SOLVING EQUATIONS WITH LOGARITHMS

1 Solve for x:

    (a) $\log_3 x = 3$ **(b)** $\log_x 81 = 2$ **(c)** $\log_6 x = 3$ **(d)** $\log_x 343 = 3$

    (e) $\log_5 x = -3$ **(f)** $\log_3 81 = x$ **(g)** $\log_x \dfrac{1}{64} = -3$ **(h)** $\log_9 x = 0.25$

    (i) $\log_3 27\sqrt{3} = x$ **(j)** $\log_7 x = 2.5$ **(k)** $\log_2 (\log_2 x) = 2$ **(l)** $\log_2 x = \log_2 8 + \log_4 8$

2 Without using a calculator, solve each equation:

    (a) $\log_{10} x = \log_{10} 4 + \log_{10} 2$ **(b)** $\log_{10} x = \log_{10} 4 - \log_{10} 2$ **(c)** $\log_{10} x = \dfrac{\log_{10} 4}{\log_{10} 2}$

(d) $\log_{10} x = \frac{1}{2}\log_{10}\left(\frac{1}{4}\right)$

(e) $2\log_{10} x + 3 = \log_{10}(x^5)$

(f) $\log_{10} x^2 = 2$

4 Solve:

(a) $\log_{10} 2 + \log_{10} 5 + \log_{10} x - \log_{10} 3 = 2$

(b) $2\log_{10} x + 3 = 5\log_{10} x$

(c) $\log_{10} 2 + 5\log_{10} x - \log_{10} 5 - \log_{10}(x^3) = \log_{10} 40$

(d) $\log_{10} x = 4\log_{10} 2 - 2\log_{10} x$

(e) $\log_{10} x - \log_{10}(x-1) = 1$

(f) $\log_{10} x = 2\log_{10} 3 + \log_{10} 5 - \log_{10} 2 - 1$

5 Solve $2^{-x} = 5$. Indicate whether each statement below is a correct or incorrect step in the solution.

(a) $x = \dfrac{\log 5}{\log 2}$

(b) $x = \log_2\left(\dfrac{1}{5}\right)$

(c) $x = \dfrac{-\log 5}{\log 2}$

(d) $x = -2.32$ (2 d.p.)

6 Solve, correct to 3 decimal places:

(a) $2^x = 7$

(b) $3^x = 18$

(c) $5^x = 2$

(d) $0.4^x = 2$

(e) $6^x = 21$ **(f)** $3^{-x} = 0.1$ **(g)** $5^x = 16$ **(h)** $4^x = 5$

7 Find the values of x (to 2 decimal places) for which:

(a) $5^x > 2$ **(b)** $1.6^x \geq 0.5$ **(c)** $3^x < 0.2$ **(d)** $3^{-x} > 27$

8 If $y = a10^{bx}$, then:

A $x = \log_{10} \dfrac{y}{ab}$ **B** $x = \dfrac{1}{b}\log_{10} \dfrac{y}{a}$ **C** $y = \dfrac{1}{b}\log_{10} \dfrac{x}{a}$ **D** $x = \dfrac{1}{a}\log_{10} \dfrac{y}{b}$

9 If $\log_{10} A = bt + \log_{10} P$, express A in terms of the other symbols.

10 If $\log y = \log a + n \log x$, find an expression for y.

11 If $y = \dfrac{\log x}{\log 2}$, express x in terms of y.

12 If $x = a^2 \sqrt{b^3 c}$, express $\log x$ in terms of $\log a$, $\log b$ and $\log c$.

13 If $\log x = 0.6$ and $\log y = 0.2$, evaluate $\log\left(\dfrac{x^2}{\sqrt{y}}\right)$.

14 If $y = ae^{4t}$, express t in terms of a and y.

15 If $\log_b a = p$ and $c = a^2$, find the following in terms of p: **(a)** $\log_b c$ **(b)** $\log_c b$

16 If $\log_a 2 = \log_b 16$, show that $b = a^4$.

17 $5000 is invested at 7% p.a. compound interest. How long does it take for this money to:

(a) double in value   (b) grow to $20000   (c) grow to $30000?

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18 $5000 is invested at 6% p.a. compound interest. If the interest is calculated monthly, how long does it take for this money to:

   (a) double in value   **(b)** grow to $20 000   **(c)** grow to $30 000?

19 Marika and Joe deposit $4000 in an account that pays 9% p.a. compound interest, to be withdrawn when it has grown to $20 000. If the interest is calculated monthly, for how many whole months must they leave the money in the account?