Q	Marking instructions	AO	Marks	Typical solution
14(a)	Evaluates $f(0) = -1$ and $f(1) = 2$ or Evaluates two other suitable appropriate values correct to 1 sig fig	1.1a	M1	$f(0) = -1 < 0$ $f(1) = 3 - 1 = 2 > 0$ Change of sign implies root therefore α is between 0 and 1
	Completes argument correctly stating $f(0) < 0$ and $f(1) > 0$ and concludes that $0 < \alpha < 1$	2.1	R1	
	Subtotal		**2**	
14(b)(i)	Uses product rule to obtain an expression of the form $Ax^{\frac{1}{2}}(3^x) + Bx^{-\frac{1}{2}}(3^x)$ A and /or B can be positive or negative	3.1a	M1	$f'(x) = x^{\frac{1}{2}}(3^x)\ln 3 + \frac{1}{2}x^{-\frac{1}{2}}(3^x)$ $= 3^x\left(\ln 3\sqrt{x} + \frac{1}{2\sqrt{x}}\right)$ $= 3^x\left(\frac{2x\ln 3}{2\sqrt{x}} + \frac{1}{2\sqrt{x}}\right)$ $= 3^x\left(\frac{x\ln 9}{2\sqrt{x}} + \frac{1}{2\sqrt{x}}\right)$ $= 3^x\left(\frac{1 + x\ln 9}{2\sqrt{x}}\right)$
	Obtains fully correct $f'(x)$	1.1b	A1	
	Completes convincing argument with no slips to show the required result. AG	2.1	R1	
	Subtotal		**3**	
14(b)(ii)	Forms correct Newton-Raphson expression PI by correct value of x_2 or x_3 stated to at least 3 decimal places	1.1a	M1	$x_{n+1} = x_n - \dfrac{(3^{x_n}\sqrt{x_n} - 1)}{\dfrac{3^{x_n}(1 + x_n\ln 9)}{2\sqrt{x_n}}}$ $x_{n+1} = x_n - \dfrac{2\sqrt{x_n}\,(3^{x_n}\sqrt{x_n} - 1)}{3^{x_n}(1 + x_n\ln 9)}$ $x_2 = 0.5829716..$ $x_3 = 0.4246536..$ $x_3 \approx 0.42465$
	Obtains the correct value of x_3 Must be stated to five decimal places	1.1b	A1	
	Subtotal		**2**	
14(b)(iii)	Explains that convergence is impossible Must use the word convergence or convergent	2.4	E1	Convergence is impossible as all values of x_n would equal 0
	Explains that the tangent at $x = 0$ is vertical or Explains all values of x_n would equal 0 or Demonstrates that several values of x_n would be 0	2.4	E1	
	Subtotal		**2**	
	Question Total		**9**	