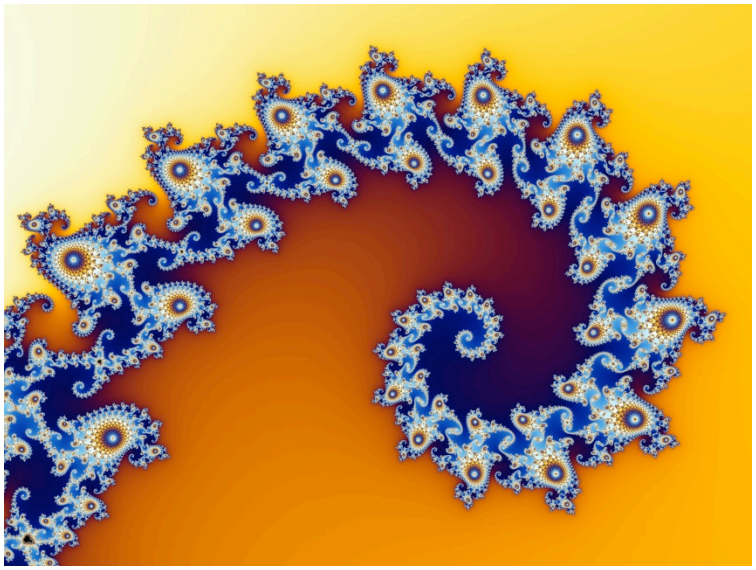
Foundations of Math III

Unit 5: Logarithmic Functions



Name: _____

WAKE COUNTY PUBLIC SCHOOL SYSTEM

APEX HIGH SCHOOL

1501 LAURA DUNCAN ROAD

Unit 5: Exponents and Logs

Day1: Thurs 11/13	Simplifying monomials with pos/neg exponents P3-4 evens	HW: p3-4 odds
Day 2: Fri 11/14	Solving Exp Eq with Same Base p5-6 evens	HW: p5-6 odds
Day 3: Mon 11/17	exp models p7-8	
Day 4: Tues 11/18	Graphing Exp Functions P9-10 1-8all	HW: p 11 all
Day 5: Wed 11/19	QUIZ 1 (covers days 1-4)	
Day 6: Thurs 11/20	Intro to Log P12	HW: p13
Day 7: Fri 11/21	Log properties P14-15	HW: p16
Day 8: Mon 11/24	"e" and Ln P17-18 evens	HW: p17-18 odds
Day 9: Tues 11/25	Quiz #2 days 6-8) Solving equations with Logs and Ln p 19 evens	HW: p 19 odds
Thanksgiving Break		
Day 10: Mon 12/1	Log/Exp Applications P20	HW: p21
Day 11: Tues 12/2	Graphing Logs p22	HW: p23
Day 12: Wed 12/3	QUIZ 3(days 9-11)	HW: Review #1 odds Pg 24-25
Day 13: Thurs 12/4	Review #1 odds p 24-25	Study for test!
Day 14: Fri 12/5	TEST EXP/LOGS	

Day 1: Simplifying Exponents.

