OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics

Advanced Subsidiary GCE

Unit **4722:** Core Mathematics 2

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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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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1. **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

2. **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 workin[...]ana establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a c answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this wo 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 specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is use that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no m sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, t 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 previous results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permi (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded f intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, e 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 mar 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candida question-by-question.

f Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicat Candidates are expected to give numerical answers to an appropriate degree of accuracy, with 3 significant figu the norm. Small variations in the degree of accuracy to which an answer is given (eg 2 or 4 significant figures w expected) should not normally be penalised, while answers which are grossly over- or under-specified should no the loss of a mark. The situation regarding any particular cases where the accuracy of the answer may be a ma 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 m... 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... 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 questio... unaltered, mark according to the scheme but following through from the candidate's data. A penalty is then appl... generally appropriate, though this may differ for some units. This is achieved by withholding one A or B mark in...

Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance	
1	(i)		$(3 + 2x)^5 = 243 + 810x + 1080x^2 + 720x^3 + 240x^4 + 32x^5$	M1*	Attempt expansion – products of powers of 3 and $2x$	Must attempt at least Each term must be an att binomial coeffs if used. Allow M1 for no, or incorrect, Powers of 3 and $2x$ must be intend each term (allow slips if intention Allow M1 even if powers used inc $2x^3$ not $(2x)^3$ can get M1. Allow M1 for powers of $^2/_3x$ from any k (allow if powers only applie
				M1d*	Attempt to use correct binomial coefficients	At least 5 correct from 1, 5, 10, 10 incorrect (but not if raised to a pow May be implied rather than explici Must be numerical eg $^5C_1$ is not en They must be part of a product wit The coefficient must be used in an term ie 5 x 3^3 x $(2x)^2$ is M0. Allow M1 for correct coefficients $k(1 + {}^2/_3x)^5$, any k.
				A1	Obtain at least four correct simplified terms	Either linked by '+' or as part of a l
				A1	Obtain fully correct expansion	With all coefficients simplified. Terms must be linked by '+' and no
				[4]		**SR for reasonable expansion atte** M2 for attempt involving all 5 bra quintic with at most one term miss A1 for four correct, simplified, ter A1 for fully correct, simplified, ex

Question			Answer	Marks	Guidance	
1	(ii)		$(3 + 2x)^5 + (3 - 2x)^5$	M1	Attempt to change signs of relevant terms	Must change the sign … their expansion, and no o… Expansion in part (i) must n… Allow M1 even if no attempt t… or if difference rather than sum fo… If expanding $(3 - 2x)^5$, then it mus… attempt, involving the product of c… powers of 2 and powers of $-3x$, an… the correct sign.
			$= 486 + 2160x^2 + 480x^4$	A1 FT	Obtain $486 + 2160x^2 + 480x^4$, from their **(i)**	Must have been a 6 term quintic i… A0 if subsequent division by a co…
				[2]		

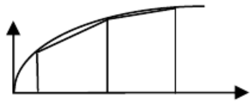
Question			Answer	Marks	Guidance	
2	(i)		$\int(x^2-2x+5)\mathrm{d}x = \frac{1}{3}x^3 - x^2 + 5x + c$	M1	Attempt integration	An increase in power by ... Allow if the +5 disappears.
				A1	Obtain two correct (algebraic) terms	Allow if the coefficient if x^2 isn't y
				A1	Obtain fully correct expression (allow no + c)	Allow if the coefficient if x^2 isn't y A0 if integral sign or dx still prese allow ∫ = ...). A0 if a list of terms rather than an
				[3]		
2	(ii)		$y = \frac{1}{3}x^3 - x^2 + 5x + c$	M1*	State or imply y = their integral from (i)	Must have come from integration a have been gained in part (i). Allow slips when transferring expr Can still get this M1 if no + c. The y does not have to be explicit eg 11 = F(3) (but not by 3 = F(11) Using definite integration with lim M0 if they start with y = their integ attempt to use $y - 11 = m(x - 3)$. T gains no credit.
			$11 = 9 - 9 + 15 + c \Rightarrow c = -4$	M1d*	Attempt to find c using (3, 11)	Need to get as far as attempting c. M1 could be implied by eg 11 = 9 attempt to include a constant to ba though + c never actually seen. M0 if no + c seen or implied. M0 if using $x = 11$, $y = 3$.
			hence $y = \frac{1}{3}x^3 - x^2 + 5x - 4$	A1	Obtain $y = \frac{1}{3}x^3 - x^2 + 5x - 4$	Coeff of x^2 now needs to be simpl Must be an equation ie y = ..., so A 'equation = ...' Allow aef, such as $3y = x^3 - 3x^2$ +
				[3]		

