

## Chapter 10 Formulas

### Properties of Exponents 10-1

$a^m a^n = a^{m+n}$	$\frac{a^m}{a^n} = a^{m-n}$
$(ab)^m = a^m b^m$	$(a^m)^n = a^{mn}$
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$a^0 = 1$
$a^{-m} = \frac{1}{a^m}$	

If  $n$  and  $m$  are integers greater than 0, and  $b$  is a positive real number then:

$$b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m = \sqrt[n]{b^m}$$

Definition of Logarithm:

If  $b$  and  $N$  are positive numbers ( $b \neq 1$ )

$$\log_b N = K \text{ if and only if } b^K = N$$

## Properties of Logarithms:

$$\log_b M = \log_b N \text{ if and only if } M = N$$

$$\log_b b^k = k$$

$$b^{\log_b N} = N$$

$$\log_b b = 1$$

$$\log_b 1 = 0$$

### Laws of logarithms 10-5

For any positive numbers  $x$  and  $y$ , where  $a$  is any positive integer where  $a \neq 1$

$$\log_a (x \bullet y) = \log_a x + \log_a y$$

For any positive number  $z$ , any number  $p$ , and any logarithm base  $a$ ,

$$\log_a x^p = p \bullet \log_a x$$

For any positive numbers  $x$ ,  $y$ , and any logarithm base  $a$ ,

$$\log_a \frac{x}{y} = \log_a x - \log_a y$$

## 10-6 Change of Base Theorem

$$\log_a x = \frac{\log_b x}{\log_b a}$$

## 10-7 Exponential Growth and Decay

Formula for exponential Growth:

$$N = ne^{kt}$$

Formula for Decay:

$$n = Ne^{kt}$$

Compound Interest Formula:

If an initial amount  $P$  (called the principal) is invested at an annual interest rate  $r$  compounded  $n$  times a year, Then in  $t$  years the interest will grow to a final amount  $A$ .

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

### Doubling-Time Growth Formula:

If a population of size  $n$  doubles every  $d$  years (or hours, or days, or any other unit of time), then the number  $N$  in the population at time  $t$  is given using the following formula:

$$N = n \bullet 2^{\frac{t}{d}}$$

$N_0$

### Half-Live Decay Formula

If an amount  $N$  has a half-life  $h$ , then the amount remaining at time  $t$  is represented by the formula:

$$n = N \left( \frac{1}{2} \right)^{\frac{t}{h}}$$

$N_0$