

Section 7.5
Exponential and Logarithmic
Equations

Students will be able to solve exponential and logarithmic equations.

Any equation where the exponent contains a variable is an exponential equation.

-Logs can be useful when solving exponential equations. Exponents can be useful when solving logarithmic equations.

Solve:

$$27^{3x} = 81$$

Same base

$$(3^3)^{3x} = 3^4$$

$$3^{9x} = 3^4$$

$$9x = 4$$

$$x = \frac{4}{9}$$

When bases are not the same, you can take the log of each side.

if m and n are positive, and $m = n$, then $\log m = \log n$

Solve:

$$5^{2x} = 130$$

$$\log 5^{2x} = \log 130$$

$$2x \log 5 = \log 130$$

$$\frac{2x \log 5}{2 \log 5} = \frac{\log 130}{2 \log 5}$$

$$x \approx 1.51$$

Solve:

$$5.2^{3x} = 400$$

$$3x \log 5.2 = \log 400$$

$$\frac{3x \log 5.2}{3 \log 5.2} = \frac{\log 400}{3 \log 5.2}$$

$$x \approx 1.21$$

Modeling with Exponential Equations:

Wood is a sustainable, natural resource when you manage forests properly. Your lumber company has 1,200,000 trees. You plan to harvest 7% of the trees each year. How many years will it take to harvest half of the trees?

$$y = ab^x \rightarrow 100 - 7 = 93\%$$

$$\frac{600,000}{1,200,000} = \frac{1,200,000 \cdot (.93)^x}{1,200,000}$$

$$\log .5 = \log (.93)^x$$

$$\frac{\log .5}{\log .93} = \frac{x \log .93}{\log .93}$$

$$x \approx 9.55 \text{ yrs}$$

A logarithmic equation is an equation that includes one or more logs involving a variable.

Solve:

$$\log_{10}(3 - 2x) = -1$$

← To get x out of log, put in exp. form

$$\frac{10^{-1} - 3}{-2} = \frac{2x}{-2}$$

$$1.45 = x$$

Solve:

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

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

$$10^1 = (x-3)x$$

$$0 = x^2 - 3x - 10$$

$$-10 \quad (x-5)(x+2)$$

check $x=5$, ~~$x=-2$~~

Solve:

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

$$\log \frac{4x^2}{5} = 1$$

$$\frac{5 \cdot 10^1}{4} = \frac{4x^2}{4 \cdot 5}$$

$$\sqrt{\frac{50}{4}} = \sqrt{x^2}$$

$$\pm 3.53 \approx x \text{ check}$$

$$x \approx 3.53$$

Hwk: pg. 473 - 475

#10 - 26 (4th), 32 - 44 (evens),

49, 62, 64 - 76 (evens), 80

