# Logarithm Notes

1. Meaning:
   - Log is the inverse function of exponential functions.
   - E.g. $2^4 = 16$ (Exp func)
     $$\log_2(16) = 4 \quad \text{(Log func)}$$
   - $\log_b(x) = y$ is the inverse of $x = b^y$

2. Product Rule:
   - $\log_b(x \cdot y) = \log_b(x) + \log_b(y)$
   - E.g. $\log_2(2 \cdot 4) = \log_2(2) + \log_2(4)$
     $$LHS = \log_2(8)$$
     $$= 3$$

     $$RHS = \log_2(2) + \log_2(4)$$
     $$= 1 + 2$$
     $$= 3$$

     $$LHS = RHS$$

3. Quotient Rule:
   - $\log_b(x/y) = \log_b(x) - \log_b(y)$
   - E.g. $\log_2(8/2) = \log_2(8) - \log_2(2)$
     $$LHS = \log_2(8/2)$$
     $$= \log_2(4)$$
     $$= 2$$

     $$RHS = \log_2(8) - \log_2(2)$$
     $$= 3 - 1$$
     $$= 2$$

     $$LHS = RHS$$

4. Power Rule:
   - $\log_b(x^y) = y \cdot \log_b(x)$
   - E.g. $\log_2(2^4) = 4 \cdot \log_2(2)$
   LHS $= \log_2(2^4)$
   $= \log_2 16$
   $= 4$

   RHS $= 4 \cdot \log_2(2)$
   $= 4$

   LHS = RHS

5. Log of 1:
   - $\log_b(1) = 0$

6. Log of base:
   - $\log_b(b) = 1$