Logarithms and log laws: 10 practice questions

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Name: _____ Date: _____

Attempt all questions and show your working. Suggested time: 15 to 20 minutes.

In this test, log x with no base written means $\log_{10} x$.

Section A: Consolidating (Questions 1-4)

Question 1

Write each statement in logarithmic form.

(a) $2^5 = 32$

(b) $10^3 = 1000$

(c) $3^{-2} = 1/9$

Question 2

Write each statement in index form.

(a) $\log_5 25 = 2$

(b) $\log_4 64 = 3$

(c) $\log_{10} 0.1 = -1$

Question 3

Evaluate.

(a) $\log_2 8$

(b) $\log_3 81$

(c) $\log_{10} 100$

(d) $\log_7 1$

Question 4

Evaluate.

(a) $\log_5 5$

(b) $\log_2 ¼$

(c) $\log_9 3$

Section B: Standard (Questions 5-10)

Question 5

Evaluate without a calculator.

(a) $\log_4 2$

(b) $\log_8 4$

(c) $\log_{27} \frac{1}{3}$

(d) $\log_2 (4\sqrt{2})$

Question 6

Write each expression as a single logarithm.

(a) $\log 3 + \log 5$

(b) $\log_2 40 - \log_2 5$, then evaluate it

(c) $3\log x$

(d) $2\log 3 + \log 4 - \log 6$

Question 7

Evaluate without a calculator.

(a) $\log_6 4 + \log_6 9$

(b) $\log_3 54 - \log_3 2$

(c) $\log 25 + \log 40$

(d) $2\log_5 10 - \log_5 4$

Question 8

Given that $\log_a 2 = p$ and $\log_a 3 = q$, write each in terms of p and q.

(a) $\log_a 6$

(b) $\log_a 9$

(c) $\log_a 8/3$

(d) $\log_a 18$

Question 9

Let $\log_a x = m$ and $\log_a y = n$, where a, x and y are positive and $a \neq 1$.

(a) Use the definition of a logarithm to write x and y as powers of a.

(b) Use an index law to show that $\log_a (xy) = \log_a x + \log_a y$.

(c) In the same way, show that $\log_a (x/y) = \log_a x - \log_a y$.

Question 10

Simplify.

(a) $\log_2 2^7$

(b) 5^(log$_5$ 3)

(c) $\log_3 1 + \log_3 3$

(d) log 10^(0.4)

Logarithms and log laws: answers

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Question 1

Answer: (a) $\log_2 32 = 5$ (b) $\log_{10} 1000 = 3$ (c) $\log_3 1/9 = -2$

Question 2

Answer: (a) $5^2 = 25$ (b) $4^3 = 64$ (c) $10^{-1} = 0.1$

Question 3

Answer: (a) 3 (b) 4 (c) 2 (d) 0

Question 4

Answer: (a) 1 (b) -2 (c) ½ (9^(½) = 3)

Question 5

Answer: (a) ½ (b) ⅔ (8^(⅔) = 4) (c) -⅓ (d) 5/2 (4√2 = 2^(5/2))

Question 6

Answer: (a) log 15 (b) $\log_2 8 = 3$ (c) log x^3 (d) log 6 (log (9 × 4)/(6))

Question 7

Answer: (a) 2 ($\log_6 36$) (b) 3 ($\log_3 27$) (c) 3 (log 1000) (d) 2 ($\log_5 100/4 = \log_5 25$)

Question 8

Answer: (a) p + q (b) 2q (c) 3p - q (d) p + 2q

Question 9

Answer: (a) $x = a^m$ and $y = a^n$ (b) $xy = a^m \times a^n = a^{(m + n)}$, so $\log_a (xy) = m + n = \log_a x + \log_a y$ (c) $x/y = (a^m)/(a^n) = a^{(m - n)}$, so $\log_a (x/y) = m - n = \log_a x - \log_a y$

Question 10

Answer: (a) 7 (b) 3 (c) 1 (0 + 1) (d) 0.4