Solving Exponential Equations (Part 1)

These notes are intended as a summary of section 5.3 (p. 358 – 363) in your workbook. You should also read the section for more complete explanations and additional examples.

Laws of Exponents

1. $x^m \cdot x^n = x^{m+n}$
2. $(x \cdot y)^m = x^m \cdot y^m$
3. $\dfrac{x^m}{x^n} = x^{m-n}$
4. $\left(\dfrac{x}{y}\right)^m = \dfrac{x^m}{y^m}$
5. $(x^m)^n = x^{m \cdot n}$
6. $\sqrt[m]{x} = x^{\frac{1}{m}}$
7. $x^{-m} = \dfrac{1}{x^m}$

Exponential Equations

An **exponential equation** is an equation that contains a power with a variable in the exponent. For example:

$$3^x = 81$$

Equations of this type can be solved by writing both sides as powers with the same base, as shown below:

$$3^x = 3^4$$

Logically, if the powers are equal, and their bases are equal, then their exponents must also be equal. Thus,

$$x = 4$$

Example 1 (sidebar p. 359)
Solve each equation.

a) $4^x = \dfrac{1}{256}$

b) $27^x = 9^{2x-1}$

Example (not in workbook)
Solve each equation.

a) $2^x = 8$

b) $3^x = \frac{1}{27}$

c) $2^{-x} = \frac{1}{32}$

d) $5^{x^2-2x}=125$

e) $81^{x+2}=27^2$

f) $2\cdot 4^{x-3}=32$

Example 2 (sidebar p. 360)
Solve each equation.

a) $2^x = 8\sqrt[3]{2}$

b) $\left(\sqrt{125}\right)^{2x+1} = \sqrt[3]{625}$

Homework: #3 – 6, 9, 10 in the exercises (p. 364 – 368). Answers on p. 369.