

A Reminder of Basic Algebra and Logarithms for Students of Population Genetics

Basic Algebra

$$1) \quad a^m \cdot a^n = a^{m+n}$$

$$2) \quad (a^x)^y = a^{xy}$$

$$3) \quad \frac{a^m}{a^n} = a^{m-n}, a \neq 0, m > n; \frac{a^m}{a^n} = \frac{1}{a^{n-m}}, a \neq 0, m < n$$

$$4) \quad (a \cdot b)^n = a^n b^n$$

$$5) \quad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$$

$$6) \quad a^0 = 1, a \neq 0$$

$$7) \quad a^{x/y} = \sqrt[y]{a^x} = (\sqrt[y]{a})^x$$

$$8) \quad a^{-p} = \frac{1}{a^p}$$

$$9) \quad a^x = e^{\ln(a)x}$$

Logarithms

$b^x = m$, x is the log of m to the base b (written as $\log_b m = x$).

$$1) \quad \log_b (P \cdot Q) = \log_b P + \log_b Q$$

$$2) \quad \log_b \left(\frac{P}{Q}\right) = \log_b P - \log_b Q$$

$$3) \quad \log_b (P^n) = n \cdot \log_b P$$

$$4) \quad \log_b \left(\sqrt[n]{P} \right) = \frac{1}{n} \log_b P$$

5) $\ln(m)$ denotes the natural logarithm of m to the base e .

Other notation and formulas

The roots of a quadratic equation $ax^2 + bx + c = 0$:

$$-\frac{b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$$

Dot-Dot-Dot: a_1, \dots, a_n mean a sequence of n numbers a_1, a_2 "on up to" a_n .

$$\text{Summation: } \sum_{k=1}^n a_k = a_1 + \dots + a_n$$

$$\text{Product: } \prod_{k=1}^n a_k = a_1 a_2 \dots a_n$$

Combinations

The number of ways that n objects can be arranged is given by n factorial:

$$N! = 1 \cdot 2 \cdot 3 \dots n$$

The number of way that k objects can be selected from n objects is given by the *binomial coefficient* n -choose- k :

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

Approximations

$$\ln(1+x) = x, \text{ for small values of } x$$