

Question	Scheme	Marks	AOs
9(a)(i)	$\log_3\left(\frac{x}{9}\right) = \log_3 x - \log_3 9 = p - 2$	B1	1.2
(ii)	$\log_3(\sqrt{x}) = \frac{1}{2}p$	B1	1.1b
		(2)	
(b)	$2\log_3\left(\frac{x}{9}\right) + 3\log_3(\sqrt{x}) = -11 \Rightarrow 2p - 4 + \frac{3}{2}p = -11 \Rightarrow p = \dots$	M1	1.1b
	$p = -2$	A1	1.1b
	$\log_3 x = -2 \Rightarrow x = 3^{-2}$	M1	1.1b
	$x = \frac{1}{9}$	A1	1.1b
		(4)	

Alternative for (b) not using (a):			
	$2\log_3\left(\frac{x}{9}\right) + 3\log_3(\sqrt{x}) = -11 \Rightarrow \log_3\left(\frac{x}{9}\right)^2 + \log_3(\sqrt{x})^3 = -11$ $\Rightarrow \log_3 \frac{x^{\frac{7}{2}}}{81} = -11$	M1	1.1b
	$\Rightarrow \frac{x^{\frac{7}{2}}}{81} = 3^{-11}$ or equivalent eg $x^{\frac{7}{2}} = 3^{-7}$	A1	1.1b
	$x^{\frac{7}{2}} = 81 \times 3^{-11} \Rightarrow x^{\frac{7}{2}} = 3^4 \times 3^{-11} = 3^{-7} \Rightarrow x = (3^{-7})^{\frac{2}{7}} = 3^{-2}$	M1	1.1b
	$x = \frac{1}{9}$	A1	1.1b

(6 marks)

Notes

- (a)(i)
B1: Recalls the subtraction law of logs and so obtains $p - 2$
- (a)(ii)
B1: $\frac{1}{2}p$ oe
- (b) ***Be aware this should be solved by non-calculator methods***
- M1: Uses their results from part (a) to form a linear equation in p and attempts to solve leading to a value for p . Allow slips in their rearrangement when solving. Allow a misread forming the equation equal to 11 instead of -11
- A1: Correct value for p
- M1: Uses $\log_3 x = p \Rightarrow x = 3^p$ following through on what they consider to be their p . It must be a value rather than p

A1: $(x =) \frac{1}{9}$ cao with correct working seen. Must be this fraction. Do not penalise invisible brackets as long as the intention is clear.

Alternative:

M1: Correct use of log rules to achieve an equation of the form $\log_3 \dots = \log_3 \dots$ or $\log_3 \dots = \text{a number}$ (typically -11). Condone arithmetical slips.

A1: Correct equation with logs removed.

M1: Uses inverse operations to find x . Condone slips but look for proceeding from $x^{\frac{a}{b}} = \dots \Rightarrow x = \dots^{\frac{b}{a}}$ where they have to deal with a fractional power.

A1: $(x =) \frac{1}{9}$ cao with correct working seen. Must be this fraction. Do not penalise invisible brackets as long as the intention is clear.