1) $(x^{-2}y^{-3})^4$

2) $(x^4)^{-3} \cdot 2x^4$

3) $(n^3)^3 \cdot 2n^{-1}$

4) $(2v)^2 \cdot 2v^2$

5) $\frac{2x^2y^4 \cdot 4x^2y^4 \cdot 3x}{3x^{-3}y^2}$

6) $\frac{2y^3 \cdot 3xy^3}{3x^2y^4}$

7) $\frac{x^3y^3 \cdot x^3}{4x^2}$

8) $\frac{3x^2y^2}{2x^{-1} \cdot 4yx^2}$

9) $\frac{x}{(2x^0)^2}$

10) $\frac{2m^{-4}}{(2m^{-4})^3}$

11) $\frac{(2m^2)^{-1}}{m^2}$

12) $\frac{2x^3}{(x^{-1})^3}$

13) $(a^{-3}b^{-3})^0$

14) $x^4y^3 \cdot (2y^2)^0$

15) $ba^4(2ba^4)^{-3}$

16) $(2x^0y^2)^{-3} \cdot 2yx^3$

17) $\frac{2k^3 \cdot k^2}{k^{-3}}$

18) $\frac{(x^{-3})^4 x^4}{2x^{-3}}$

19) $\frac{(2x)^{-4}}{x^{-1} \cdot x}$

20) $\frac{(2x^3z^2)^3}{x^3y^4z^2 \cdot x^{-4}z^3}$

Day 2: Solve each equation

1) $4^{2x+3} = 1$

2) $5^{3-2x} = 5^{-x}$

3) $3^{1-2x} = 243$

4) $3^{2a} = 3^{-a}$

5) $4^{3x-2} = 1$

6) $4^{2p} = 4^{-2p-1}$

7) $6^{-2a} = 6^{2-3a}$

8) $2^{2x+2} = 2^{3x}$

9) $6^{3a} \cdot 6^{-a} = 6^{-2a+4}$

10) $\frac{2^x}{2^x} = 2^{-2x}$

11) $10^{-3x} \cdot 10^x = \frac{1}{10}$

12) $3^{-2x+1} \cdot 3^{-2x-3} = 3^{-x}$

13) $4^{-2x} \cdot 4^{x} = 64$

14) $6^{-2x} \cdot 6^{-x} = \frac{1}{216}$

15) $2^{x} \cdot \frac{1}{32} = 32$

16) $2^{-3p} \cdot 2^{2p} = 2^{2p}$

17) $64 \cdot 16^{-3x} = 16^{3x-2}$

18) $\frac{81^{3a+2}}{243^{-a}} = 3^{4}$

19) $81 \cdot 9^{-2b-2} = 27$

20) $9^{-3x} \cdot 9^{x} = 27$

21) $\left(\frac{1}{6}\right)^{3x+2} \cdot 216^{3x} = \frac{1}{216}$

22) $243^{k+2} \cdot 9^{2k-1} = 9$

23) $16^{r} \cdot 64^{3-3r} = 64$

24) $16^{2p-3} \cdot 4^{-2p} = 2^{4}$

Day 3: Finding the Best Exp Model for a Data Set

1. **Heart Disease Death Rates**: The table contains heart disease rates per 100,000 people in 1996 for selected ages.

Age	30	40	50	60	70
Death Rate	30.5	108.2	315	776	2010

a.) What profession would be interested in this information?

b.) Make a scatter plot for your data in the calculator.

c.) Does this look like an exponential graph?

d.) Find the best regression equation for the data.

e.) How well does this model fit the data?

2. **Modeling Interest Rate**: The table lists the interest rates for certificates of deposit (you might hear them referred to as CD's) during September 2001.

Time	6 months	1 year	2.5 years	5 years
Yield (%)	3.23	3.42	3.84	4.58

a.) What profession would be interested in this information?

b.) Make a scatter plot for your data in the calculator.

c.) Does this look like an exponential graph?

d.) Find the best regression equation for the data.

e.) How well does this model fit the data?

3. **Telecommuting**: Some workers use technology such as fax machines, e-mail, computers, and multiple phone lines to work at home rather than in the office. However, because of the need for teamwork and collaboration in the workplace, fewer employees are telecommuting than expected. The table lists the expected telecommuters in millions from 1997 to 2006.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Telecommuters	9.2	9.6	10.0	10.4	10.6	11.0	11.1	11.2	11.3	11.4

a.) What profession would be interested in this information?

b.) Make a scatter plot for your data in the calculator.

c.) Does this look more like an exponential graph?

d.) Find the best regression equation for the data.

e.) How well does this model fit the data?

4. **Midair Near Collisions**: The table shows the number of airliner near collisions *y* in year *x*.

x	1989	1991	1993	1995
y	131	78	44	34

a.) What profession would be interested in this information?

b.) Make a scatter plot for your data in the calculator.

c.) Does this look more like an exponential graph?

d.) Find the best regression equation for the data.

e.) How well does this model fit the data?

Day 4: Graphing Exponential Functions

$Y = ab^x$ is the basic form of an exponential function where:

a = the initial value

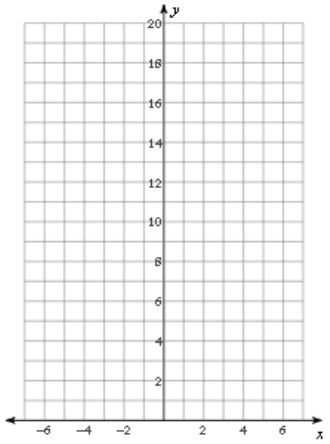
b = growth factor: b>1 means growth, 0<b<1 means decay

x = time

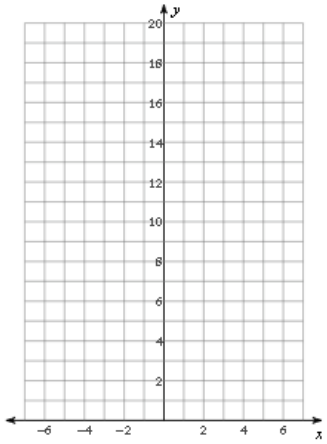
The parent function $y = b^x$ has a horizontal asymptote of y = 0, and passes through (0,1)

Sketch the graph of each function.

