by later working Could be implied by stating general rule in terms of y_0 etc, as long as these have been attempted elsewhere and clearly labelled Could use other than 4 strips as long as of equal width Using x-values is M0 Can give M1, even if error in y-values eg using 9, 12, 15, 18, 21 or using now incorrect function eg $\log(2x) + 1$ Allow BoD if first or last y-value incorrect, unless clearly from an incorrect x-value (eg $y_0 = \lg 7$, but $x = 4$ not seen)
				M1	Use correct h in recognisable attempt at trap rule	Must be in attempt at trap rule, not Simpson's rule Allow if muddle over placing y-values (but M0 for x-values) Allow if $\frac{1}{2}$ missing Allow other than 4 strips, as long as h is consistent Allow slips which result in x-values not equally spaced
				A1	Obtain 6.97, or better	Allow answers in the range [6.970, 6.975] if >3sf Answer only is 0/4 Using the trap rule on result of an integration attempt is 0/4 Using 4 separate trapezia can get full marks – if other than 4 trapezia then mark as above However, using only one trapezium is 0/4
				[4]		

Question			Answer	Marks	Guidance	
2	(ii)		tops of trapezia are below curve	B1 [1]	Convincing reason referring to the top of a trapezium being below the curve, or the gap between a trapezium and the curve – explanation must be sufficient and fully correct	B0 for 'the trapezium is below the curve' (ie 'top' not used) Sketch with explanation is fine, even if just arrow and 'gap' Sketching rectangles / triangles is B0, as is a trapezium that doesn't have both top vertices intended to be on curve Concave / convex is B0, as is comparing to exact area B1 for reference to decreasing gradient
3	(i)		$20 \times 4^3 \times a^3 = 160$ $1280a^3 = 160$ $a^3 = \frac{1}{8}$ $a = \frac{1}{2}$	M1	Attempt relevant term	Must be an attempt at a product involving a binomial coeff of 20 (not just ${}^6C_3$ unless later seen as 20), 4^3 and an intention to cube ax (but allow for ax^3) Could come from $4^6(1 + {}^{ax}/_4)^6$ as long as done correctly Ignore any other terms if fuller expansion attempted
				A1	Obtain correct $1280a^3$, or unsimplified equiv	Allow $1280a^3x^3$, or $1280(ax)^3$, but not $1280ax^3$ unless a^3 subsequently seen, or implied by working
				M1	Equate to 160 and attempt to solve for a	Must be equating coeffs – allow if x^3 present on both sides (but not just one) as long as they both go at same point Allow for their coeff of x^3, as long as two, or more, parts of product are attempted eg $20ax^3$ / $64ax^3$ Allow M1 for $1280a = 160$ (giving $a = 0.125$) M0 for incorrect division (eg giving $a^3 = 8$)
				A1 [4]	Obtain $a = \frac{1}{2}$	Allow 0.5, but not an unsimplified fraction Answer only gets full credit, as does T&I **SR: max of 3 marks** for $a = 0.5$ from incorrect algebra, eg $1280ax^3 = 160$, so $a = 0.5$ would get M1A1(implied)B1

Question			Answer	Marks	Guidance	
3	(ii)		$4^6 + 6 \times 4^5 \times \frac{1}{2} = 4096 + 3072x$	**B1**	State 4096	Allow 4^6 if given as final answer Mark final answer – so do not isw if a constant term is subsequently added to 4096 from an incorrect attempt at second term eg using sum rather than product
				B1FT	State $3072x$, or $(6144 \times \text{their } a)x$	Must follow a numerical value of a, from attempt in part **(i)** Must be of form kx so just stating coeff of x is B0 Mark final answer B2 can still be awarded if two terms are not linked by a '+' sign – could be a comma, 'and', or just two separate terms **SR: B1** can be awarded if both terms seen as correct, but then 'cancelled' by a common factor
				[2]		
4	(i)		$b^2 = 2.4^2 + 2^2 - 2 \times 2.4 \times 2 \times \cos 40^{\circ}$ $b = 1.55$ km	**M1**	Attempt use of correct cosine rule	Must be correct formula seen or implied, but allow slip when evaluating eg omission of 2, incorrect extra 'big bracket' Allow M1 even if subsequently evaluated in rad mode (4.02) Allow M1 if expression is not square rooted, as long as LHS was intended to be correct ie $b^2 = \ldots$ or $AC^2 = \ldots$
				A1	Obtain 1.55, or better	Actual answer is 1.55112003… so allow more accurate answer as long as it rounds to 1.551
				[2]		Units not required

