Rules of logarithms

IB SL/HL

The Laws of Logarithms

$$\log_a b = c \Leftrightarrow b = a^c$$

$$\log_a m + \log_a n = \log_a mn$$

$$\log_a m - \log_a n = \log_a\left(\frac{m}{n}\right)$$

$$\log_a m^n = n\log_a m$$

$$\log_n m = \frac{\log_c m}{\log_c n}$$

1. Convert each of the following into logarithmic form.

   a) $4^2 = 16$

   b) $10^5 = 100000$

   c) $2^3 = 8$

   d) $7^3 = 343$

   e) $3^4 = 81$

   f) $25^{\frac{1}{2}} = 5$

2. Convert each of the following into index form.

   a) $\log_2 32 = 5$

   b) $\log_3 9 = 2$

   c) $\log_{125} 5 = \frac{1}{3}$

   d) $\log_{10} 1000 = 3$

   e) $\log_{100} 10 = \frac{1}{2}$

   f) $\log_7 49 = 2$

3. Write each of the following as a single logarithm.

   a) $\log 3 + \log 8$

   b) $\log 10 - \log 5$

   c) $\log 5 + \log 8 + \log \frac{1}{4}$

   d) $\log 12 + \log 6 - \log 4$

4. Write each of the following in the form $a\log b$.

   a) $\log 2^3$

   b) $\log 5^4$

   c) $\log 9$

   d) $\log 125$

5. $x = \log_2 3$ and $y = \log_2 4$.

Write each of the following in logarithmic form, simplifying your answer where possible.

a) $x + y$

b) $2x + y$

c) $3x - y$

d) $\frac{2x}{y}$

6. $x = \log_5 2$ and $y = \log_5 10$.

Write each of the following in terms of x and y.

a) $\log_5 5$

b) $\log_5 200$

c) $\log_5 25$

d) $\frac{\log_5 1000}{\log_5 32}$

Answers

1.

a) $\log_4 16 = 2$

b) $\log_{10} 100000 = 5$

c) $\log_2 8 = 3$

d) $\log_7 343 = 3$

e) $\log_3 81 = 4$

f) $\log_{25} 5 = \frac{1}{2}$

2.

a) $2^5 = 32$

b) $3^2 = 9$

c) $125^{\frac{1}{3}} = 5$

d) $10^3 = 1000$

e) $100^{\frac{1}{2}} = 10$

f) $7^2 = 49$

3.

a) $\log 24$

b) $\log 2$

c) $\log 10$

d) $\log 18$

4.

a) $3\log 2$

b) $4\log 5$

c) $2\log 3$

d) $3\log 5$

5.

a) $\log_2 12$

b) $\log_2 36$

c) $\log_2\left(\frac{27}{4}\right)$

d) $\frac{\log_a 9}{\log_a 4}$

6.

a) $y - x$

b) $x + 2y$

c) $2y - 2x$

d) $\frac{3y}{5x}$