34 Logarithms

Question 1 Solve the following exponential equations:

(a) $3^{2x+1} = 81$

(b) $8^x = 4$

(c) $3^{x-1} = \frac{1}{27}$

(d) $9^x = 243$

(e) $4^{x-1} = \sqrt{2}$

(f) $8^{3x-1} = 16$

(g) $4^{2x-1} = \left(\frac{1}{32}\right)^x$

(h) $2^{3-x} = 8^{x+1}$

(i) $\left(3\sqrt{3}\right)^x = \left(9\sqrt{27}\right)^{2-x}$

Question 2 Write each of the following in logarithmic form:

(a) $64 = 2^6$

(b) $100 = 10^2$

(c) $125 = 5^3$

(d) $3 = 2^x$

(e) $5 = 10^x$

(f) $15 = 4^x$

Question 3 Evaluate the following:

(a) $\log_2 16$

(b) $\log_9 81$

(c) $\log_5 625$

(d) $\log_9 27$

(e) $\log_{25} 125$

(f) $\log_8 32$

Question 4 Solve the following for the variable:

(a) $\log_2 32 = x$

(b) $\log_m 27 = 3$

(c) $\log_{16} 64 = y$

(d) $\log_p 125 = 3$

(e) $\log_n 6\frac{1}{4} = 2$

(f) $\log_x 8 = 3$

(g) $\log_y 8 = \frac{1}{4}$

(h) $\log_2 m = 7$

(i) $\log_{3\frac{1}{2}} q = 2$

Question 5 Evaluate the following:

(a) $\log_{10} 25 + \log_{10} 4$

(b) $\log_5 1000 - \log_5 8$

(c) $\log_6 12 + \log_6 3$

(d) $\log_4 32 + \log_4 2$

(e) $\log_{25} 300 - \log_{25} 12$

(f) $2\log_6 2 + 2\log_6 3$

Question 6 Solve the following equations for x:

(a) $\log_3 x = \log_3 7 + \log_3 2$

(b) $\log_a x = 2\log_a 3 - 3\log_a 2$

(c) $\log_a x + \log_a 5 = \log_a (x+1)$

(d) $2\log_3 x = \log_3 49$

(e) $\log_2 x + \log_2 (x+4) = 5$

(f) $\log_{12} 2x + \log_{12} (x-1) = 1$

Question 7 Solve the following exponential equations correct to 4 decimal places:

(a) $3^x = 7$

(b) $5^x = 15$

(c) $2^{x+1} = 9$

(d) $3^x = 6^{x-1}$

(e) $6^{x+2} = 10^{x-7}$

(f) $3^{x+1} = 5^{x-1}$

34 Logarithms (ANSWERS)

1 (a) $x = \frac{3}{2}$ (b) $x = \frac{2}{3}$ (c) $x = -2$
(d) $x = \frac{5}{2}$ (e) $x = \frac{5}{4}$ (f) $x = \frac{7}{9}$
(g) $x = \frac{2}{9}$ (h) $x = 0$ (i) $x = \frac{7}{5}$

2 (a) $\log_2 64 = 6$ (b) $\log_{10} 100 = 2$
(c) $\log_5 125 = 3$ (d) $\log_2 3 = x$
(e) $\log_{10} 5 = x$ (f) $\log_4 15 = x$

3 (a) 4 (b) 2 (c) 4 (d) $\frac{3}{2}$
(e) $\frac{3}{2}$ (f) $\frac{5}{3}$ 4 (a) 5 (b) 3
(c) $\frac{3}{2}$ (d) 5 (e) $\frac{5}{2}$ (f) 2
(g) 4096 (h) 128 (i) $12\frac{1}{4}$

5 (a) 2 (b) 3 (c) 2 (d) 3
(e) 1 (f) 2

6 (a) $x = 14$ (b) $x = \frac{9}{8}$ (c) $x = \frac{1}{4}$
(d) $x = 7$ (e) $x = 4$ (f) $x = 3$

7 (a) 1·7712 (b) 1·6826 (c) 2·1699
(d) 2·5850 (e) 38·5682 (f) 5·3013