Math 120 HW #7

Due: Nov. 29

Note that for the purposes of this assignment, you should always treat log and ln as though they have base e.

Chapter 4.1

Graph the following functions

2. $f(x) = 3^x$
3. $f(x) = \left(\frac{1}{3}\right)^x$

18. Express $y = 2^{3x}$ as an exponential function in base 8. Try also with base e.

29. A certificate of deposit is purchased for $6500 and is held for six years. If the certificate earns 4% compounded quarterly, what is it worth at the end of six years? Write your answer as an expression, it does not need to be evaluated. *Note: Make sure to handle the change between quarters and years.*

30. The population of a town of 5000 grows at the rate of 3% per year. (a) Determine an equation that gives $P(t)$, the populations t years from now. (b) Find an expression for the population three years from now, but you do not need to evaluate it in decimal form.

36. After a careful demographic analysis, a university forecasts that student enrollments will drop by 3% per year for the next 12 years. If the university currently has 14,000 students, how many students will it have 12 years from now. Write an expression, but do not evaluate it.

49. If a radioactive substance has a half-life of 8 years, how long does it take for 1 gram of the substance to decay to $\frac{1}{16}$ gram? Assuming the substance decays at a rate $P(t) = P_0 e^{\lambda t}$, use the half-life of the substance to find an expression for λ.

Chapter 4.2

Evaluate the following expressions.

17. $\log_6 36$
18. $\log_2 64$
19. $\log_3 27$
20. $\log_{16} 4$
21. $\log_7 7$
22. $\log_{10} 10000$
23. $\log_{10} 0.01$
25. $\log_5 1$

Find x in the following equations

29. $\log_3 x = 4$
30. $\log_2 x = 8$
34. $\log x = 1$
35. $\log x = -3$
38. $\log_x 3 = \frac{1}{2}$
42. $\log_x (2x - 3) = 1$
44. $\log_8 64 = x - 1$
48. $\log_x (6 + 4x - x^2) = 2$

Chapter 4.3

Use the properties of logarithms to rewrite the following expressions in terms of $\log x$, $\log(x+1)$, and $\log(x + 2)$.

21. $\log(x(x + 1)^2)$

22.
$$\log \frac{\sqrt{x}}{x + 1}$$

23.
$$\log \frac{x^2}{(x + 1)^3}$$

24. $\log(x(x + 1))^3$

25.
$$\log \left(\frac{x + 1}{x + 2}\right)^4$$

26.
$$\log \sqrt{x(x + 1)(x + 2)}$$

31.
$$\log \left(\frac{1}{x + 2}\left(\frac{x^2}{x + 1}\right)^{1/5}\right)$$

32.
$$\log \left(\frac{x^3(x + 2)^2}{(x + 1)^3}\right)^{1/3}$$

Use the properties of logarithms to express each of the following as a single logarithm.

33. $\log 6 + \log 4$

34. $\log_3 10 + \log_3 5$

37. $5 \log 10 + 2 \log 13$

38. $5(2 \log x + 3 \log y - 2 \log z)$

Chapter 4.4

Solve the following equations for x. Leave the answers as expressions with logarithms in it.

2. $\log x - \log 5 = \log 7$

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

8. $(e^{3x-2})^3 = e^3$

10. $27^{2x+1} = \frac{1}{3}$

15. $10^{4/x} = 6$

17.
$$\frac{5}{10^{2x}} = 7$$

20. $7^{2x+3} = 9$

24. $5(3^x - 6) = 10$

26.
$$\frac{7}{3^x} = 13$$

28. $\log_2(x + 1) = 4$

31. $\log(3x - 1) - \log(x - 3) = 2$

33. $\log_2(5x + 1) = 4 - \log_2(3x - 2)$

42. Given the function

$$F(t) = \frac{q - pe^{-(t+C)(p+q)}}{q[1 + e^{(t+C)(p+q)}]}$$

where p, q, and C are constants. Prove that if $F(0) = 0$, then

$$C = -\frac{1}{p + q} \log \frac{p}{q}$$

.

43. The demand equation for a consumer product is $q = 80 - 2^p$. Solve for p and express your answer using logarithms.