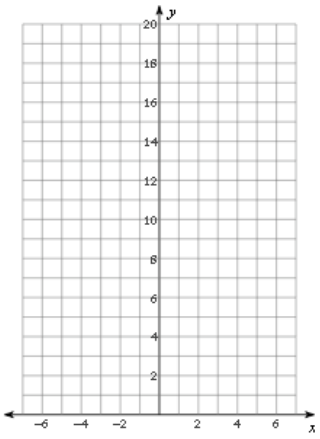
1) $y = 4 \cdot 2^x$



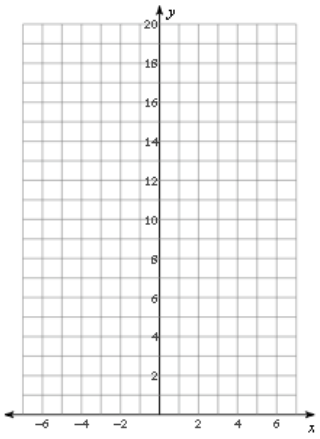
2) $y = 5 \cdot 2^x$



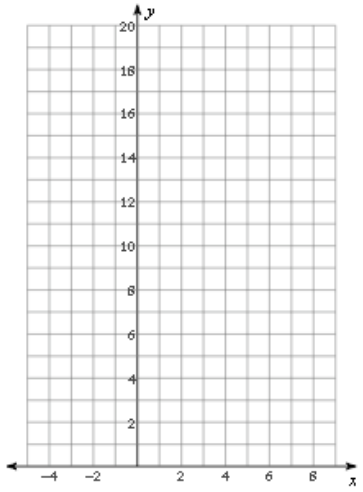
3) $y = 4 \cdot \left(\frac{1}{2}\right)^x$



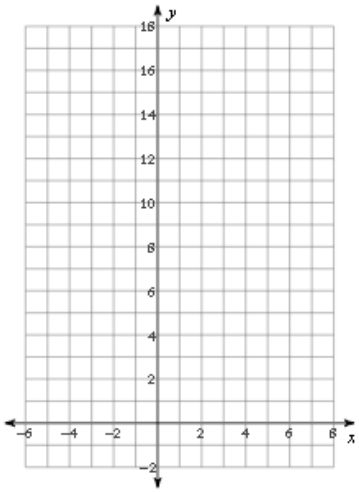
4) $y = 2 \cdot \left(\frac{1}{2}\right)^x$



5) $y = 3 \cdot 2^{x-2} + 2$

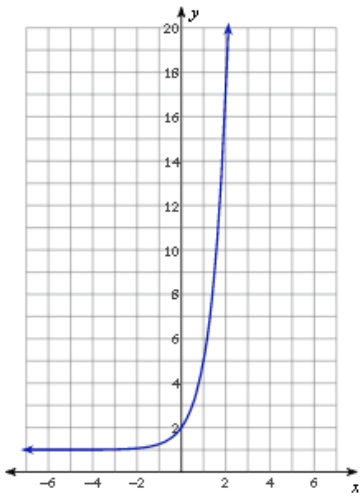


6) $y = 4 \cdot \left(\frac{1}{2}\right)^{x-1} - 2$

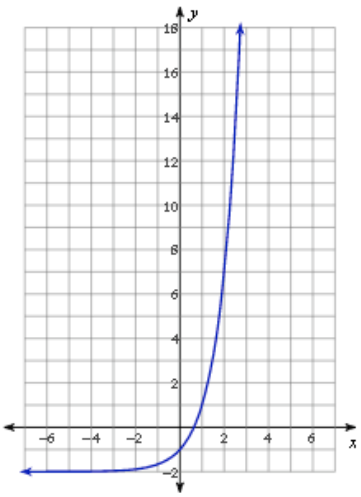


Write an equation for each graph.

