

Question number	Scheme	Marks
5	$\log_3 \sqrt{x-5} + \log_9 (x+3) - 1 = 0$ $\frac{1}{2} \log_3 (x-5) + \frac{\log_3 (x+3)}{\log_3 9} = 1 \Rightarrow \left(\frac{1}{2} \log_3 (x-5) + \frac{\log_3 (x+3)}{2} = 1 \right)$ $\log_3 (x-5) + \log_3 (x+3) = 2 \Rightarrow \log_3 [(x-5)(x+3)] = 2$ $\Rightarrow (x-5)(x+3) = 3^2 \Rightarrow x^2 - 2x - 24 = 0$ $(x+4)(x-6) = 0 \Rightarrow x = 6 \text{ (reject } x = -4)$	M1M1 M1 M1A1 dM1A1 [7]
Total 7 marks		

Mark	Notes
Method 1 – Works in base 3	
M1	Uses $n \log A = \log A^n$ correctly to write $\log_3 \sqrt{x-5} = \frac{1}{2} \log_3 (x-5)$
M1	For an attempt to change the base of $\log_9 (x+3)$ to base 3 using $\log_a x = \frac{\log_b x}{\log_b a}$ $\log_9 (x+3) = \frac{\log_3 (x+3)}{\log_3 9} = \frac{\log_3 (x+3)}{2}$ [accept $\frac{\log_3 (x+3)}{p}$ where $p \neq 1$]
M1	Uses $\log A + \log B = \log AB$ to correctly combine the logs $\log_3 (x-5) + \log_3 (x+3) = \log_3 (x-5)(x+3)$
M1	For removing the logs in the equation to obtain $(x-5)(x+3) = 3^2$ and rearranging to a 3TQ
A1	For obtaining a correct 3TQ. $x^2 - 2x - 24 = 0$
Method 2 – Works in base 9	
M1	Uses $n \log A = \log A^n$ correctly to write $\log_3 \sqrt{x-5} = \frac{1}{2} \log_3 (x-5)$
M1	For an attempt to change the base of $\log_3 \sqrt{x-5}$ or $\frac{1}{2} \log_3 (x-5)$ to base 9 using $\log_a x = \frac{\log_b x}{\log_b a}$ $\log_3 \sqrt{x-5} = \frac{\log_9 \sqrt{x-5}}{\log_9 3} = \frac{\log_9 \sqrt{x-5}}{1/2} = 2 \log_9 \sqrt{x-5}$ [accept $q \log_9 \sqrt{x-5}$ where $q \neq 1$] $\frac{1}{2} \log_3 (x-5) = \frac{1}{2} \times \frac{\log_9 (x-5)}{\log_9 3} = \frac{1}{2} \times \frac{\log_9 (x-5)}{1/2} = \log_9 (x-5)$
M1	Uses $\log A + \log B = \log AB$ to correctly combine the logs $\log_9 (x-5) + \log_9 (x+3) = \log_9 (x-5)(x+3)$
M1	For removing the logs in the equation to obtain $(x-5)(x+3) = 9$ and rearranging to a 3TQ
A1	For obtaining a correct 3TQ. $x^2 - 2x - 24 = 0$
Attempt to solve the quadratic equation	
dM1	For an attempt to solve their 3TQ. See General Guidance for the definition of an attempt. Dependent on at least one previous M mark scored.
A1	$x = 6$ Must reject $x = -4$ if this solution is also included.