

	<i>Generalization</i>	<i>Explanation</i>
Power Rule of Multiplication	$x^m \cdot x^n = x^{m+n}$	When multiplying like bases, add the exponents.
Power Rule of Division	$\frac{x^m}{x^n} = x^{m-n}$	When dividing like bases, subtract the exponents.
Negative Powers	$x^{-p} = \frac{1}{x^p}$	Negative exponents mean factors remain but they are in the denominator.
Zero Powers	$x^0 = 1$	For non-zero x-values, a zero exponent means 1.
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Fractional Powers	$x^{\frac{n}{d}} = \sqrt[d]{x^n}$	The denominator of a fractional exponent is the index of a radical.

Properties of Natural Logarithms

General Properties

1. $\log_b 1 = 0$
2. $\log_b b = 1$
3. $\log_b b^x = x$
4. $b^{\log_b x} = x$

Natural Logarithms

1. $\ln 1 = 0$
2. $\ln e = 1$
3. $\ln e^x = x$
4. $e^{\ln x} = x$

$$e^x = 7$$

$$\ln e^x = \ln 7$$

$$x \log_e e = \ln 7 \quad (\log_e e = 1)$$

$$x = \ln 7$$

$$x = 1.9459$$

Similar Powers

$$(18)^3 = 2^3 * 9^3 = 3^3 * 6^3 = 5832$$

Power to a Power

$$(x^2)^3 = x^2 * x^2 * x^2 = x^6$$

$$\ln a + \ln b = \ln ab$$

$$\ln a - \ln b = \ln \frac{a}{b}$$

$$\ln a^k = k \ln a$$

$$\ln e = 1$$

$$\ln e = \log_e e = 1$$

$$\log_e 35 = A$$

$$\ln 35 = A$$

$$\log_2(8)=X$$

$$2^X=8$$

$$2^X=2^3$$

$$X=3$$

$$\log_2(x) + \log_2(x - 2) = 3$$

$$\log_2[(x)(x - 2)] = 3$$

$$\log_2(x^2 - 2x) = 3$$

$$2^3 = x^2 - 2x$$

$$8 = x^2 - 2x$$

$$0 = x^2 - 2x - 8$$

$$0 = (x - 4)(x + 2)$$

$$x = 4, -2$$

$$\log_2(5x + 7) = 5$$

$$5x + 7 = 2^5$$

$$5x + 7 = 32$$

$$x = 5$$

$$\ln(4x - 1) = 3$$

$$4x - 1 = e^3$$

$$4x - 1 \approx 20.085537$$

$$x \approx 5.271384$$

$$\log_3(9x + 2) = 4$$

$$9x + 2 = 3^4$$

$$9x + 2 = 81$$

$$X=79/9$$

$$\text{Log}_{10}(5x - 11) = 2$$

$$5X - 11 = 10^2$$

$$5X - 11 = 100$$

$$X = 111 / 5$$

$$\text{Log}_4 x + \log_4 (x - 12) = 3$$

$$\text{Log}_4 (x(x - 12)) = 3$$

$$x(x - 12) = 4^3$$

$$x^2 - 12x = 64$$

$$x^2 - 12x - 64 = 0$$

$$(X + 4)(X - 16) = 0$$

$$x = -4 \text{ or } x = 16$$

$x = 16$ cannot be negative

$$\text{Log}_2(X + 1) - \text{Log}_2(X - 4) = 3$$

$$\text{Log}_2((X + 1) / (X - 4)) = 3$$

$$(X + 1) / (X - 4) = 2^3$$

$$(X + 1) / (X - 4) = 8$$

$$X + 1 = 8(X - 4)$$

$$X + 1 = 8X - 32$$

$$X = 33 / 7$$

$$\text{Log}_6(x + 4) + \log_6(x - 2) = \log_6(4x)$$

$$\text{Log}_6((x + 4)(x - 2)) = \log_6(4x)$$

$$(x + 4)(x - 2) = 4x$$

$$x^2 + 2x - 8 = 4x$$

$$x^2 - 2x - 8 = 0$$

$$(x + 2)(x - 4) = 0$$

~~$x = -2$~~ or $x = 4$ cannot be negative