

## 12.3 Properties of Logarithms

$$1. \log_b(mn) = \log_b(m) + \log_b(n)$$

$$2. \log_b\left(\frac{m}{n}\right) = \log_b(m) - \log_b(n)$$

$$3. \log_b(m^p) = p \log_b(m)$$

### Example 12.3.1

Expand and rewrite. Simplify where appropriate.

$$1. \log_8\left(\frac{23}{x}\right) =$$

$$2. \ln\left(\frac{e^5}{11}\right) =$$

$$3. \ln \sqrt[3]{x} =$$

$$4. \log[(x+2)(x+2)] =$$

$$5. \log_b \left( x^4 \sqrt[3]{y} \right) =$$

$$6. \log_5 \left( \frac{\sqrt{x}}{25y^{-3}} \right) =$$

**Example 12.3.2**

Write each as a single log.

$$1. \log(25) + \log(4) =$$

$$2. \log(7x^2 - 6x) - \log(x) =$$

$$3. 2 \ln(x) + \frac{1}{3} \ln(x + 5) =$$

4.  $2 \log(x - 3) - \log x =$

5.  $\frac{1}{4} \log_b(x) - 2 \log_b(5) - 10 \log_b(y) =$