4.4B Exponential and Logarithmic Equations

- Use the definition of a logarithm to solve logarithmic equations

LT: Use the definition of a logarithm to solve logarithmic equations

Steps for using Definition of Log to solve:

1. Express the equation as a log
2. Use the definition to rewrite the equation in exponential form
3. Solve for the variable
4. Check solution

Example 6: Solve a. $\log_4(x+3) = 2$

$$4^2 = x + 3$$

$$16 = x + 3$$

$$13 = x$$

b. $3\ln(2x) = 12$

$$\frac{3\ln(2x)}{3} = \frac{12}{3}$$

$$\ln 2x = 4$$

$$e^4 = 2x$$

$$\frac{e^4}{2} = x$$

Your Turn 6: Solve

a. $\log_2(x-4)=3$

$2^3 = x-4$

$8 = x-4$

$12 = x$

b. $4\ln(3x)=8$

$\ln 3x = 2$

$e^2 = 3x$

$\frac{e^2}{3} = x$

Example 7: Solve: $\log_2 x + \log_2(x-7) = 3$

$$\log_2 x\,(x-7) = 3$$

$$2^3 = x(x-7)$$

$$8 = x^2 - 7x$$

$$0 = x^2 - 7x - 8$$

$$0 = (x-8)(x+1)$$

$$0 = x - 8 \qquad 0 = x + 1$$

$$8 = x \qquad -1 = x$$

Only value that checks is $x = 8$

Your Turn 7: Solve: $\log x + \log(x-3) = 1$

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

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

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

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

$$0 = (x-5)(x+2)$$

$$0 = x - 5 \qquad 0 = x + 2$$

$$5 = x \qquad -2 = x$$

Only value that checks is $x = 5$