## 1 Introduction

**Definition 1.0.1** (Log Definition).

$$log_a b = c$$

$$a^{log_a b} = a^c$$

$$b = a^c$$

$$log_a b = log_a a^c$$

$$log_a b = c$$

Theorem 1.1 (Logarithm Product Rule).

$$log_x(A*B) = log_x A + log_x B$$

Proof.

$$x^l = A \tag{1}$$

$$log_x x^l = log_x A (2)$$

$$l = log_x A \tag{3}$$

$$x^m = B (4)$$

$$log_x x^m = log_x B (5)$$

$$m = log_x B (6)$$

$$x^n = A * B \tag{7}$$

$$log_x x^n = log_x (A * B) \tag{8}$$

$$n = log_x(A * B) \tag{9}$$

$$log_x(A*B) = n (10)$$

$$x^n = A * B \tag{11}$$

$$x^n = x^l * x^m \tag{12}$$

$$x^n = x^{l+m} (13)$$

$$n = l + m$$
 use (3) (6) (9) (14)

$$log_x(A*B) = log_x A + log_x B \tag{15}$$

Theorem 1.2 (Logarithm Power Rule).

$$log_x A^B = B * log_x(A)$$

Proof.

$$log_x(A^B) (16)$$

$$log_x(\prod_{n=1}^B A) \tag{17}$$

$$\sum_{x=1}^{B} (log_x A) \qquad \text{use (1.1)}$$

$$log_x(A^B)$$

$$log_x(\prod_{n=1}^B A)$$

$$\sum_{n=1}^B (log_x A)$$

$$log_x A * \sum_{n=1}^B 1$$

$$B * log_x A$$

$$(16)$$

$$(17)$$

$$(18)$$

$$B * log_x A \tag{20}$$