Question			Answer	Marks	Guidance	
4	(ii)		$\frac{\sin A}{2} = \frac{\sin 40}{1.55}$ $\frac{\sin C}{2.4} = \frac{\sin 40}{1.55}$	M1	Attempt to find one of the other two angles in triangle	Could use sine rule or cosine rule, but must be correct rule attempted Need to substitute in and rearrange as far as sin A = … / cos A = … etc, but may not actually attempt angle
			$A = 56^{\circ}$ $C = 84^{\circ}$ hence bearing is 124°	A1	Obtain $A = 56^{\circ}$, or $C = 84^{\circ}$	Any angle rounding to 56° or 84°, and no errors seen
				A1ft [3]	Obtain 124°, following their angle A or C	Allow any answer rounding to 124 Finding bearing of A from C is A0 – ie not a MR
4	(iii)		$d = 2 \times \sin\ 40^{\circ}$ $= 1.29$ km	M1	Attempt perpendicular distance	Any valid method, but must attempt required distance Can still get M1 if using incorrect or inaccurate sides / angles found earlier in question Allow M1 if evaluated in rad mode (1.49)
				A1 [2]	Obtain 1.29, or better	Allow more accurate final answers in range [1.285, 1.286] A0 for inaccurate answers due to PA elsewhere in question (typically C = 84.4, so A = 55.6, so d = 1.28) Units not required
5	(i)		$f(3) = 54 + 27 - 51 + 6$ $= 36$	M1	Attempt f(3)	Allow equiv methods as long as remainder is attempted A0 if answer subsequently stated as –36 ie do not isw
				A1 [2]	Obtain 36	

Question			Answer	Marks	Guidance	
5	(ii)		$f(x) = (x-2)(2x^2 + 7x - 3)$	**B1**	State or imply that $(x-2)$ is a factor	Just stating this is enough for B1, even if not used Could be implied by attempting division, or equiv, by $(x-2)$
				M1	Attempt full division, or equiv, by $(x \pm 2)$	Must be complete method – ie all three terms attempted If long division then must subtract lower line (allow one slip); if inspection then expansion must give correct first and last terms and also one of the two middle terms of the cubic; if coefficient matching then must be valid attempt at all 3 quadratic coeffs, considering all relevant terms each time Allow M1 for valid division attempt by $(x+2)$
				A1	Obtain $2x^2$ and at least one other correct term	If coeff matching then allow for stating values eg $A = 2$ etc
				A1 **[4]**	Obtain $(x-2)(2x^2 + 7x - 3)$	Must be stated as a product
5	(iii)		$b^2 - 4ac = 73$ > 0 hence 3 roots	**M1**	Attempt explicit numerical calculation to find number of roots of quadratic	Could attempt discriminant (allow $b^2 \pm 4ac$) , or could use full quadratic formula to attempt to find the roots themselves (implied by stating decimal roots); M0 for factorising unless their incorrect quotient could be factorised M0 for '3 roots as positive discriminant' but no evidence
				A1ft **[2]**	State 3 roots ($\sqrt{}$ their quotient) Condone no explicit check for repeated roots	Sufficient working must be shown, and all values shown must be correct Discriminant needs to be 73 (allow $7^2 - 4(2)(-3)$) Quadratic formula must be correct, though may not necessarily be simplified as far as $\frac{1}{4}(-7 \pm \sqrt{73})$ Need to state no. of roots – just listing them is not enough **SR:** if a conclusion is given in part **(iii)** then allow evidence from part **(ii)** eg finding actual roots

