1 $2^x = 32 \iff x = \log_2 32$

Write similar logarithmic equivalents of these equations. In each case find also the value of x, using your knowledge of indices and not using your calculator.

(i) $3^x = 9$ **(ii)** $4^x = 64$ **(iii)** $2^x = \frac{1}{4}$

(iv) $5^x = \frac{1}{5}$ **(v)** $7^x = 1$ **(vi)** $16^x = 2$

2 Write the equivalent of these equations in exponential form. Without using your calculator, find also the value of y in each case.

(i) $y = \log_3 9$ **(ii)** $y = \log_5 125$ **(iii)** $y = \log_2 16$

(iv) $y = \log_6 1$ **(v)** $y = \log_{64} 8$ **(vi)** $y = \log_5 \frac{1}{25}$

3 Write down the values of the following without using a calculator. Use your calculator to check your answers for those questions which use base 10.

(i) $\log_{10} 10\,000$ **(ii)** $\log_{10}\left(\frac{1}{10\,000}\right)$

(iii) $\log_{10} \sqrt{10}$ **(iv)** $\log_{10} 1$

(v) $\log_3 81$ **(vi)** $\log_3\left(\frac{1}{81}\right)$

(vii) $\log_3 \sqrt{27}$ **(viii)** $\log_3 \sqrt[4]{3}$

(ix) $\log_4 2$ **(x)** $\log_5\left(\frac{1}{125}\right)$

4 Write the following expressions in the form $\log x$ where x is a number.

(i) $\log 5 + \log 2$ **(ii)** $\log 6 - \log 3$

(iii) $2\log 6$ **(iv)** $-\log 7$

(v) $\frac{1}{2}\log 9$ **(vi)** $\frac{1}{4}\log 16 + \log 2$

(vii) $\log 5 + 3\log 2 - \log 10$ **(viii)** $\log 12 - 2\log 2 - \log 9$

(ix) $\frac{1}{2}\log \sqrt{16} + 2\log\left(\frac{1}{2}\right)$ **(x)** $2\log 4 + \log 9 - \frac{1}{2}\log 144$

5 Express the following in terms of $\log x$.

(i) $\log x^2$ **(i)** $\log x^5 - 2\log x$

(iii) $\log \sqrt{x}$ **(iv)** $\log x^{\frac{3}{2}} + \log \sqrt[3]{x}$

(v) $3\log x + \log x^3$ **(vi)** $\log \left(\sqrt{x}\right)^5$

6 Express the following as a single logarithm.

$$2\log_{10} x - \log_{10} 7$$

Hence solve

$$2\log_{10} x - \log_{10} 7 = \log_{10} 63.$$