7)



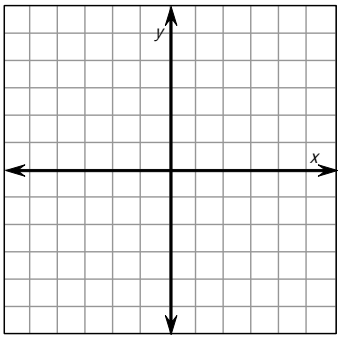
8)



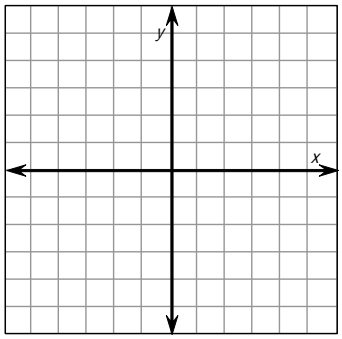
Day 4 HW

Exponential Functions: Bacteria Growth or Decay

1.) Graph $y = 2^x$



2.) Graph $y = \left(\frac{1}{2}\right)^x$



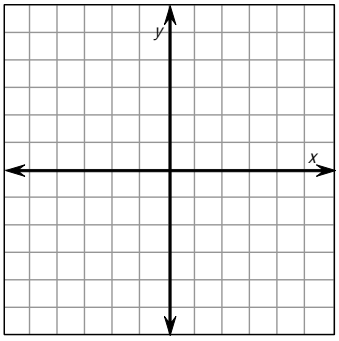
Describe the following transformations for each of the following equations.

3.) $y = 2^{x-3} + 4$

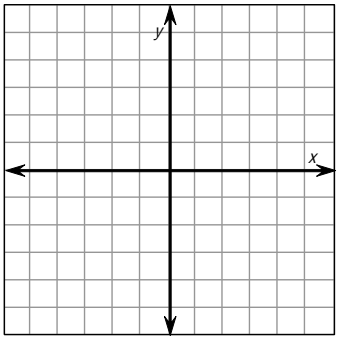
4.) $y = \left(\frac{1}{2}\right)^{x+1} - 5$

Graph the following:

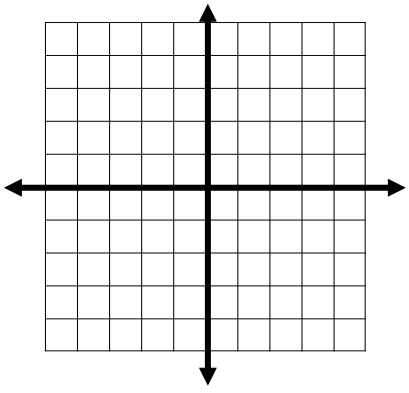
5.) $y = 2(4^x)$



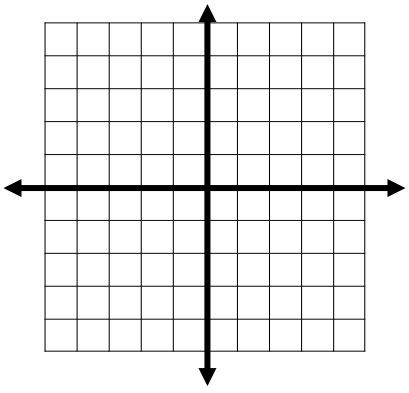
6.) $y = 3^x + 2$



7.) $y = 3^{x-1} + 2$



8.) $y = -1(2^x)$



Day 6: Logarithm Notes and Practice $x^b = a$ means $\log_x a = b$

I. Write in exponential form.

1. $\log_2 8 = 3$
2. $\log_{16} 8 = \frac{3}{4}$
3. $\log_3 81 = 4$
4. $\log_8 1 = 0$
5. $\log_3 \frac{1}{3} = -1$
6. $\log_8 4 = \frac{2}{3}$
7. $\log_5 \frac{1}{25} = -2$
8. $\log_{\frac{1}{3}} 81 = -4$
9. $\log_4 2 = \frac{1}{2}$
10. $\log_{10} 100 = 2$

II. Write in logarithmic form.

1. $25 = 5^2$
2. $81 = 3^4$
3. $6^0 = 1$
4. $3^{-2} = \frac{1}{9}$
5. $16^{-\frac{2}{3}} = \frac{1}{64}$
6. $25^{\frac{3}{2}} = 125$
7. $\left(\frac{1}{3}\right)^{-2} = 9$
8. $2^{-5} = \frac{1}{32}$

III. Find the logarithm.

1. $\log_{10} .1 =$
2. $\log_{10} .01 =$
3. $\log_{27} 3 =$
4. $\log_{27} 9 =$
5. $\log_8 16 =$
6. $\log_4 .5 =$
7. $\log_{\frac{1}{2}} \frac{1}{4} =$
8. $\log_{\frac{1}{3}} 9 =$
9. $\log_{\frac{1}{5}} 25 =$
10. $\log_2 2^{10} =$

Find x.(remember "left/right/left!")

