QUESTION **1** Complete:

a If $\log_a x = c$ then $x =$ _____ **b** $\log_a xy = \log_a x +$ _____

c $\log_a \frac{x}{y}$ _____ **d** $\log_a a =$ _____

e $\log_a 1 =$ _____ **f** $\log_a x^n =$ _____

QUESTION **2** Express as an integer:

a $\log_3 27$ **b** $\log_2 32$ **c** $\log_5 5$ **d** $\log_7 1$

e $\log_6 36$ **f** $\log_{10} 100\,000$ **g** $\log_7 343$ **h** $\log_2 256$

1 Write each expression in logarithmic form.

a $9 = 3^2$ **b** $8 = 2^3$ **c** $6^2 = 36$ **d** $2^5 = 32$

e $8^1 = 8$ **f** $5^0 = 1$ **g** $64 = 4^3$ **h** $3^5 = 243$

i $5^{-1} = \frac{1}{5}$ **j** $2^{-2} = \frac{1}{4}$ **k** $\sqrt{3} = 3^{\frac{1}{2}}$ **l** $\sqrt[3]{7} = 7^{\frac{1}{3}}$

m $9^{\frac{3}{2}} = \sqrt{27}$ **n** $\sqrt[5]{8} = 2^{\frac{3}{5}}$ **o** $144^{-\frac{1}{2}} = \frac{1}{12}$ **p** $16^{-\frac{3}{4}} = \frac{1}{8}$

2 Write each expression in index form.

a $\log_5 25 = 2$ **b** $\log_2 16 = 4$ **c** $\log_7 7 = 1$ **d** $\log_2 8 = 3$

e $\log_3 81 = 4$ **f** $\log_{10} 100 = 2$ **g** $\log_2 32 = 5$ **h** $\log_6 1 = 0$

i $\log_3 243 = 5$ **j** $\log_2\left(\frac{1}{2}\right) = -1$ **k** $\log_3\left(\frac{1}{9}\right) = -2$ **l** $\log_4 2 = \frac{1}{2}$

m $\log_{27} 3 = \frac{1}{3}$ **n** $\log_5 \sqrt{5} = \frac{1}{2}$ **o** $\log_8 4 = \frac{2}{3}$ **p** $\log_{1000}\left(\frac{1}{100}\right) = -\frac{2}{3}$

3 Evaluate:

a $\log_{10} 10$ **b** $\log_4 16$ **c** $\log_3 27$ **d** $\log_2 32$

e $\log_9 1$ **f** $\log_{10} 1000$ **g** $\log_6 36$ **h** $\log_3 81$

i $\log_2 \sqrt{2}$ **j** $\log_8 2$ **k** $\log_4\left(\frac{1}{4}\right)$ **l** $\log_3\left(\frac{1}{9}\right)$

5 Solve for x.

a $\log_x 8 = 3$ **b** $\log_x 9 = 2$ **c** $\log_x 13 = 1$ **d** $\log_x 64 = 6$

e $\log_x 121 = 2$ **f** $\log_x 64 = 3$ **g** $\log_x 243 = 5$ **h** $\log_x 10\,000 = 4$

i $\log_x\left(\frac{1}{5}\right) = -1$ **j** $\log_x\left(\frac{1}{36}\right) = -2$ **k** $\log_x\left(\frac{1}{16}\right) = -4$ **l** $\log_x \sqrt{6} = \frac{1}{2}$

m $\log_x 2 = \frac{1}{3}$ **n** $\log_x 4 = \frac{2}{3}$ **o** $\log_x 27 = \frac{3}{2}$ **p** $\log_x 64 = \frac{6}{5}$

2 Write the missing numbers.

a $\log_2 \square = 1$ **b** $\log_3 \square = 0$ **c** $\log_{\square} 32 = 5$

d $\log_a 2 + \log_a \square = \log_a 8$ **e** $\log_a 36 - \log_a \square = \log_a 3$ **f** $\square \log_a 5 = \log_a 5^3$

g $\log_a 3^4 = \square \log_a 3$ **h** $\log_a \frac{1}{7} = \log_a 7^{\square}$ **i** $\square \log_a 3 = \log_a \frac{1}{3}$

4 Simplify:

a $\log_a 3 + \log_a 2$ **b** $\log_a 5 + \log_a 3$ **c** $\log_a 7 + \log_a 4$

d $\log_b 6 + \log_b 3$ **e** $\log_b 15 + \log_b 1$ **f** $\log_b 1 + \log_b 17$

a $\log_a 10 - \log_a 5$ **b** $\log_a 36 - \log_a 12$ **c** $\log_a 100 - \log_a 10$

d $\log_b 28 - \log_b 14$ **e** $\log_b 3 - \log_b 2$ **f** $\log_b 7 - \log_b 5$

1 Evaluate each of the following using the logarithm laws.

a $\log_{12} 3 + \log_{12} 4$ **b** $\log_3 15 - \log_3 5$ **c** $\log_6 12 + \log_6 3$

d $\log_2 48 - \log_2 6$ **e** $\log_2 80 - \log_2 5$ **f** $\log_7 2 + \log_7 \left(\frac{1}{2}\right)$

g $\log_4 36 - 2\log_4 3$ **h** $3\log_{10} 5 + \log_{10} 8$ **i** $\log_{100} 40 - \log_{100} 4$

j $\log_2 5 - \log_2 40$ **k** $4\log_8 2 + \frac{1}{2}\log_8 16$ **l** $2\log_{10} 5 - \log_{10}\left(\frac{1}{4}\right)$

9 If $\log_a 5 = 1.16$ and $\log_a 10 = 1.66$, evaluate:

a $\log_a 5a$ **b** $\log_a\left(\frac{10}{a}\right)$ **c** $\log_a\left(\frac{a}{5}\right)$

d $\log_a 25a$ **e** $\log_a 10a^2$ **f** $\log_a 125a^3$

g $\log_a a\sqrt{5}$ **h** $\log_a \sqrt{5a}$ **i** $\log_a\left(\frac{a^2}{10}\right)$

j $\log_a 2a$ **k** $\log_a\left(\frac{a}{2}\right)$ **l** $\log_a\left(\frac{1}{2a}\right)$

6 Solve $\log_5[\log_5(\log_5 x)] = 0$.