Exponential and Logarithmic Function Review Name: ____________________

Write each equation in exponential form.

1. $\log_8 2 = \frac{1}{3}$ 2. $\log_5 \frac{1}{125} = -3$ 3. $\log_a x = y$

Write each equation in logarithmic form.

4. $6^2 = 36$ 5. $8^3 = 512$ 6. $10^3 = 1000$

Evaluate using exponent rules:

7. 3^{-4} 8. $\left(\frac{4}{5}\right)^{-2}$ 9. $\left(\frac{64}{8}\right)^{\frac{1}{3}}$ 10. $\left(\frac{81}{64}\right)^{-\frac{1}{2}}$

Evaluate each logarithm

8. $\log_2 8$ 9. $\log_{144} \frac{1}{12}$ 10. $\log_2 \frac{1}{4}$ 11. $\log_8 \frac{1}{64}$

12. $\log_3 27$ 13. $\log_{49} 7$ 14. $\log \sqrt[3]{100}$ 15. $\log_3 \frac{1}{3}$

Write each logarithmic expression as a single logarithm, simplify if possible!

16. $\log_3 5 + \log_3 2$ 17. $\log_4 64 - \log_4 4$ 18. $5\ln(x) - 2\ln(x) + 6\ln(x)$

19. $2\ln(8) + 5\ln(z)$ 20. $-\frac{1}{2}\log 16$ 21. $2\ln(t) + 3\ln(t) - 4\ln(t^3)$

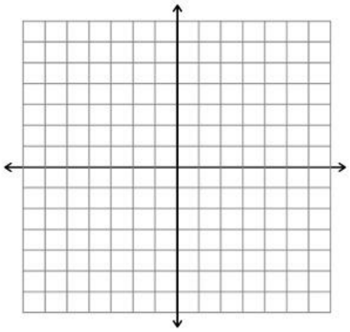
Expand each logarithmic expression (Simplify if possible!)

22. $\log(x^4\sqrt{x-1})$ 23. $\log_2 2x^3y^2$ 24. $\ln\left(\frac{rs}{\sqrt[3]{t}}\right)$

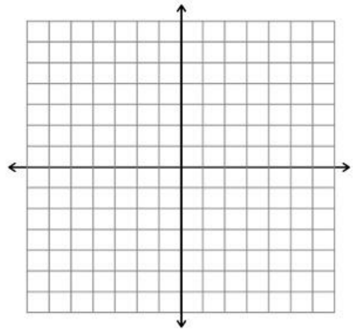
25. $\log(4xyz)^2$ 26. $\ln(\frac{x^4\sqrt{y}}{z^5})$

27. Graph the following functions. Identify the initial value, domain and range, and asymptote(s).

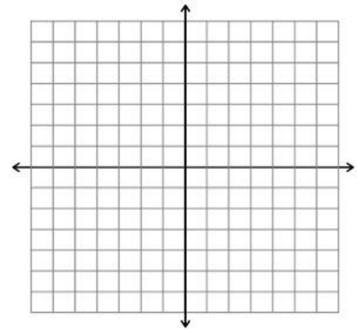
$y = 3^x$



$y = 3^{x-1}$



$y = 3^x - 1$



Find the inverse function

28. $y = 5^{x+2}$

29. $y = 6^x - 4$

30. $y = \log_2(x + 7) + 3$

31. $y = \log_6(x - 1) - 4$

Find the initial value, growth/decay <u>factor</u>, and growth/decay <u>rate</u>

32. $f(x) = 1.2(3)^x$

33. $f(x) = 3.4\ (1.018)^x$

34. $f(x) = 3.7\left(\frac{1}{4}\right)^x$

Identify the rate and initial value

35. $A(t) = 250e^{.12t}$

36. $A(t) = 144e^{-.32t}$

37. $A(t) = 50\left(1 + \left(\frac{.04}{2}\right)\right)^{2t}$

38. You bought a new car for $18,000 and it depreciates 25% each year. Write a function that models the value of the car.

   a. Find the value of the car after 4 years.

   b. In what year will the car be worth $10,000

39. Initial population of bacteria is 47 and is growing at a rate of 5.2% per year. Write a function that models the population of the bacteria.

   a. Find the population of bacteria after 5 years.

   b. In what year will the population of bacteria reach a population of 80.

40. An initial deposit into your saving account of $2000 and earns 1.2% interest each year. Write a function that models the situation.

a. What will your balance be after 10 years?

b. In what year will your savings account have $10,000

41. You receive an inheritance of $1500 and decide to invest it at an interest rate of 3%. Find the amount in the account after 3 years if interest is compounded quarterly? Monthly?

42. The population of Wilbraham is 45,000 in the year 2013 people and is **continuously** increasing at a rate of 1.2% per year. What will the population be in the year 2018?

43. The population of a city is **relatively** decreasing at a rate of 1.1%. The initial population is 45,500, what will the population be in 4 years?

44. You are about to invest $5000 into an account for 5 years. You are given two options for interest.

Option 1: 1.2% interest rate compounded semiannually.
Option 2: 0.9% interest rate compounded monthly.

Which option should you chose to maximize the money earned in the account?
Defend your choice!

Use logarithms to solve the exponential equations

45. $10^{2y} = 52$

46. $3^{x+4} = 6$

47. $\frac{1}{4}e^{x} = 5$

48. $7 + e^{2-x} = 28$

49. $32 + e^{7x} = 46$

50. $2^{2x} = 3^{2x+1}$

Solve the logarithmic equation

51. $2\log_4 x = \log_4 16$

52. $\log(x) + \log(x + 15) = 2$

53. $\log_5(2x + 1) = 1$

54. $2\log(x) = \log(3) + \log(2x - 3)$

55. $\ln(3x + 2) = 2$

56. $2\log_2 x - \log_2(3x - 4) = 1$

57.

A cup of soup is left on a countertop to cool. The table below gives the temperatures, in degrees Fahrenheit, of the soup recorded over a 10-minute period.

Time in Minutes (x)	Temperature in ^{0}F (y)
0	180.2
2	165.8
4	146.3
6	135.4
8	127.7
10	110.5

a. Use your calculator to find an exponential regression equation.

b. Use your equation to estimate the temperature after 5 minutes.

c. Use your equation to find the time it takes to cool the soup to 90 degrees. (Show your work!!)

(Challenge – Optional Math Funsies) Traces of burned wood found along with ancient stone tools in an archaeological dig in Chile. The wood was found to contain approximately 1.67% of the original amount of carbon-14. The equation $A(t) = A_0e^{kt}$ models the amount A of carbon-14 present at time t, where $A_0$is the original amount of radioactive material and k is a negative number (constant). If the half-life of carbon-14 is 5600 years, approximately when was the tree cut and burned?