Question			Answer	Marks	Guidance	
3	(i)		$72° = 72 \times {}^{\pi}/_{180} = {}^{2\pi}/_{5}$ radians	B1 **[1]**	State $\frac{2\pi}{5}$, $\frac{2}{5}\pi$ or 0.4π	Must be simplified. B0 for decimal equiv (1.… value seen but then given i…
3	(ii)		$\frac{1}{2} \times r^2 \times {}^{2\pi}/_5 = 45\pi$	M1	Equate attempt at area using $(\frac{1}{2})r^2\theta$ to 45π and attempt to solve for r	Condone omission of ½, but no o… Must be equated to 45π (so M0 fo… $(\frac{1}{2})r^2 \times {}^2/_5 = 45$ (assuming π has b… Allow M1 for using 0.4 or 1.26π. Allow if using incorrect angle fro… clearly intended to be in radians. Allow equivalent method using fr… Valid method using degrees can g… Must get as far as attempt at r. Allow M1 for T&I, as long as com…
			$r = 15$ cm	A1 **[2]**	Obtain $r = 15$	Must be exact working only – any… (but allow 15.0 if giving previousl… Any evidence of 15 having come f… inaccurate answer is A0.
3	(iii)		area triangle = $\frac{1}{2} \times 15^2 \times \sin({}^{2\pi}/_5) = 106.99$	M1*	Attempt area of triangle using $(\frac{1}{2})r^2\sin\theta$	Condone omission of ½, but no o… Must be using their r and angle lin… Could be using degrees or radians… Allow even if evaluated in incorre… 2.47, rad mode gives 28.66). If using a right-angled triangle, it … use of trig to find b and h.
			area segment = $45\pi - 106.99$	M1d*	Attempt 45π – area of triangle	Must be using 45π (not 45), decim… or $\frac{1}{2} \times 15^2 \times 1.26$ (or better), so M… M0 if area of triangle is greater th… Using $\frac{1}{2} \times 15^2 \times (\theta - \sin\theta)$ with in…
			$= 34.4$ cm^2	A1 **[3]**	Obtain 34.4 cm^2	If >3sf then allow any values rou…

Question			Answer	Marks	Guidance	
4			$4(1-\sin^2 x) + 7\sin x - 7 = 0$	M1	Use $\cos^2 x = 1 - \sin^2 x$	Must be used and not j Must be used correctly, s
			$4\sin^2 x - 7\sin x + 3 = 0$	A1	Obtain correct quadratic	aef, as long as three term quad one side of the equation. Condone $4\sin^2 x - 7\sin x + 3$ ie no
			$(\sin x - 1)(4\sin x - 3) = 0$	M1	Attempt to solve quadratic in $\sin x$	Not dependent on previous M1, so $\cos^2 x = \sin^2 x - 1$ used. This M mark is just for solving a 3 guidance sheet for acceptable meth Condone any substitution used, inc
			$\sin x = 1$, $\sin x = {}^3/_4$	M1	Attempt to find x from roots of quadratic	Attempt $\sin^{-1}$ of at least one of the Allow for just stating $\sin^{-1}$ (their ro Not dependent on previous marks If going straight from $\sin x = k$ to x only if their angle is consistent wit
			$x = 90°$ $x = 48.6°, 131°$	A1	Obtain two correct solutions	Allow 3sf or better. Must come from a correct solution – if the second bracket was correct + 1) then A0 even though 2 solutio Allow radian equivs – ${}^{\pi}/_2$ or 1.57 /
				A1	Obtain all 3 correct solutions, and no others	Must now all be in degrees. Allow 3sf or better. A0 if other incorrect solutions in r ignore any outside this range).
				[6]		**SR** If no working shown then allo solution (max of **B2** if in radians, c range).