1. $\log_x 81 = 4$
2. $\log_x 10 = 1$
3. $\log_x 16 = 2$
4. $\log_x 125 = 3$
5. $\log_4 x = -4$
6. $\log_6 x = -2$
7. $\log_3 x = 0$
8. $\log_8 x = \frac{2}{3}$
9. $\log_{10} 100 = x$
10. $\log_9 27 = x$
11. $\log_{16} 8 = x$
12. $\log_2 .5 = x$
13. $\log_{\sqrt{2}} x = 4$
14. $\log_{\sqrt{3}} x = 6$
15. $\log_x \sqrt{3} = \frac{1}{2}$
16. $\log_x \sqrt{2} = \frac{1}{6}$
17. $\log_{\sqrt{2}} 8 = x$
18. $\log_{\sqrt{5}} 25 = x$
19. $\log_x 3 = \frac{1}{4}$
20. $\log_4 x = -3$

Day 6: Simplify and Solve Logs HOMEWORK (Do all work on a separate sheet of paper!)

Write each equation in logarithmic form.

1. $5^3 = 125$

2. $27^{\frac{4}{3}} = 81$

Write each equation in exponential form.

3. $\log_{10} 0.00001 = -5$

4. $\log_{\frac{3}{2}} \frac{\sqrt{6}}{3} = -\frac{1}{2}$

Evaluate each expression.

5. $\log_3 81$

6. $\log_{10} 0.0001$

7. $\log_2 \frac{1}{16}$

8. $\log_{\frac{1}{3}} 27$

9. $\log_9 1$

10. $\log_8 4$

Solve each equation. (left/right/left!)

11. $\log_4 x = \frac{3}{2}$

12. $\log_y 16 = -4$

13. $\log_a \frac{1}{8} = -3$

14. $\log_7 n = -\frac{1}{2}$

15. $\log_{\sqrt{5}} y = \frac{4}{3}$

16. $\log_x \sqrt[3]{9} = \frac{1}{6}$

Remember: get one log equal to one log with the same bases, then drop the logs and solve for "x"

17. $\log_8(3x+7) = \log_8(2x+1)$

18. $\log_7(8x+20) = \log_7(4)$

19. $\log_3(9x-1) = \log_3(x+7)$

20. $\log_{12}(x-9) = \log_{12}(12)$

21. $\log_6(x^2-30) = \log_6(x)$

22. $\log_4(x^2+15) = \log_4(-8x)$

Day 7: Log Properties NOTES and practice

1.) $\log xy = \log x + \log y$ 2.) $\log \frac{x}{y} = \log x - \log y$ 3.) $\log x^m = m \log x$

4.) $m^{\log_m x} = x$ 5.) change of base : $\log_m n = \frac{\log m}{\log n}$

I. Express each logarithm as a sum or difference of simpler logarithmic expressions. Assume that all variables represent positive numbers.

1. $\log_6 7t$ 2. $\log_2 pqr$ 3. $\log_{10} 3x^2$ 4. $\log_3 \frac{x}{5}$

5. $\log_{10} 2a^{\frac{1}{3}}$ 6. $\log_3 a^2 b^3$ 7. $\log_5 (ab)^3$ 8. $\log_6 \frac{\sqrt{a}}{b}$

9. $\log_4 \frac{a}{\sqrt{b}}$ 10. $\log_6 \sqrt{\frac{a}{b}}$ 11. $\log_2 \frac{ab}{3}$ 12. $\log_{10} \frac{4}{x^2}$

Express as a single logarithm with coefficient 1.

13. $\log_2 a + \log_2 b + \log_2 c$ 14. $(\log_3 x + \log_3 y) - \log_3 z$ 15. $3\log_3 2a$

16. $\frac{1}{2}\log_3 a^4$ 17. $2\log_5 x - 3\log_5 y$ 18. $2\log_5 x + 3\log_5 2x$

II. Solve for x.

1. $\log_5 x = 2\log_5 10$ 2. $\log_2 x = \log_2 10 - \log_2 5$

3. $\log_4 x = 2\log_4 6 - \log_4 3$ 4. $\log_{10} x = \frac{1}{3}\log_{10} 64$

5. $\log_{10} x = \frac{1}{2}\log_{10} 81 - \frac{1}{3}\log_{10} 27$

6. $\log_7 x = 4\log_7 2 + (\log_7 3 - \log_7 6)$

7. $\log_5 2x = 3\log_5 2 - \log_5 12$

8. $2\log_5 x = \log_5 12 + \log_5 75$

9. $3\log_{10} x = \log_{10} 12 + \log_{10} 18$

10. $\log_{10} 3x = \log_{10} 12 + 2(\log_{10} 5 - \log_{10} 2)$

Given that $\log_3 2 = 0.631$ and $\log_3 5 = 1.465$ find:

11. $\log_3 25$

12. $\log_3 10$

13. $\log_3 0.4$

14. $\log_3 2.5$

15. $\log_3 50$

16. $\log_3 0.5$

17. $\log_3 15$

18. $\log_3 45$

Find the value of each expression.

