

		Mark	Total	
6	(i) $u_1 = 7$ $u_2 = 9, u_3 = 11$	B1		Correct u_1
		B1	2	Correct u_2 and u_3
	(ii) Arithmetic Progression	B1	1	Any mention of arithmetic
	(iii) $\frac{1}{2}N(14 + (N-1) \times 2) = 2200$ $N^2 + 6N - 2200 = 0$ $(N-44)(N+50) = 0$ hence $N = 44$	B1		Correct interpretation of sigma notation
		M1		Attempt sum of AP, and equate to 2200
A1			Correct (unsimplified) equation	
M1			Attempt to solve 3 term quadratic in N	
		A1	5	Obtain $N = 44$ only ($N = 44$ wwww is full marks)
				8
7	(i) Some of the area is below the x -axis	B1	1	Refer to area / curve below x -axis or 'negative area' ...
		M1		Attempt integration with any one term correct
	(ii)	A1		Obtain $\frac{1}{3}x^3 - \frac{3}{2}x^2$
		M1		Use limits 3 (and 0) – correct order / subtraction
		A1		Obtain $(-)\frac{1}{2}$
	M1		Use limits 5 and 3 – correct order / subtraction	
	A1		Obtain $8\frac{2}{3}$ (allow 8.7 or better)	
A1	7	Obtain total area as $13\frac{1}{6}$, or exact equiv		
				SR: if no longer $\int f(x)dx$, then B1 for using $[0, 3]$ and $[3, 5]$
				8
8	(i) $u_4 = 10 \times 0.8^3$ $= 5.12$	M1		Attempt u_4 using ar^{n-1}
		A1	2	Obtain 5.12 aef
	(ii) $S_{20} = \frac{10(1-0.8^{20})}{1-0.8}$ $= 49.4$	M1		Attempt use of correct sum formula for a GP
		A1	2	Obtain 49.4
	(iii) $\frac{10}{1-0.8} - \frac{10(1-0.8^N)}{(1-0.8)} < 0.01$ $50 - 50(1-0.8^N) < 0.01$ $0.8^N < 0.0002$ A.G. $\log 0.8^N < \log 0.0002$ $N \log 0.8 < \log 0.0002$ $N > 38.169$, hence $N = 39$	M1		Attempt S_∞ using $\frac{a}{1-r}$
		A1		Obtain $S_\infty = 50$, or unsimplified equiv
		M1		Link $S_\infty - S_N$ to 0.01 and attempt to rearrange
		A1		Show given inequality convincingly
		M1		Introduce logarithms on both sides
		M1		Use $\log a^b = b \log a$, and attempt to find N
A1	7	Obtain $N = 39$ only		
				11

	Mark	Total	
<p>9 (i) $(90^\circ, 2), (-90^\circ, -2)$</p> <p>(ii) (a) $180 - \alpha$ (b) $-\alpha$ or $\alpha - 180$</p> <p>(iii) $2\sin x = 2 - 3\cos^2 x$ $2\sin x = 2 - 3(1 - \sin^2 x)$ $3\sin^2 x - 2\sin x - 1 = 0$ $(3\sin x + 1)(\sin x - 1) = 0$ $\sin x = -\frac{1}{3}, \sin x = 1$ $x = -19.5^\circ, -161^\circ, 90^\circ$</p>	B1		State at least 2 correct values
	B1	2	State all 4 correct values (radians is B1 B0)
	B1	1	State $180 - \alpha$
	B1	1	State $-\alpha$ or $\alpha - 180$ (radians or unsimplified is B1B0)
	M1		Attempt use of $\cos^2 x = 1 - \sin^2 x$
	A1		Obtain $3\sin^2 x - 2\sin x - 1 = 0$ aef with no brackets
	M1		Attempt to solve 3 term quadratic in $\sin x$
	A1		Obtain $x = -19.5^\circ$
	A1√		Obtain second correct answer in range, following their x
	A1	6	Obtain 90° (radians or extra answers is max 5 out of 6)
			SR: answer only (and no extras) is B1 B1√ B1
			10
<p>10 (i) $(2x + 5)^4 = (2x)^4 + 4(2x)^3 \cdot 5 + 6(2x)^2 \cdot 5^2 + 4(2x) \cdot 5^3 + 5^4$ $= 16x^4 + 160x^3 + 600x^2 + 1000x + 625$</p> <p>(ii) $(2x + 5)^4 - (2x - 5)^4 = 320x^3 + 2000x$</p> <p>(iii) $9^4 - (-1)^4 = 6560$ and $7360 - 800 = 6560$ A.G. $320x^3 - 1680x + 800 = 0$ $4x^3 - 21x + 10 = 0$ $(x - 2)(4x^2 + 8x - 5) = 0$ $(x - 2)(2x - 1)(2x + 5) = 0$ Hence $x = \frac{1}{2}, x = -2\frac{1}{2}$</p>	M1*		Attempt expansion involving powers of $2x$ and 5 (at least 4 terms)
	M1*		Attempt coefficients of 1, 4, 6, 4, 1
	A1dep*		Obtain two correct terms
	A1	4	Obtain a fully correct expansion
	M1		Identify relevant terms (and no others) by sign change oe
	A1	2	Obtain $320x^3 + 2000x$ cwo
	B1		Confirm root, at any point
	M1		Attempt complete division by $(x - 2)$ or equiv
	A1√		Obtain quotient of $ax^2 + 2ax + k$, where a is their coeff of x^3
	A1		Obtain $(4x^2 + 8x - 5)$ (or multiple thereof)
M1		Attempt to solve quadratic	
A1	6	Obtain $x = \frac{1}{2}, x = -2\frac{1}{2}$	
			SR: answer only is B1 B1
			12

