7.3 Solving Exponential Functions:

Review of Exponential Rules

1. $b^0 = 1$ 2. $b^x \cdot b^y = b^{x+y}$ 3. $\frac{b^x}{b^y} = b^{x-y}$

4. $(b^x)^y = b^{xy}$ 5. $b^{-x} = \frac{1}{b^x}$ 6. $\left(\frac{b}{a}\right)^{-x} = \left(\frac{a}{b}\right)^{x} = \frac{a^x}{b^x}$

7. $(ab)^x = a^x b^x$ 8. $a^x = a^y$ if and only if $x = y$

Example 1: Write each expression as a power with base 2:

a.) 4^3

b.) $\frac{1}{8}$

c.) $8^{\frac{2}{3}}(\sqrt{16})^3$

Example 2: Simplify by changing the base

a.) $(4^x)^{2+x}\ (32^x)^{-x}$

b.) $\frac{9^x(27^{x-3})}{243^{x+1}}$

Solving Exponential Equations

Exponential Equations can be solved if the bases are the same on both sides. Otherwise, a graphing calculator can be used.

Example 3: Solve

a.) $4^{x+2} = 64^{x}$

b.) $3^{3x+4} = 81^{x+2}$

c.) $4^{x+2} = 8^{2x-3}$

d.) $8(8)^{x} = 2$

Example 4:

a.) (Algebraically) A colony of 20000 ants grows by 50% every hour. After how many hours will it take the colony to reach 151875 ants?

b.) (Graphing calculator) Determine how long $1000 needs to be invested in an account that earns 8.3% compounded semi-annually (once every 6 months) before it increases to $1500.