Question			Answer	Marks	Guidance	
5	(a)	(i)	$u_2 = ½$	B1	State ½	Allow 0.5 or $^2/_4$.
			$u_3 = 4$	B1 FT	State 4, following their u_2	Follow through on their u_2 (B0 for $^2/_{0.5}$, $^2/_{½}$ etc.
				[2]		
5	(a)	(ii)	periodic / alternating / repeating / oscillating / cyclic	B1	Any correct description	Allow associated words eg 'repetit Must be a mathematical term rathe as 'it changes between 4 and ½' or terms are ½. Mark independently of any values Ignore irrelevant terms (eg 'recurs additional incorrect terms (eg 'geo
				[1]		
5	(b)		$a + 8d = 18$	B1	State $a + 8d = 18$	Allow any equivalent, including u Must be correct when seen – can't stated but with incorrect a substitu
			$^9/_2\,(2a + 8d) = 72$	B1	State $^9/_2\,(2a + 8d) = 72$	Allow any equivalent, including u Must be correct when seen – as ab
			$a + 8d = 18$ and $2a + 8d = 16$	M1	Attempt to solve simultaneously	M1 is awarded for eliminating a va equations in a and d, from attempt at $S_9 = 72$ (formulas must be recog but not necessarily correct). Don't If balancing equations, then there subtract (but allow $a = 2$). If substituting then allow sign erro not operational errors (eg $a = {}^{18}/_{8d}$
			$a = -2$, $d = {}^5/_2$	A1	Obtain either $a = -2$ or $d = {}^5/_2$	A1 is given for the first correct val Allow $d = 2½$ or 2.5, but not unsin
				A1	Obtain both $a = -2$, $d = {}^5/_2$	A1 is given for obtaining second c Allow $d = 2½$ or 2.5, but not unsin
				[5]		

Question			Answer	Marks	Guidance	
			OR		**Alternative method using** $^n/_2(a + l)$	**NB If using** $a + (n - 1$ ... **and solving simultaneo... per scheme below.**
			$^9/_2\,(a + 18) = 72$	B1*	State $^9/_2\,(a + 18) = 72$	Allow any equivalent. Award B1 as soon as seen correct, ... error.
			$a = -2$	B1d*	Obtain $a = -2$	Must come from correct equation.
			$-2 + 8d = 18$ or $^9/_2\,(-4 + 8d) = 72$	M1	Attempt use of either u_9 or S_9	Must be attempting either $u_9 = 18$ ... Must be using correct formula.
				A1FT	Obtain correct equation, following their a	Allow any equivalent, including u...
			$d = {}^5/_2$	A1	Obtain $d = {}^5/_2$	Allow $d = 2½$ or 2.5, but not unsin...

