

# 1.5 Exponential and Logarithmic Functions

## Logarithms

Find the inverse of the exponential function:  $f(x) = b^x$ .

**Exponential form:**

**Logarithmic form:**

EXAMPLE: Change  $\log_c 6 = 8$  into exponential form.

EXAMPLE: Change  $2^d = 8$  into logarithmic form.

## Properties of Logarithms

1.)  $\log_b 1 = 0$

Example:

2.)  $\log_b b = 1$

Example:

3.)  $b^{\log_b M} = M$

Example:

4.)  $\log_b b^r = r$

Example:

5.)  $\log_b M^r = r \cdot \log_b M$

Example:

6.)  $\log_b (M \cdot N) = \log_b M + \log_b N$

Example:

7.)  $\log_b \left( \frac{M}{N} \right) = \log_b M - \log_b N$

Example:

EXAMPLE: Find the exact value using logarithm properties:  $\log_3(\log_7 21 - \log_7 3)$ .

EXAMPLE: Find the exact value using logarithm properties:  $\log_{144} 12$ .

EXAMPLE: Express  $\log_9 x^2 \cdot \sqrt{3x-5}$  as a sum or difference of logarithms. Express powers as factors.

EXAMPLE: Express  $\ln \frac{(x+5)^4}{x^3}$  as a sum or difference of logarithms. Express powers as factors.

EXAMPLE: Express  $\log_4 \frac{(x-5)^5 \cdot \sqrt[3]{x-2}}{(x-1)^4}$  as a sum or difference of logarithms. Express powers as factors.

### Solving Exponential Equations

**Equal Bases Property** (The Equivalence Property of Exponential Expressions)

If  $a^u = a^v$  then  $u = v$ .

EXAMPLE: Solve  $2^{x-2} = 8$

EXAMPLE: Solve:  $4^{x-2} - 64 = 0$ .

EXAMPLE: Solve:  $3^x = 7$ .

EXAMPLE: Solve:  $e^{x+5} = 4$ .

### **Solving Logarithmic Equations**

EXAMPLE: Solve:  $\log_5(4x + 5) = 2$ .

EXAMPLE: Solve:  $\log_2(x + 11) + \log_2(x + 7) = 5$

EXAMPLE: Solve:  $\log_2(x + 3) - \log_2(x + 5) = 1$