Question			Answer	Marks	Guidance	
6	(i)		$u_1 = 80$	B1	State 80	Just a list of numbers is fine, no need for labels
			$u_2 = 75$, $u_3 = 70$	B1 [2]	State 75 and 70	Ignore extra terms beyond u_3
6	(ii)		$S_{20} = \frac{20}{2}(2 \times 80 + 19 \times -5)$ $= 650$	M1	Show intention to sum 1st 20 terms of an arithmetic sequence	Any recognisable attempt at the sum of an AP, including manual addition of terms – no need to list all of the terms, but intention (inc no of terms) must be clear
				M1	Attempt use of correct sum formula for an AP, with $n = 20$, $a = 80$, $d = \pm 5$	Must use correct formula – only exception is $10(2a + 9d)$ If using $\frac{1}{2}n(a + l)$, must be a valid attempt at l, either from $a + 19d$ or from u_{20}
				A1 [3]	Obtain 650	Answer only gets full marks, as does manual addition

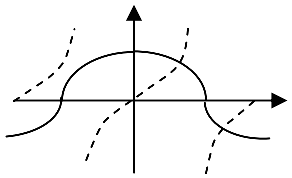
Question			Answer	Marks	Guidance	
6	(iii)		$r = \frac{60}{80} = 0.75$ $u_p = 80 \times 0.75^2 = 45$ $85 - 5p = 45$ $p = 8$	**M1***	Attempt to find u_p	Allow any valid method, inc informal Allow if first and/or second terms of their GP are incorrect Allow ratio of $\frac{4}{3}$ if used correctly to find 3rd term ($60 \div \frac{4}{3}$)
				A1	Obtain 45	Seen or implied **SR: M1* A0** if 45 results from using $u_n = ar^n$. The following M1A1 are still available.
				M1d*	Attempt to solve $85 - 5p = k$	k must be from attempt at third term of GP LHS could be $80 + (p-1)(-5)$, from p^{th} term of the AP, but M0 if incorrect eg $80 + (p-1)(5)$
				A1 **[4]**	Obtain $p = 8$	Allow full credit for answer only Any variable, including n
6	(iv)		$S_\infty = \frac{80}{1-0.75}$ $= 320$	**M1**	Use correct formula for sum to infinity	Must be from attempt at r for their GP
				A1 **[2]**	Obtain 320	A0 for 'tends to 320', 'approximately 320' etc

Question			Answer	Marks	Guidance	
7	(a)		$\int\left(x^3-6x^2+4x-24\right)\mathrm{d}x$	M1	Expand and attempt in	Must attempt to expand brackets first Increase in power by 1 for the majority of their terms Allow if the constant term disappears
			$=\frac{1}{4}x^4-2x^3+2x^2-24x+c$	A1ft	Obtain at least two correct (algebraic) terms	At least two correct from their expansion Allow for unsimplified coefficients
				A1	Obtain fully correct expression, inc + c	All coefficients now simplified A0 if integral sign or dx still present in their answer (but allow $\int$ = …)
				[3]		
7	(b)		$\int 6x^{\frac{3}{2}}\mathrm{d}x=\frac{12}{5}x^{\frac{5}{2}}$	M1	Obtain $kx^{\frac{5}{2}}$	Any exact equiv for the index
				A1	Obtain $\frac{12}{5}x^{\frac{5}{2}}$, or any exact equiv	Including unsimplified coefficient
			$\int\left(8x^{-2}-2\right)\mathrm{d}x=-8x^{-1}-2x$	M1	Obtain at least one of $-8x^{-1}$ and $-2x$	Allow M1 even if –2 disappears Could be part of a sum or difference; with consistent signs
			$\left[\frac{12}{5}x^{\frac{5}{2}}\right]_0^1=\frac{12}{5}$ $\left[-8x^{-1}-2x\right]_1^2=(-8)-(-10)=2$	A1	Obtain $-8x^{-1}-2x$	Allow unsimplified expressions If subtraction from other curve attempted before integration then allow for $8x^{-1}+2x$
			hence total area = $\frac{22}{5}$	B1	State or imply that pt of intersection is (2, 0)	Could imply by using it as a limit
				M1	Use limits correctly at least once	Must be using correct x limits, and subtracting, with the appropriate function (allow implicit use of x = 0); the only error allowed is an incorrect (2, 0) Allow use in any function other than the original, inc from differentiation