Question			Answer	Marks	Guidance	
6	(i)		$0.5 \times 4 \times (4\sqrt{1} + 8\sqrt{5} + 4\sqrt{9})$	M1*	Attempt y-values at $x = 1, 5, 9$ only	Must be using y, not a… at Allow slips eg $\sqrt{(4x)}$ as i… Allow decimal equiv for y_1… Allow M1 for 4, 20, 72 (ie om… M0 if other y-values found (unles…
			$= 2(16 + 8\sqrt{5})$	M1d*	Attempt correct trapezium rule, inc h = 4	Correct structure, including 'big b… Allow 2 used for ½ h – no need fo… Allow slips when calculating y val… must be correct. Could use two separate trapezia.
			$= 32 + 16\sqrt{5}$ **AG**	A1 **[3]**	Obtain $32 + 16\sqrt{5}$	Must come from exact working, so… found in decimals (67.777…) whi… same as $32 + 16\sqrt{5}$. However, isw… first, and then decimal equiv stated…
6	(ii)		 Curve is above tops of trapezia	B1* B1d* **[2]**	Sketch showing correct graph of $y = 4\sqrt{x}$ and two trapezia (allow if only tops of trapezia seen as chords) Reason comparing the tops of trapezia to the curve, or referring to the gap between the trapezia and the curve	Correct graph shown, existing for… Exactly two trapezia must be show… widths, with top vertices on the cu… Must refer to the tops of the trapez… below curve' (ie 'top' not used). Allow 'trapezium' rather than 'tra… Could shade gaps on their diagram… B0 for 'some area not calculated' … Concave / convex is B0, as is com… B1 for decreasing gradient (but B0… B0 (rather than isw) if explanation… No sketch is B0, irrespective of ex… **SR B1** for correct explanation, and… graph of $y = 4\sqrt{x}$ for $1 \le x \le 9$ but i… (eg curvature / y-intercept / not jus…

Question			Answer	Marks	Guidance	
6	(iii)		$\int_1^9 4x^{\frac{1}{2}}\,dx = \left[\frac{8}{3}x^{\frac{3}{2}}\right]_1^9$	M1	Obtain $k\,x^{\frac{3}{2}}$	Any numerical k, incl… Any exact equiv for the i…
			$= 72 - \frac{8}{3}$	A1	Obtain $\frac{8}{3}x^{\frac{3}{2}}$	Allow unsimplified coefficient… Allow non exact decimal ie 2.7, 2… Allow $+c$.
			$= 69\frac{1}{3}$	M1	Attempt correct use of limits	Must be F(9) – F(1) ie subtraction… order. Allow use in any function other th… from differentiation. Allow processing errors eg $\left(\frac{8}{3}\times 9\right)$…
				A1	Obtain $69\frac{1}{3}$, or any exact equiv	Allow improper fraction, or recurr… A0 for 69.333…. A0 for $69\frac{1}{3} + c$.
				[4]		Answer only is 0/4.

Question			Answer	Marks	Guidance	
7	(a)	(i)	$\cos\alpha = {}^{5}/_{\sqrt{29}}$	M1	Attempt $\cos\alpha$	Could draw triangle a… tha hypotenuse, or use trig id… Must get as far as attemptin… Must be working in exact valu… Must be using correct ratios for ta…
				A1	Obtain ${}^{5}/_{\sqrt{29}}$	Allow any exact equiv, including r… $\sqrt{({}^{25}/_{29})}$ isw if decimal equiv subsequently Answer only gets full credit.
				[2]		**SR B1** for exact answer following
7	(a)	(ii)	$\cos\beta = {}^{-\sqrt{40}}/_{7}$	M1	Attempt $\cos\beta$	Could draw triangle and use Pytha… adjacent, or use trig identities. Must get as far as attempting $\cos\beta$… Must be working in exact values f… Must be using correct ratios for sin…
				A1	Obtain ${}^{\sqrt{40}}/_{7}$	Allow any exact equiv, including … Allow $\pm\,{}^{\sqrt{40}}/_{7}$ (from using $\cos^2 x =$ … isw if decimal equiv subsequently Answer only gets M1A1.
				A1 FT	Obtain ${}^{-\sqrt{40}}/_{7}$, or –ve of their exact numerical value for $\cos\beta$	A1 FT can only be awarded follow… isw if decimal equiv subsequently Answer only gets full credit.
				[3]		**SR B1** for ${}^{\sqrt{40}}/_{7}$, or equiv, followin… **SR B2** for ${}^{-\sqrt{40}}/_{7}$, or equiv, followi… **SR B1** for decimal answer in rang…

