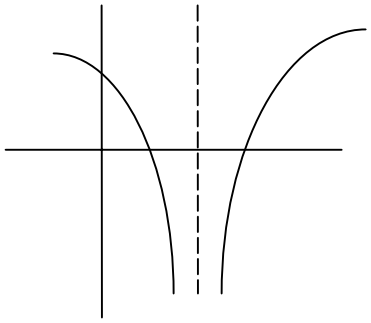
Question Number	Scheme	Marks
1.	$\frac{(x-3)(x-5)}{(x-3)(x+3)} \times \frac{2x(x+3)}{(x-5)^2}$ (3 × factorising) $= \frac{2x}{x-5}$	B1 B1 B1 B1 **(4 marks)**
2. (i)	A correct form of $\cos 2x$ used $1-2\left(\frac{3}{5}\right)^2$ or $\left(\frac{4}{5}\right)^2-\left(\frac{3}{5}\right)^2$ or $2\left(\frac{4}{5}\right)^2-1$ $\left\{\frac{7}{25}\right\}$ $\sec 2x = \frac{1}{\cos 2x}$; $= \frac{25}{7}$ or $3\frac{4}{7}$	M1 A1 M1A1 (4)
(ii)	(*a*) $\frac{\cos 2x}{\sin 2x} + \frac{1}{\sin 2x}$ or (*b*) $\frac{1}{\tan 2x} + \frac{1}{\sin 2x}$ Forming single fraction (or ** multiplying both sides by sin2*x*) Use of correct trig. formulae throughout and producing expression in terms of sin*x* and cos*x* Completion (cso) e.g. $\frac{2\cos^2 x}{2\sin x\cos x} = \frac{\cos x}{\sin x} = \cot x$ **(*)**	M1 M1 M1 A1 (4) **(8 marks)**
3. (*a*)	$(x^3)^{12}$; ... $+\binom{12}{1}(x^3)^{11}\left((-)\frac{1}{2x}\right)+\binom{12}{2}(x^3)^{10}\left((-)\frac{1}{2x}\right)^2+\ldots$ [For M1, needs binomial coefficients, ${}^nC_r$ form OK, at least as far as shown] Correct values for ${}^nC_r$ *s* : 12, 66, 220 used (may be implied) $(x^3)^{12} + 12(x^3)^{11}\left(-\frac{1}{2x}\right) + 66(x^3)^{10}\left(-\frac{1}{2x}\right)^2 + 220(x^3)^9\left(-\frac{1}{2x}\right)^3 \ldots$ $x^{36} - 6x^{32} + \frac{33}{2}x^{28} - \frac{55}{2}x^{24}$	B1; M1 B1 A2(1,0) (5)
(*b*)	Term involving $(x^3)^3\left((-)\frac{1}{2x}\right)^9$; coeff $= \frac{12.11.10}{3.2.1}\left((-)\frac{1}{2}\right)^9$ $= -\frac{55}{128}$ (or –0.4296875)	M1 A1 A1 (3) **(8 marks)**

