

- 1 Express each of the following in the form  $\log_a b = c$ .
- a  $10^3 = 1000$       b  $3^4 = 81$       c  $256 = 2^8$       d  $7^0 = 1$   
 e  $3^{-3} = \frac{1}{27}$       f  $32^{-\frac{1}{5}} = \frac{1}{2}$       g  $19^1 = 19$       h  $216 = 36^{\frac{3}{2}}$
- 2 Express each of the following using index notation.
- a  $\log_5 125 = 3$       b  $\log_2 16 = 4$       c  $5 = \log_{10} 100\,000$       d  $\log_{23} 1 = 0$   
 e  $\frac{1}{2} = \log_9 3$       f  $\lg 0.01 = -2$       g  $\log_2 \frac{1}{8} = -3$       h  $\log_6 6 = 1$
- 3 Without using a calculator, find the exact value of
- a  $\log_7 49$       b  $\log_4 64$       c  $\log_2 128$       d  $\log_3 27$   
 e  $\log_5 625$       f  $\log_8 8$       g  $\log_7 1$       h  $\log_{15} \frac{1}{15}$   
 i  $\log_3 \frac{1}{9}$       j  $\lg 0.001$       k  $\log_{16} 2$       l  $\log_4 8$   
 m  $\log_9 243$       n  $\log_{100} 0.001$       o  $\log_{25} 125$       p  $\log_{27} \frac{1}{9}$
- 4 Without using a calculator, find the exact value of  $x$  in each case.
- a  $\log_5 25 = x$       b  $\log_2 x = 6$       c  $\log_x 64 = 3$       d  $\lg x = -3$   
 e  $\log_x 16 = \frac{2}{3}$       f  $\log_5 1 = x$       g  $\log_x 9 = 1$       h  $\lg 10^{12} = x$   
 i  $2 \log_x 7 = 1$       j  $\log_4 x = 1.5$       k  $\log_x 0.1 = -\frac{1}{3}$       l  $3 \log_8 x + 1 = 0$
- 5 Express in the form  $\log_a n$
- a  $\log_a 4 + \log_a 7$       b  $\log_a 10 - \log_a 5$       c  $2 \log_a 6$   
 d  $\log_a 9 - \log_a \frac{1}{3}$       e  $\frac{1}{2} \log_a 25 + 2 \log_a 3$       f  $\log_a 48 - 3 \log_a 2 - \frac{1}{2} \log_a 9$
- 6 Express in the form  $p \log_q x$
- a  $\log_q x^5$       b  $\frac{1}{2} \log_q x^{15}$       c  $\log_q \frac{1}{x}$       d  $\log_q \sqrt[3]{x}$   
 e  $4 \log_q \frac{1}{\sqrt{x}}$       f  $\log_q x^2 + \log_q x^5$       g  $\log_q \frac{1}{x^2} + \log_q \frac{1}{x^3}$       h  $3 \log_q x^2 - \frac{1}{2} \log_q x^4$
- 7 Express in the form  $\lg n$
- a  $\lg 5 + \lg 4$       b  $\lg 12 - \lg 6$       c  $3 \lg 2$       d  $4 \lg 3 - \lg 9$   
 e  $\frac{1}{2} \lg 16 - \frac{1}{5} \lg 32$       f  $1 + \lg 11$       g  $\lg \frac{1}{50} + 2$       h  $3 - \lg 40$
- 8 Without using a calculator, evaluate
- a  $\log_3 54 - \log_3 2$       b  $\log_5 20 + \log_5 1.25$       c  $\log_2 16 + \log_3 27$   
 d  $\log_6 24 + \log_6 9$       e  $\log_3 12 - \log_3 4$       f  $\log_4 18 - \log_4 9$   
 g  $\log_9 4 + \log_9 0.25$       h  $2 \lg 2 + \lg 25$       i  $\frac{1}{3} \log_3 8 - \log_3 18$   
 j  $\frac{1}{3} \log_4 64 + 2 \log_5 25$       k  $\frac{1}{2} \log_5 (1\frac{9}{16}) + 2 \log_5 10$       l  $\log_3 5 - 2 \log_3 6 - \log_3 (3\frac{3}{4})$