Question Number	Scheme	Notes	Marks
3(i)	There is no credit if only signs instead of values are used		
	$f(x) = x^2 + 5 - 8^{5x}$ $f(0) = 4,\ f(0.5) = -175.769...,\ [f(1) = -32762]$	Obtains a **value** for f(0.5) and at least one of f(0) and f(1) with at least one correct: $f(0) = 4,\ f(0.5) = \text{awrt} -180,\ [f(1) = \text{awrt} -33000]$	M1
	$\{f(0) > 0, f(0.5) < 0$ so root in $[0, 0.5]\} \Rightarrow f(0.25) = ...$ Having obtained different signs of values for f(0.5) and f(0), obtains a **value** for f(0.25). If by error the sign change occurs with f(0.5) and f(1), allow for attempting f(0.75) $\{= -2429.93... \approx -2400\}$. Accept using a full list/table of values e.g., $f(0) = 4,\ f(0.25) = -8.39184...,\ f(0.5) = -175.769...,\ f(0.75) = -2429.93...,\ f(1) = -32762$ $f(0) = 4,\ f(0.25) = \text{awrt} -8.4\ f(0.5) = \text{awrt} -180,\ f(0.75) = \text{awrt} -2400, f(1) = \text{awrt} -33000$ Allow the values to be calculated in any order. **Previous mark required.**		**d**M1
	$f(0.25) = -8.39184... \Rightarrow (\alpha \in)\ [0, 0.25]$ f(0.25) = awrt -8.4 **and all** other values used correct to 2 sf (ignore values from further bisections e.g., f(0.125), f(0.375), f(0.625), f(0.875)) **and** concludes required interval is [0, 0.25]. Accept e.g., (0, 0.25). Condone e.g., $0 \leqslant x \leqslant 0.25,\ 0 < "\beta" < 0.25$ but do not allow e.g., (0.25, 0). Must give an interval so e.g., "It's between 0 & 0.25" is A0. Ignore further bisections provided correct interval has been seen. Allow 2 sf truncated values.		A1
			(3)

Question Number	Scheme	Notes	Marks
3(ii)(a)	$g(x) = 3^{\sin x} - 3\cos x$ $g(4) = 2.396...,\ g(5) = -0.502...$	Attempts both g(4) and g(5) with at least one correct (using radians): $g(4)$ = awrt 2.4 (or 2.3 truncated), $g(5)$ = awrt -0.5	M1
	Sign change oe and g (x) is **continuous** therefore a **root oe** e.g., β is between $x = 4$ and $x = 5$	Both g(4) = awrt 2.4 (or 2.3 truncated) and g(5) = awrt −0.5, sign change (**accept equivalents** e.g., g(4) > 0 & g(5) < 0 or g(4)g(5) <0 or "positive, negative"), continuous and conclusion all given. Be generous with attempt at "continuous" and condone e.g., "x is continuous". Minimum in bold. Condone a wrong interval following e.g., "There is a solution in..." May use f for g.	A1
			(2)
(ii)(b)	E.g. $\frac{\beta - 4}{"2.396..."} = \frac{5 - \beta}{-"-0.502..."} \Rightarrow \beta = ...$ $\frac{5 - \beta}{\beta - 4} = \frac{-"-0.502..."}{"2.396..."} \Rightarrow \beta = ...$ $\frac{\beta - 4}{5 - 4} = \frac{"2.396..."}{"2.396"-"-0.502"} \Rightarrow \beta = ...$ $\frac{4("-0.502...") - 5("2.396...")}{"-0.502..."-"2.396..."} = ...$ or $m = \frac{"-0.502"-"2.396"}{5-4} \{= -2.8986...\}$ $\Rightarrow$ e.g., $y - "2.396..." = m(x-4),\ y = 0$ $\Rightarrow x$ or $\beta = ...$ If only unsubstituted $"\frac{ag(b) - bg(a)}{g(b) - g(a)}"$ oe is seen followed by value it must round to 4.83 unless a, b, $g(a)$ & $g(b)$ are identified. May use f for g.	Uses a correct interpolation equation/expression for their values (allow for any value provided g(4) positive, g(5) negative and condone clear miscopying) **and** finds a value for β or x etc. Accept any correct statement for their values followed by any attempt to solve. If not fully substituted, values for g(4) & g(5) may be seen separately here or in part (a). May use f for g. Alternatively finds the gradient and then the line joining the endpoints and sets $y = 0$ to get β. Straight line equation must be correct for their values but allow a correct unsimplified gradient seen which is miscalculated later and allow errors finding c from a consistent equation with a correctly substituted point. Ignore how the value is labelled (may be unlabelled or x or α used). If their variable denotes e.g., the distance between (4, 0) and $(\beta, 0)$ then 4 must be added later. Implied by awrt 4.83 **provided no evidence of incorrect equation** but must not clearly be using the actual root of 4.8245... from solving by calculator. Note that failure to change the sign of g(5) leads to 5.265...	M1
	= 4.827 (4 s.f.)	awrt 4.827 Accept answer only. Ignore further interpolations.	A1
			(2)
			Total 7