Question Number	Scheme	Marks
4. (*a*)	$y^2 = \left(\frac{x+2}{\sqrt{x}}\right)^2 = \frac{x^2+4x+4}{x} = x+4+\frac{4}{x}$	M1A1
	$\pi\int y^2 dx$ [dependent on attempt at squaring y]	B1
	$\int y^2 dx = \int(\frac{x^2+4x+4}{x})dx; = \frac{x^2}{2}+4x+4\ln x$	M1;A1 ft
	[A1√ must have ln x term]	
	Correct use of limits: $[\ ]_1^4 = [\ ]^4 - [\ ]_1$	M1
	[M dependent on prev. M1]	
	Volume $= \left(\frac{39}{2}+4\ln 4\right)\pi$ or equivalent exact	A1 (7)
(*b*)	Showing that $y = 3$ at $x = 1$ and $x = 4$	B1 (1)
(*c*)	Volume $= 2^3 \times$ answer to (a) ; $= 629.5\ \text{cm}^3 \approx 630\ \text{cm}^3$ (*)	M1;A1 (2)
	[allow 629 – 630]	**(10 marks)**
5. (*a*)	Attempting to reach at least the stage $x^2(x+1) = 4x+1$	M1
	Conclusion (no errors seen) $x = \sqrt{\frac{4x+1}{x+1}}$ (*)	A1 (2)
	[Reverse process: need to square and clear fractions for M1]	
(*b*)	$x_2 = \sqrt{\frac{4+1}{1+1}} =$ 1.58…	M1
	$x_3 = 1.68,$ $x_4 = 1.70$	A1A1 (3)
	[Max. deduction of 1 for more than 2 d.p.]	
(*c*)	Suitable interval; e.g. [1.695, 1.705] (or "tighter")	M1
	f(1.695) = –0.037… , f(1.705) = +0.0435…	Dep. M1
	Change of sign, no errors seen, so root = 1.70 (correct to 2 d.p.)	A1 (3)
(*d*)	$x = -1$, "division by zero not possible", or equivalent	B1,B1 (2)
	or **any number in interval $-1 < x < -¼$,** "square root of neg. no."	
		(10 marks)

Question Number	Scheme	Marks
6. (*a*)	$\log_5 x^2 - \log_5 y \quad ; = \quad 2\log_5 x - \log_5 y = 2a - b$	M1A1 (2)
(*b*)	$\log_5 25 = 2$ or $\log_5 y$	B1
	$\log_5 25 + \log_5 x + \log_5 y^{\frac{1}{2}}; = 2 + a + \frac{1}{2} b$	M1;A1 (3)
(*c*)	$2a - b = 1, \quad 2 + a + \frac{1}{2} b = 1$ (must be in a and b)	B1 ft (1)
(*d*)	Using both **correct** equations to show that $a = -0.25$ (*)	M1
	$b = -1.5$	B1 (2)
	[Mark for (c) can be gained in (d)]	
(*e*)	Using correct method to find a value for x or a value of y:	M1
	$x = 5^{-0.25} = 0.669, \quad y = 5^{-1.5} = 0.089$	A1 A1 ft (3)
	[max. penalty –1 for more than 3 d.p.]	**(11 marks)**
7. (*a*)	Differentiating; $f'(x) = 1 + \frac{e^x}{5}$	M1;A1 (2)
(*b*)	*A*: $\left(0, \frac{1}{5}\right)$	B1
	Attempt at $y - f(0) = f'(0)x$;	M1
	$y - \frac{1}{5} = \frac{6}{5}x$ or equivalent "one line" 3 termed equation	A1 ft (3)
(*c*)	1.24, 1.55, 1.86	B2(1,0) (2)
(*d*)	Estimate = $\frac{0.5}{2}$; (×) [(0.45 + 1.86) + 2(0.91 + 1.24 + 1.55)]	B1 M1 A1 ft
	= 2.4275 $\left(\begin{matrix}2.428\\2.429\end{matrix}, \quad 2.43\right)$	A1 (4)
		(11 marks)

Question Number		Scheme	Marks
8.	(*a*)	$y = \ln(3x - 6) \quad \Rightarrow 3x - 6 = e^{y}$	M1
		$\Rightarrow x = \frac{e^{y} + 6}{3}; \quad \{f^{-1}(x)\} = \frac{e^{x} + 6}{3}$	M1;A1 (3)
	(*b*)	Domain: $x \in \Re$	B1
		Range: $f^{-1}(x) > 2$	B1 (2)
	(*c*)	Attempting to find $f^{-1}(3)$ $[= \frac{e^{3} + 6}{3}]$; $= 8.70$	M1;A1 (2)
	(*d*)	 ln curve passing through $y = 0$	B1
		Symmetry in $x = k$, $k > 0$	M1
		All correct and asymptote at $x = 2$ labelled	A1
	(*e*)	Meets *y*-axis: $(x = 0)$, $y = \ln 6$	B1
		Meets *x*-axis**:** $x = \frac{5}{3}$, (0); $x = \frac{7}{3}$, (0) [May be seen on graph]	B1B1 (3)
			(13 marks)