

Pre Calculus

Date:

Items Needed: .Book,

Objective: The students will be able to solve logarithmic and exponential functions.

Lesson:

- Today we are going to solve some equations involving logarithmic and exponential functions. What defines an equation? The equal sign.
- Remind students about the one to one properties and the inverse properties.
 1. When you have an e function take the \ln of both sides.
 2. When you have a \ln function take the e of both sides.
 3. When you have a log function raise everything to the base of the log.
- Do example 1.
- Let's do some examples. Remind students that the main goal is to get everything on the other side of the equation before you take the inverse function of it to solve for x .

Example 1. Solve each equation and round your answer to three decimal places.

a)

$$4e^{2x} = 16 \Rightarrow e^{2x} = 4 \Rightarrow \ln e^{2x} = \ln 4 \Rightarrow 2x = \ln 4$$

$$x = \frac{\ln 4}{2} \approx 0.693$$

b)

$$5e^{x+2} - 8 = 14 \Rightarrow 5e^{x+2} = 22 \Rightarrow e^{x+2} = \frac{22}{5} \Rightarrow \ln e^{x+2} = \ln \frac{22}{5} \Rightarrow$$

$$x + 2 = \ln \frac{22}{5} \Rightarrow x = \ln \frac{22}{5} - 2 \approx -0.518$$

c)

$$2(3^x - 1) = 10 \Rightarrow 3^x - 1 = 5 \Rightarrow 3^x = 6 \Rightarrow \ln 3^x = \ln 6 \Rightarrow x \ln 3 = \ln 6$$

$$x = \frac{\ln 6}{\ln 3} \approx 1.262$$

d)

$$e^{2x} - e^x - 20 = 0 \Rightarrow (e^x + 4)(e^x - 5) = 0$$

$$e^x + 4 = 0 \Rightarrow e^x = -4 \text{ or } e^x - 5 = 0 \Rightarrow e^x = 5 \Rightarrow x = \ln 5 \approx 1.609$$

- Do examples 7 & 8.
- Do example 9 and point out the bottom note that is highlighted in the TE. Review how to find a Domain of a logarithmic or exponential function.

- Do these examples. In ex b, show how you can bring the $\ln x$ to the left side and then take the e of it to get the solution.

Example 2. Solve the following logarithmic equations and round your answers to three decimal places.

a) $2 \log x = 5 \Rightarrow \log x = \frac{5}{2} \Rightarrow x = 10^{\frac{5}{2}} \approx 316.228$

b)

$$\ln \sqrt{x+2} = \ln x \Rightarrow \sqrt{x+2} = x \Rightarrow x+2 = x^2 \Rightarrow x^2 - x - 2 = 0$$

$$(x-2)(x+1) = 0$$

$$x-2 = 0 \Rightarrow x = 2$$

$$x+1 = 0 \Rightarrow x = -1$$

-1 cannot be a solution because of the domain of the logarithmic function.

c)

$$\log x - \log(x-3) = 1 \Rightarrow \log \frac{x}{x-3} = 1 \Rightarrow \frac{x}{x-3} = 10^1 \Rightarrow$$

$$x = 10x - 30 \Rightarrow -9x = -30 \Rightarrow x = \frac{10}{3}$$

Example 4. You have \$50,000 to invest. You need to have \$350,000 to retire in thirty years. At what continuously compounded interest rate would you need to invest to reach your goal?

$$350,000 = 50,000e^{r \cdot 30}$$

$$7 = e^{30r}$$

$$\ln 7 = \ln e^{30r}$$

$$\ln 7 = 30r$$

$$r = \frac{\ln 7}{30} \approx 6.5\%$$

- Do example 13.

Assignment: Have students do 24, 28, 39, 42, 45, 57-78 (every 3), p. 217.

Have students do 93-108 (every 3), 110, 149, 150, p. 218.

Evaluation: (Could be from any one/several of the following)

- Responses from classroom questions
- Results of classroom sample problems
- Homework responses
- Check answer with Calculator
- End of the section exam

Enrichment: