3.5 Solve Exponential and Logarithmic Equations

ESSENTIAL QUESTIONS:

1. What strategies help solve exponential & logarithmic equations?
2. How are exponentials & logs applied to real-life problems, such as Newton's Law of Cooling?

Solve Exponential Equations

1. $32(\frac{1}{4})^{x/3} = 2$

2. $3 \cdot (5^{-x/4}) - 2 = 13$

3. $2e^{2x} + 5e^{x} - 3 = 0$

4. $\frac{e^{x} - e^{-x}}{2} = 5$

5. $\frac{400}{1 + 95e^{-0.6t}} = 150$ (Now we'll do this by hand instead of with a calculator!)

Solve Logarithmic Equations

- isolate logs from other terms
- condense logs
- logs on one side of equation: convert to exponential form
- logs on both sides: exponential both sides
- solve

6. $3 - \log(x + 2) = 5$

7. $\log x - \frac{1}{2}\log(x + 4) = 1$

8) $\log(x - 2) + \log(x + 5) = 2\log 3$

9) $\ln(3x - 2) - 2\ln x = \ln \frac{1}{x - 1}$

Newton's Law of Cooling

An object that has been heated will cool to the temperature of the surrounding medium in which it is placed. The temperature T at time t is given by:

$$T(t) = T_m + (T_0 - T_m)e^{-kt}$$

T_m = temperature of medium
T_0 = initial temperature of object

$$T(t) = T_m + (T_0 - T_m)e^{-kt}$$

A hard-boiled egg at temperature 96°C is placed in 16°C water to cool. Four minutes later the temperature of the egg is 45°C. Use Newton's Law of Cooling to determine when the egg will be 20°C.