

**DEFINITION 10.2**

If  $r$  is any positive real number, then the unique exponent  $t$  such that  $b^t = r$  is called the **logarithm of  $r$  with base  $b$**  and is denoted by  $\log_b r$ .

$$\log_b r = t \text{ is equivalent to } b^t = r.$$

**PROPERTY 10.3**

For  $b > 0$  and  $b \neq 1$ ,  
 $\log_b b = 1$  and  $\log_b 1 = 0$ .

**PROPERTY 10.4**

For  $b > 0$ ,  $b \neq 1$ , and  $r > 0$ ,  
 $b^{\log_b r} = r$ .

**PROPERTY 10.5**

For positive numbers  $b$ ,  $r$ , and  $s$ , where  $b \neq 1$ ,  
 $\log_b rs = \log_b r + \log_b s$ .

**PROPERTY 10.6**

For positive numbers  $b$ ,  $r$ , and  $s$ , where  $b \neq 1$ ,  
 $\log_b \left( \frac{r}{s} \right) = \log_b r - \log_b s$ .

**PROPERTY 10.7**

If  $r$  is a positive real number,  $b$  is a positive real number other than 1, and  $p$  is any real number, then  
 $\log_b r^p = p(\log_b r)$ .

Handout for section 10.3