19. $7^{\log_7 5 + \log_7 2}$

20. $10^{\log_{10} 12 - \log_{10} 2}$

21. $2^{2\log_2 6 - \log_2 12}$

22. $5^{3\log_5 2 + 2\log_5 3}$

23. $9^{\log_3 5}$

24. $8^{-\log_2 3}$

Solve for x.

25. $\log_3 x + \log_3 (x-8) = 2$

26. $\log_3 (x-4) + \log_3 (x+4) = 2$

27. $\log_2 (x+3) + \log_2 (x-3) = 4$

28. $\log_7 (x-5) + \log_7 (x+1) = 1$

Day 7 HW Log Properties (All work must be shown on a separate sheet of paper!)

Expand the following logarithms.
Use either the power rule, product rule or quotient rule.

1. $\log_2(9^5) =$ _____

2. $\log_2(21) =$ _____

3. $\log_5\left(\frac{19}{2}\right) =$ _____

4. $\log_2(6a) =$ _____

5. $\log_3(xy) =$ _____

6. $\log_5\left(\frac{a}{3}\right) =$ _____

7. $\log_3(5y) =$ _____

8. $\log_3(a^{10}) =$ _____

Expand the following logarithms using one or more of the logarithm rules.

9. $\log_5\left(\frac{12a}{2}\right) =$ _____

10. $\log_2\left(\frac{a}{b}\right)^5 =$ _____

11. $\log_5\sqrt{x^5y} =$ _____

12. $\log_5\left(\frac{xy}{z}\right)^8 =$ _____

13. $\log_2\left(\frac{1-x}{y}\right)^3 =$ _____

14. $\log_3\sqrt[5]{9x^3} =$ _____

15. $\log_3\sqrt[3]{2x^5} =$ _____

16. $\log_2\left(\frac{9x^{10}}{y^2}\right) =$ _____

17. $\log_2\left(\frac{4a}{5}\right) =$ _____

18. $\log_2\sqrt[3]{x^2a} =$ _____

Write as a single logarithm.

19. $2\log_3 10 - \log_3 4 =$ _____

20. $\frac{2}{3}\log_2 x + \log_2 y =$ _____

21. $\frac{1}{2}\log_5 x + \log_5 y =$ _____

22. $3\log_3 x + 4\log_3 y =$ _____

23. $6\log_3 x + 2\log_3 11 =$ _____

24. $4\log_5 x - \log_5 y + \log_5 z =$ _____

25. $\frac{1}{2}\log_3 144 - \log_3 4 =$ _____

26. $\log_3 a + \log_3 b - 2\log_3 c =$ _____

Day 8: Natural Logs

The Natural Base e (Euler's number):

An irrational number, symbolized by the letter e, appears as the base in many applied exponential functions. This irrational number is approximately equal to 2.72. More accurately, $e = 2.71828\ldots$ The number e is called the natural base.

The function $f(x) = e^x$ is called the natural exponential function.

$$\lim_{X \to \infty} \left(1 + \frac{1}{X}\right)^X = e$$

I. Express in logarithmic form:

1. $10^{2.33} = x$
2. $10^x = 379.31$
3. $e^{2.5} = 12.18$
4. $e^{\frac{1}{5}} = 1.221$
5. $e^{-2} = 0.135$
6. $\sqrt{e} = 1.649$

II. Express in exponential form:

7. Log 229 = 2.3598
8. Log .8033 = -.0951
9. ln 8 = 2.079
10. $\ln \frac{1}{4} = -1.39$
11. ln .01 = -4.605
12. ln e = 1

III. Express as a single Logarithm.

13. ln 6 + ln 5 – ln2
14. $\frac{1}{2}\ln 9 - \ln 6$
15. $-\frac{1}{3}\ln 8 + 3$
16. $\frac{3}{2}\ln 4 + 2$

IV. Find the Log of each number using a calculator. (Round to four decimal places)

17. Log 95
18. Log .233
19. Log 6.437×10^{-9}
20. Log 1.8519
21. ln 120
22. ln 690
23. $\ln \frac{6}{5}$
24. $\ln 84^{2/3}$
25. ln 0

