Section 7.4

Solving Exponential Equations Using Logarithms

From previous chapter, we were able to solve for the variable exponent using like bases.

$$3^x = 27$$
$$3^x = 3^3$$
$$x = 3$$

What if we wanted to solve

$$3^x = 30$$

We use logs and the power property

$$\log 3^x = \log 30$$
$$x \log 3 = \log 30$$
$$x = \frac{\log 30}{\log 3} \approx 3.1$$

Further Examples

$$5^x = 120$$

$$\log 5^x = \log 120$$

$$x \log 5 = \log 120$$

$$x = \frac{\log 120}{\log 5} \approx 2.97$$

ex. 2 pg. 450

$$3^{x-1} = 20$$

$$(x-1)\log 3 = \log 20$$

$$x - 1 = \frac{\log 20}{\log 3}$$

$$x = \frac{\log 20}{\log 3} + 1 = 3.727$$

Your turn,

$$5^{x+2} = 104$$

$$x+2 \log 5 = \log 104$$

$$x+2 = \frac{\log 104}{\log 5}$$

$$x = \frac{\log 104}{\log 5} - 2$$

$$x = 0.8857$$

Ex. 4 pg 453

$$2^{x-1} = 3^{x+1}$$

$$(x-1)\log 2 = (x+1)\log 3$$

$$(x-1)0.3010 = (x+1)0.4771$$

$$0.3010x - 0.3010 = 0.4771x + 0.4771$$

$$0.3010x - 0.4771x = 0.4771 + 0.3010$$

$$-0.1761x = .7781$$

$$\frac{-0.1761}{-0.1761} x = \frac{.7781}{-0.1761}$$

$$x = -4.419$$

Your Turn

$$5^{x-2} - 7^{x+1} = 0$$

$$5^{x-2} = 7^{x+1}$$

$x-2\log 5 = x+1\log 7$

$0.6990x - 1.3979 = 0.8451x + 0.8451$

$0.6990x - 0.8451x = 0.8451 + 1.3979$

$-.1461x = 2.243$

$x = -15.4$

Evaluate

$\log_5 450$

$\log_5 450 = y$

$5^y = 450$

$y \log 5 = \log 450$

$y = \frac{\log 450}{\log 5}$

$y = 3.796$

Practice

pg. 456 # 5, 6, 16