Question			Answer	Marks	Guidance	
7	(b)		$\frac{\sin \gamma}{6} = \frac{\sin 60}{8}$	M1*	Attempt use of correct sine rule	Must be correct sine r… w… substitute values in – no …
				M1d*	Use $\sin 60° = {}^{\sqrt{3}}/_{2}$	Could be implied eg $\frac{6}{\sin \gamma} = \frac{16}{3}\sqrt{\ }$…
			$\sin \gamma = \frac{3\sqrt{3}}{8}$	A1	Obtain $\sin \gamma$ as $\frac{3\sqrt{3}}{8}$	Must be seen simplified to this, or isw if decimal equiv subsequently isw any attempt to find the angle. A0 if only ever seen as $\sin^{-1} \frac{3\sqrt{3}}{8}$
				[3]		

Question			Answer	Marks	Guidance	
8	(i)		$f(2) = 8 + 2a - 6 + 2b = 0$ $g(2) = 24 + 4 + 10a + 4b = 0$	M1	Attempt at least one of f(2), g(2)	Allow for substituting ... ei to simplify at this stage. Division – complete attemp Coeff matching - attempt all 3
				M1	Equate at least one of f(2) and g(2) to 0	Just need to equate their substituti writing eg f(2) = 0 is not enough). It could be implied by later workir solve equations. Division - equating their remainde Coeff matching – equate constant
			$2a + 2b = -2$, $5a + 2b = -14$	A1	Obtain two correct equations in a and b	Could be unsimplified equations. Could be $8a + 2b = -26$ (from f(2)
			hence $3a = -12$	M1	Attempt to find a (or b) from two simultaneous eqns	Equations must come from attemp g(2) = 0, f(2) = g(2). M1 is awarded for eliminating a or allow sign slips only. Most will attempt a first, but they finding b from their simultaneous
			so $a = -4$ **AG**	A1	Obtain $a = -4$, with necessary working shown	If finding b first, then must show a working to find a (unless earlier sl eg $a = -1 - b$).
			$b = 3$	A1	Obtain $b = 3$	Correct working only
				[6]		**SR Assuming a = -4** **Either use this scheme, or the or** **elements from both** M1 Attempt either f(2) or g(2) M1 Equate f(2) or g(2) to 0 (also A1 Obtain $b = 3$ A1 Use second equation to confirr

Question			Answer	Marks	Guidance	
8	(ii)		$f(x) = (x - 2)(x^2 + 2x - 3)$ $= (x - 2)(x + 3)(x - 1)$	M1	Attempt full division of their f(x) by (x – 2) Could also be for full division attempt by (x – 1) or (x + 3) if identified as factors	Must be using f(x) = x Must be complete metho Long division – must subtra Inspection – expansion must g terms of their cubic. Coefficient matching – must be va quadratic coeffs, considering all re Factor theorem – must be finding
				A1	Obtain x^2 and at least one other correct term, from correct f(x)	Could be middle or final term depe Coeff matching – allow for stating Factor theorem – state factors of (
				A1	Obtain (x – 2)(x + 3)(x – 1)	Must be seen as a product of three Answer only gains all 3 marks.
			$g(x) = (x - 2)(3x^2 + 7x - 6)$ $= (x - 2)(x + 3)(3x - 2)$ **OR** $g(1) = -4$, $g(-3) = 0$	M1	Attempt to verify two common factors	Possible methods are: Factorise g(x) completely – f(x) m Find quadratic factor of g(x) and ic Test their roots of f(x) in g(x). Just stating eg g(-3) = 0 is not eno If f(x) hasn't been factorised, allow thm on both functions to find com factorising g(x) and testing roots in
			Hence common factor of (x + 3)	A1	Identify (x + 3) as a common factor	Just need to identify (x + 3) - no ne explicitly state 'two common facto Need to see (x + 3) as factor of g(x g(-3) = 0 and then stating 'commo CWO (inc A0 for g(x) = (x – 2)(x + If using factor thm, no need to finc Just stating (x + 3) with no support A0 if referring to -3 (and 2) as 'fac A0 if additional incorrect factor gi
				[5]		