4723 Core Mathematics 3

1 (i) Show correct process for composition of functions	M1 numerical or algebraic; the right way round
Obtain $(-3$ and hence) -23	A1 2
(ii) <u>Either</u> : State or imply $x^3 + 4 = 12$	B1
Attempt solution of equation involving x^3	M1 as far as $x = \dots$
Obtain 2	A1 3 and no other value
<u>Or</u> : Attempt expression for f^{-1}	M1 involving x or y ; involving cube root
Obtain $\sqrt[3]{x-4}$ or $\sqrt[3]{y-4}$	A1
Obtain 2	A1 (3) and no other value
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2 (i) Obtain correct first iterate 2.864	B1 or greater accuracy 2.864327...; condone 2 dp here and in working
Carry out correct iteration process	M1 to find at least 3 iterates in all
Obtain 2.877	A1 3 after at least 4 steps; answer required to exactly 3 dp
$[3 \rightarrow 2.864327 \rightarrow 2.878042 \rightarrow 2.876661 \rightarrow 2.876800]$	
(ii) State or imply $x = \sqrt[3]{31 - \frac{5}{2}x}$	B1
Attempt rearrangement of equation in x	M1 involving cubing and grouping non-zero terms on LHS
Obtain equation $2x^3 + 5x - 62 = 0$	A1 3 or equiv with integers
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3 (a) State correct equation involving $\cos \frac{1}{2}\alpha$	B1 such as $\cos \frac{1}{2}\alpha = \frac{1}{4}$ or $\frac{1}{\cos \frac{1}{2}\alpha} = 4$
Attempt to find value of α	M1 or ...
Obtain 151	A1 3 using correct order for the steps or greater accuracy; and no other values between 0 and 180
(b) State or imply $\cot \beta = \frac{1}{\tan \beta}$	B1
Rearrange to the form $\tan \beta = k$	M1 or equiv involving $\sin \beta$ only or $\cos \beta$ only; allow missing \pm
Obtain 69.3	A1
Obtain 111	A1 4 or greater accuracy; and no others between 0 and 180
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4 (i) Obtain derivative of form $kh^5(h^6 + 16)^n$	M1 any constant k ; any $n < \frac{1}{2}$; allow if -4 term retained
Obtain correct $3h^5(h^6 + 16)^{-\frac{1}{2}}$	A1 or (unsimplified) equiv; no -4 now
Substitute to obtain 10.7	A1 3 or greater accuracy or exact equiv
(ii) Attempt multn or divn using 8 and answer from (i) M1	
Attempt 8 divided by answer from (i)	M1
Obtain 0.75	A1 $\sqrt{3}$ or greater accuracy; allow 0.75 ± 0.01 ; following their answer from (i)