Exponential and Logarithmic Functions Worksheet Chapter 3
Spring 2016

Find the indicated values, when necessary, round your answer to two decimal places.

1. \(2^{2.5}\)  
2. \(1000 \cdot (1 + 0.04)^{36}\)  
3. \(8500 \left(\frac{3}{4}\right)^{24}\)

4. \(350e^{(0.05)(12)}\)  
5. \(12.05e^{-1.250}\)  
6. \(5000e^{(0.2354)(100)}\)

7. \(\frac{250}{1 + 12.5e^{-0.0150}}\)  
8. \(\ln(1)\)  
9. \(\ln(e)\)  
10. \(-3 \ln 2\)

11. \(\ln\left(\frac{1}{8}\right)\)  
12. \(\ln\left(4e^{-2}\right)\)  
13. \(\ln(4) - 2\)

8. Use the appropriate formula \(A = P\left(1 + \frac{r}{n}\right)^{nt}\) and \(A = Pe^{rt}\)

Suppose your grandparents deposited $100 into an account the day that you were born. Find the amount in that account on your 20\textsuperscript{th} birthday, if the interest rate was 6% and the interest was compounded,

a. monthly.  
b. continuously.

9. The population of smurfs in a small backwoods village can be approximated by the model, \(S = 12e^{0.025t}\), where \(S\) is the number of smurfs, and \(t\) is the year with \(t = 0\) corresponding to 2000. Use the model to approximate the smurfs population in 2000, 2010, and 2015 and the projected population in 2020.

10. Use a graphing utility to find the domain, any asymptotes, intercepts, of the graph of the function, \(f(x) = e^x\) and \(g(x) = \ln(x)\)

11. Use the properties of logarithms to expand the expression as a sum/difference or multiple of logarithms:

a. \(\ln\left(\frac{\sqrt{x^2 + 1}}{x_4}\right)\)  
b. \(\ln\left(x^2 \sqrt{1 - x^2}\right)\)
12. Use the properties of logarithms to condense the expression as a logarithm of a single quantity.

a. $\ln(x + 2) - 3\ln x$

b. $4\ln x + \frac{1}{2}\ln(x + 2)$

13. Solve the exponential equation, if necessary round to three decimal places.

a. $e^{-4x} = 1$

b. $5e^{2x} - 2 = 10$

c. $200e^{-0.06x} = 12000$

d. $\frac{750}{1 + 2.5e^{-0.5t}} = 250$

14. The population of a small town in central PA was approximately 10,000 in 2010 and 12,000 in 2015. Assuming the population is increasing exponentially, find the population model, $P = ae^{kt}$ where $P$ is the population and $t$ is the year with $t = 0$ corresponding to the year 2020.

15. A SUV that was purchased new 4 years ago, today has a depreciated value of $18,000. The value of SUV is expected to be $9,000 when it is 6 years old. Find the exponential (decay) model that gives the value, $V = ae^{kt}$ where $V$ is the value of the SUV, in terms of the number of years, $t$ since the vehicle was purchased.

16. A PSU graduate student as part of her research is recording the number of chin-ups (pull-ups) an athlete can do in 60 seconds during their physical therapy rehabilitation. The grad student has fit the data to the model, $N = \frac{72}{1 + 5e^{-0.25t}}$ where $N$ is the number of chin-ups, and $t$ is time in weeks since starting rehab. Find the following:

a. The number of chin-ups the athlete could in 60 seconds prior to starting rehab.

b. The time it will take until the athlete could do 30 chin-ups in 60 seconds.

c. The limiting number of chin-ups the athlete can do in 60 seconds as time in rehab passes infinitely.