Question			Answer	Marks	Guidance	
9	(a)	(i)	$u_4 = \log_2 27 + 3\log_2 x$	**M1**	Use $u_4 = a + 3d$	Allow missing / incor… Starting with $\log_2 27 +$ lo… Starting with $\log_2 27$ x $3\log$… below). Starting with $\log_2 27 + \log_2 x + \log$… credit.
			$= \log_2 27 + \log_2 x^3$	**M1**	Use $b \log a = \log a^b$ on $3\log_2 x$	u_4 must still be shown as two term… Could get M1 if using $a + 4d$. Could get M1 for $\log_2 27$ x $3\log_2 x$… $\log_2 27$ x $3\log_2 x = \log_2 27 + \log_2 x^3$… Allow missing / incorrect / inconsi…
			$= \log_2(27x^3)$ **AG**	**A1** **[3]**	Show $\log_2(27x^3)$ convincingly	Can go straight from $\log_2 27 + \log$… CWO, including using base 2 thro… **SR – finding consecutive terms (… explicit)** **B1** for $u_2 = \log_2 27 + \log_2 x = \log_2$… **B1** for $u_3 = \log_2 27x + \log_2 x = \log$… **B1** for $u_4 = \log_2 27x^2 + \log_2 x = \log$…
9	(a)	(ii)	$27x^3 = 2^6$	B1*	State correct equation no longer involving $\log_2 x$	Equation could still involve consta… or $\log_2 3$. Allow truncated or rounded decim…
			$x = {}^4/_3$	B1d* **[2]**	Obtain ${}^4/_3$	Must be ${}^4/_3$, $1\,{}^1/_3$ or an exact recurr… 1.333….). A0 if cube root still present. Working must be exact, so sight o… used is B0, even if final answer is… Answer only gets full credit.

Question			Answer	Marks	Guidance	
9	(b)	(i)	$\frac{1}{2} < y < 2$	**M1**	Identify at least one of ½ and 2 as end-points	Only one end-point re Ignore if additional inco Ignore any signs used.
				A1	Obtain $\frac{1}{2} < y < 2$	Not two separate inequalities, un A0 for $\frac{1}{2} \le y \le 2$.
				[2]		
9	(b)	(ii)	$\frac{\log_2 27}{1-\log_2 y} = 3$	B1	State $\frac{\log_2 27}{1-\log_2 y} = 3$	Allow B1 if no base stated, but B0 Must be equated to 3 for B1.
			$\log_2 27 = 3 - 3\log_2 y$ $\log_2 27 = 3 - \log_2 y^3$ $\log_2(27y^3) = 3$	M1*	Attempt to rearrange equation to $\log_2 \mathrm{f}(y) = k$	Must be using $\frac{\log_2 27}{\pm 1 \pm \log_2 y}$ (but a Allow at most 2 manipulation erro muddles, or slips when expanding other errors (eg incorrect use of lo
			$27y^3 = 8$	M1d*	Use $\mathrm{f}(y) = 2^k$ as inverse of $\log_2 \mathrm{f}(y) = k$	Must have first been arranged to lo No need to go any further than sta
				A1*	Obtain correct exact equation no longer involving $\log_2 y$	Equation could still involve consta or $\log_2 3$. Sight of decimals used is A0, even
			$y^3 = {}^8/_{27}$ $y = {}^2/_3$	A1d*	Obtain ${}^2/_3$	Allow equiv recurring decimal, bu A0 if still cube root present.
				[5]		**SR** answer only is **B3** Correct $S_\infty = 3$, then answer with n

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 ir
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 solution
ignore any others, correct or incorrect.

Solving equations
With simultaneous equations, the method mark is given for eliminating one variable. Any valid method is allowed ie balancing or su
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
two coefficients. This method is only credited if it is possible to factorise the quadratic – if the roots are surds then candidates are e
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, with some attempt at evaluation (eg calculating $4ac$). Sign sl
$4ac$, but all other aspects of the formula must be seen correct, either algebraic or numerical. The division line must extend under the e
implied by later working). If the algebraic formula is quoted then candidates are allowed to make one slip when substituting their values.
$2a$ as long as it has been seen earlier.

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