7	(b) con			M1	Attempt fully correct process to find required area	Use both pairs of limits correctly (allow an incorrect (2, 0)), in appropriate functions and sum the two areas
				A1	Obtain $\frac{22}{5}$, or any exact equiv	
				[8]		Answer only is 0/8, as no evidence is provided of integration
			Alternative scheme for those who integrate between the curves and the y-axis Some solutions may involve both integration onto x-axis and y-axis, so you may need to combine aspects of both schemes	M1	Obtain $ky^{\frac{5}{3}}$	
				A1	Obtain $6^{\frac{-2}{3}} \times \frac{3}{5} \times y^{\frac{5}{3}}$	
				M1	Obtain $k\sqrt{2+y}$	
				A1	Obtain $2\sqrt{8}\sqrt{2+y}$	
				M1	Use limits of 6 (and 0) correctly at least once	
				M1	Attempt correct method to find required area – correct use of limits required	
				A2	Obtain 4.4	

Question			Answer	Marks	Guidance	
8	(a)		$\log 7^{w-3} = \log 184$ $(w-3)\log 7 = \log 184$ $w - 3 = 2.68$ $w = 5.68$	**M1***	Rearrange, introduce logs and use $\log a^b = b \log a$	Must first rearrange to $7^{w-3} = k$, with k from attempt at 180±4, before introducing logs Can use logs to any base, as long as consistent on both sides If taking $\log_7$ then base must be explicit
				A1	Obtain $(w-3)\log 7 = \log 184$, or equiv eg $w - 3 = \log_7 184$	Condone lack of brackets ie $w - 3 \log 7 = \log 184$, as long clearly implied by later working
				M1d*	Attempt to solve linear equation	Attempt at correct process ie $w = {}^{\log k}/_{\log 7} \pm 3$, or equiv following expanding bracket first
				A1	Obtain 5.68, or better	More accurate final answer must round to 5.680
				[4]		Answer only, or T&I, is 0/4

Question			Answer	Marks	Guidance	
8	(b)		$\log xy = \log 3$ hence $xy = 3$ $3x + y = 10$ $x(10 - 3x) = 3$ $3x^2 - 10x + 3 = 0$ $(3x - 1)(x - 3) = 0$ **or** $^1/_3(10 - y)y = 3$ $y^2 - 10y + 9 = 0$ $(y - 1)(y - 9) = 0$ $x = {}^1/_3,\ y = 9 \quad x = 3, y = 1$	M1	Attempt correct use of log law to combine 2 (or more) logs	Must be used on at least two of log$x$ / log$y$ / log3 Allow log $(^{xy}/_3)$ (condone no = 0)
				A1	Obtain $xy = 3$	aef as long as no logs present, or equiv in one variable
				B1	Obtain $3x + y = 10$	aef as long as no logs present, or equiv in one variable **SR:** if A0 B0 given above, then allow **B1** for a correct combination of the 2 eqns eg $9x + 3y = 10xy$ (others poss)
				M1	Attempt to eliminate one variable, and solve the resulting three term quadratic	Elimination of one variable could happen prior to removal of logs from one equation – as long as logs are then removed completely to obtain three term quadratic
				A1	Obtain two correct values	Could be for two values for one variable, or for one pair of correct (x, y) values
				A1 **[6]**	Obtain $x = {}^1/_3,\ y = 9$ and $x = 3, y = 1$	Pairings must be clear, but not necessarily as coordinates **SR: B1** for each pair of correct (x, y) values but no method **M1A1B1B1** - 1 pair of (x, y) values, from 2 correct eqns but no other method shown (but 6/6 if both pairs found)

