

Question number	Scheme	Marks
10	$\frac{\log_2 x}{\log_2 4} + \frac{\log_2 x}{\log_2 16} + \log_2 x = 10.5$ $\frac{\log_2 x}{2} + \frac{\log_2 x}{4} + \log_2 x = 10.5$ $\frac{7}{4} \log_2 x = 10.5$ $x = 2^{6'}$ $x = 64$	M1 M1 M1 M1 A1 (5)
Total 5 marks		

Mark	Notes
The first two marks are common to both methods	
M1	<p>Changes the base of any log correctly seen anywhere. Accept change to \log_x or even \log_{10}</p> <p>Base 2 $\frac{\log_2 x}{\log_2 4}, \frac{\log_2 x}{\log_2 16}$</p> <p>Base 4 $\frac{\log_4 x}{\log_4 16}, \frac{\log_4 x}{\log_4 2}$</p> <p>Base 16 $\frac{\log_{16} x}{\log_{16} 4}, \frac{\log_{16} x}{\log_{16} 2}$</p>
M1	<p>For forming an equation (in any form) in a single base in any base <u>For example:</u></p> <p>Base 2 $\frac{\log_2 x}{2} + \frac{\log_2 x}{4} + \log_2 x = 10.5$ or e.g., $\frac{\log_2 x}{\log_2 4} + \frac{\log_2 x}{4} + \log_2 x = 10.5$</p> <p>Base 4 e.g $\log_4 x + \frac{\log_4 x}{2} + \frac{\log_4 x}{\frac{1}{2}} = 10.5$</p> <p>Base 16 $\frac{\log_{16} x}{\frac{1}{2}} + \log_{16} x + \frac{\log_{16} x}{\frac{1}{4}} = 10.5$</p> <p>NB - This is an A mark in Epen</p>

Method 1	
M1	<p>For simplifying to the form $A \log_{(\text{any base})} = B$ where A and B are constants</p> <p>For example;</p> <p>Base 2 $1.75 \log_2 x = 10.5$</p> <p>Base 41 $3.5 \log_4 x = 10.5$</p> <p>Base 16 $7 \log_{16} x = 10.5$</p>
M1	<p>For undoing the log</p> <p><u>For example:</u></p> <p>Base 2 $x = 2^6$</p> <p>Base 4 $x = 4^3$</p> <p>Base 16 $x = 16^{1.5}$</p>
Method 2	
M1	<p>Uses the addition law to simplify to the form:</p> $\log_n (x^a \times x^b \times x^c) = 10.5 \Rightarrow (a + b + c) \log_n x = 10.5$ <p>For example: B</p> <p>Base 2 $\log_2 \left(x^{\frac{1}{2}} \times x^{\frac{1}{4}} \times x \right) = 10.5 \Rightarrow \frac{7}{4} \log_2 x = 10.5$</p> <p>Base 4 $\log_4 \left(x \times x^{\frac{1}{2}} \times 2x \right) = 10.5 \Rightarrow \frac{7}{2} \log_4 x = 10.5$</p> <p>Base 16 $\log_{16} (2x \times x \times 5x) = 10.5 \Rightarrow 7 \log_{16} x = 10.5$</p>
M1	<p>For undoing the log:</p> <p>Base 2 $2^{10.5} = x^{\frac{7}{4}}$</p> <p>Base 4 $4^{10.5} = x^{\frac{7}{2}}$</p> <p>Base 16 $16^{10.5} = x^7$</p>
A1	For $x = 64$