# Exponents and Logarithms - It's the *LAW*

**THEOREM 1 Laws of Exponents ($b > 0$)**

| | Rule | Example |
|---|---|---|
| Exponent zero | $b^0 = 1$ | |
| Products | $b^x b^y = b^{x+y}$ | $2^5 \cdot 2^3 = 2^{5+3} = 2^8$ |
| Quotients | $\frac{b^x}{b^y} = b^{x-y}$ | $\frac{4^7}{4^2} = 4^{7-2} = 4^5$ |
| Negative exponents | $b^{-x} = \frac{1}{b^x}$ | $3^{-4} = \frac{1}{3^4} = \frac{1}{81}$ |
| Power to a power | $(b^x)^y = b^{xy}$ | $(3^2)^4 = 3^{2(4)} = 3^8$ |
| Roots | $b^{1/n} = \sqrt[n]{b}$ | $5^{1/2} = \sqrt{5}$ |

**Laws of Logarithms**

| | Law | Example |
|---|---|---|
| Log of 1 | $\log_b(1) = 0$ | |
| Log of $b$ | $\log_b(b) = 1$ | |
| Products | $\log_b(xy) = \log_b x + \log_b y$ | $\log_5(2 \cdot 3) = \log_5 2 + \log_5 3$ |
| Quotients | $\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$ | $\log_2\left(\frac{3}{7}\right) = \log_2 3 - \log_2 7$ |
| Reciprocals | $\log_b\left(\frac{1}{x}\right) = -\log_b x$ | $\log_2 \frac{1}{7} = -\log_2 7$ |
| Powers (any $n$) | $\log_b(x^n) = n \log_b x$ | $\log_{10}(8^2) = 2 \cdot \log_{10} 8$ |

Guided Notes:

1) Who invented logarithms?

2) Exponents and logarithms are the _____ of each other.

3) You can graph exponents and logarithms by: _____

_____.

4) The common log is defined as _____.

5) The natural log is defined as _____.

6) $log_b 1$ is always equal to _____.

7) $log \frac{m}{N^2} =$

8) $log 8 + log 5 - log 4 =$

9) $5(log_b A + log_b B) - 2log_b C =$

10) a) $lne^4 =$

b) $ln\frac{1}{e^3} =$

c) $ln\sqrt[3]{e} =$

d) $ln1 =$

12) a) $lny - lnx = 2ln7$

b) $lny = 2lnx - ln4$

13) a) $log_6(x+1) + log_6 x = 1$

b) $log_3 x + log_3(x-2) = 1$

14) a) $\ln(x-4)+ln3 \leq 0$

b) $\log(5-x)-log7 > 0$

15) a) $log_6 40 =$

b) $log_6 3 =$