Question			Answer	Marks	Guidance	
9	(i)			B1	Correct shape for $y = k\cos(\frac{1}{2}x)$	Must show intention to pass through $(-\pi, 0)$ and $(\pi, 0)$ Should be roughly symmetrical in the y-axis, but condone slightly different y-values at -2π and 2π Ignore graph outside of given range
				B1	Correct shape for $y = \tan(\frac{1}{2}x)$	Must show intention to pass through $(-2\pi, 0)$, $(0, 0)$, $(2\pi, 0)$ Asymptotes need not be marked, but there should be no clear overlap of the limbs, nor significant gaps between them Ignore graph outside of given range
				B1 **[3]**	(0, 3) stated or clearly indicated	Can still be given if $y = 3\cos(\frac{1}{2}x)$ graph is incorrect or not attempted If more than one point marked on the y-axis then mark the label on the graph intercept

Question			Answer	Marks	Guidance	
9	(ii)		$\frac{\sin(\frac{1}{2}x)}{\cos(\frac{1}{2}x)} = 3\cos(\frac{1}{2}x)$ $\sin(\frac{1}{2}x) = 3\cos^2(\frac{1}{2}x)$ $\sin(\frac{1}{2}x) = 3(1 - \sin^2(\frac{1}{2}x))$	**M1**	Attempt use of relevant identities to show given equation	Must attempt use of both identities; these must be correct but allow poor notation eg using $\frac{\sin}{\cos}(\frac{1}{2}x)$ and/or $3(1 - \sin^2)(\frac{1}{2}x)$ could get M1A0
			$3\sin^2(\frac{1}{2}x) + \sin(\frac{1}{2}x) - 3 = 0$ **AG**	**A1**	Obtain given equation, with no errors seen	Use both identities correctly, to obtain given equation Brackets around the $\frac{1}{2}x$ not required
			$\sin(\frac{1}{2}x) = 0.847, -1.18$ $\frac{1}{2}x = 1.01, 2.13$ $x = 2.02, 4.26$	**M1**	Attempt to solve given quadratic to find solution(s) for $\sin(\frac{1}{2}x)$	Must use quadratic formula (or completing the square) – M0 if attempting to factorise Allow variables other than $\sin(\frac{1}{2}x)$, eg $y =$, or even $x =$ Allow –1.18 to be discarded at any stage
				M1	Attempt to solve $\sin(\frac{1}{2}x) = k$	Attempt $\sin^{-1}$ (their root) and then double the answer
				A1	Obtain one correct angle	Allow in degrees (116° and 244°)
				A1	Obtain both correct angles, and no others in given range	Must both be in radians (allow equivs as multiples of π) A0 if extra, incorrect, angles in given range of $[-2\pi, 2\pi]$ but ignore any outside of given range **SR:** if no working shown then allow B1 for each correct solution (max of B1if in degrees, or extra solns in range)
				[6]		

Guidance for marking C2

Accuracy
Allow answers to 3sf or better, unless an integer is specified or clearly required.
Answers to 2 sf are penalised, unless stated otherwise in the mark scheme.
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 falls within the guidance given 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. This method is only credited if it is possible to factorise the quadratic – if the roots are surds then candidates are expected to use either the quadratic formula or complete the square.
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. The division line must extend under the entire numerator (seen or implied by later working). 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.

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