V. Use a calculator to find 'x' of each.

26. Log x = 2.63
27. Log x = -.4089
28. Log x = 5.3
29. ln x = 2.208
30. ln x = 1.808
31. ln x = -.105

VI. Evaluate WITHOUT USING A CALCULATOR!

32. $\ln e$

33. $\ln (e^2)$

34. $\ln 1$

35. $\ln 0$

36. $\ln \frac{1}{e}$

37. $\ln \sqrt{e}$

38. $\ln (e^n)$

39. $e^{\ln 6 + \ln 7}$

40. $e^{2 \cdot \ln 7}$

41. $e^{\frac{1}{3}\ln 8 + \frac{1}{2}\ln 9}$

VII. Simplify and then Evaluate. (Use a calculator only when necessary)

42. $\ln 48 - 4 \ln 2$

43. $\frac{1}{2}\ln 9 + \ln 12 - 2\ln 3$

44. $\frac{1}{2}(\ln 45 + \ln 5) - 2\ln 3$

45. $e^{\ln 8 - \ln 6}$

46. $\ln 6 + \ln 30 - (\ln 5 + 3 \ln 2)$

47. $\frac{1}{2}\ln 4 + \ln 8 - (5\ln 2 + \ln 3)$

48. $3 \ln 4 - (\ln 2 + \ln 8)$

49. $e^{\frac{1}{2}(\ln 3)}$

VIII. Solve and Check!

50. $\text{Log}(x + 2) + \text{Log}(x) = 1$

51. $\text{Log}(x + 3) - \text{Log}(x - 1) = 1$

52. $\text{Log}\, x = 2 - \text{Log}(x + 21)$

IX. Solve by rewriting the problem in another form. Round decimal answers to four places!

53. $\ln x = 3$

54. $\ln x = \frac{1}{3}$

55. $e^x = 5$

56. $x = \ln e^{\frac{3}{5}}$

57. $e^{\ln x} = 12$

58. $\ln x = -\frac{1}{2}$

Day 9: Using logs to solve Exponential Equations

Use logarithms to solve each equation.

1. $3.5^x = 47.9$

2. $8.2^y = 64.5$

3. $y = \log_3 78.5$

4. $k = \log_4 91.8$

5. $x = \log_7 30$

6. $n = \log_3 152$

7. $2000 = 5e^{0.045x}$

8. $2 = e^{5x}$

9. $\ln 3.6 = \ln\left(e^{0.031x}\right)$

10. $65 = e^{6x}$

Day 10: Exp/Log Applications Notes and Practice

Growth/Decay: $y = ab^x$

Value of an Asset: $y = a(1 \pm r)^x$

Continuously Compounded: $A = Pe^{rt}$

Half Life: $y = a(.5)^{\frac{t}{h}}$

Compound Interest: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

Solve each problem.

1. Suppose $500 is invested at 6% annual interest compounded twice a year When will the investment be worth $1000?

2. Suppose $500 is invested at 6% annual interest compounded <u>continuously</u> When will the investment be worth $1000?

3. An organism of a certain type can grow from 30 to 180 organisms in 5 hours. Find b for the growth formula.

4. For a certain strain of bacteria, b is 3 when t is measured in days. How long will it take 20 bacteria to increase to 2000?

5. An investment service promises to triple your money in 12 years. Assuming continuous compounding of interest, what rate of interest is needed?

6. A radioactive element has a half life of 30 years. If you have 6 g. now, how much will be left in 100 years?

7. A piece of machinery valued at $250,000 depreciates at 12% per year by the fixed rate method. After how many years will the value have depreciated to $100,000?

8. Dave bought a new car 8 years ago for $5400. To buy a new car comparably equipped now would cost $12,500. assuming a steady rate of increase, what was the yearly rate of inflation in car prices over the 8 year period?

Day 10: Word problems HW -- Use a formula and show your work!

1. For a certain strain of bacteria, b is 4 when time is measured in hours. How long will it take 2 bacteria to increase to 1000 bacteria?

2. Jackson deposited $100 in a savings account that pays 6% interest compounded continuously. He just withdrew the entire balance of $200. How long ago did he open the account?

3. The half life for a radioactive substance is 7 years. In how many years will a 250-gram sample reduce to 50 grams?

4. A culture of a certain bacteria will grow from 500 to 4000 bacteria in **90 minutes**. Find the growth factor for this certain bacteria if time is in **hours**.

5. Charlotte invested $1000 in a certificate of deposit three years ago. The CD is now worth $1276. Assuming that the interest was compounded continuously, what was the interest rate?

6. A piece of office equipment valued at $25,000 depreciates at a steady rate of 10% annually. What will it be worth in 5 years?

7. Keith has saved $2000 to buy a stereo that will cost about $2500. If he has the money in an account paying 7.25% compounded continuously, when will Keith be able to buy the stereo?

8. Suppose you deposited $10 in a savings account that pays 8% interest compounded continuously. In how many years will the account have a balance of $100?

9. The Smith's bought a condominium for $63,000. Assuming that its value will appreciate 8% a year, how much money will the condo be worth in five years when the Smith's are ready to move?

10. Ten years ago, Cathy bought a new car for $6000. It is now worth $600. Assuming a steady rate of depreciation, what was the annual rate of depreciation?

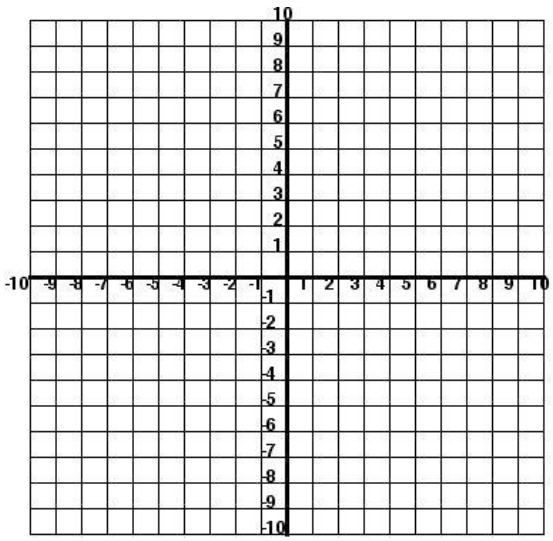
11. A piece of machinery valued at $2500 depreciates at a steady rate of 10% yearly. The owner of the business will replace the equipment when its value has depreciated to $500. In how many years will the equipment be replaced?

Day 11: Graphing Logs

4^x and $\log_4 x$ are inverses of each other!

Graph $f(x) = 4^x$ and $f^{-1}(x) = \log_4 x$ on the same axes

Fill in the table for $f(x)$ and $f^{-1}(x)$

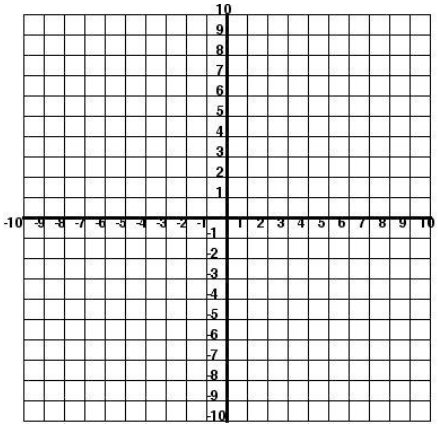


	$f(x)$	$f^{-1}(x)$
Domain		
Range		
Increasing?		
Decreasing?		
Asymptotes		

2. A function contains the following points: $(1, 0), (\frac{1}{2}, 1), (\frac{1}{4}, 2), (1/8, 3), (2, -1), (4, -2)\ (8, -3)$

Find an equation that represents the INVERSE of the given function. Explain how you arrived at your answer.

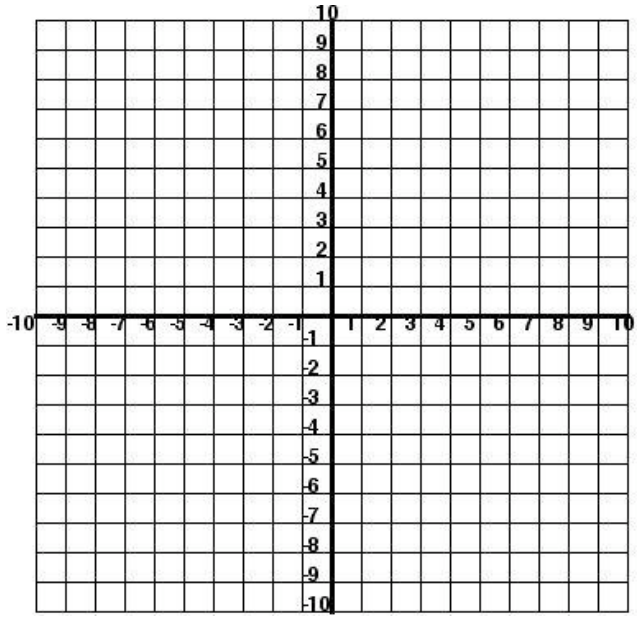
3. Graph the function $f(x) = \log_{\frac{1}{2}} x$ and the inverse $f^{-1}(x)$ on the same axes. And give their D and R.



Day 11; HW—Graphing Logs

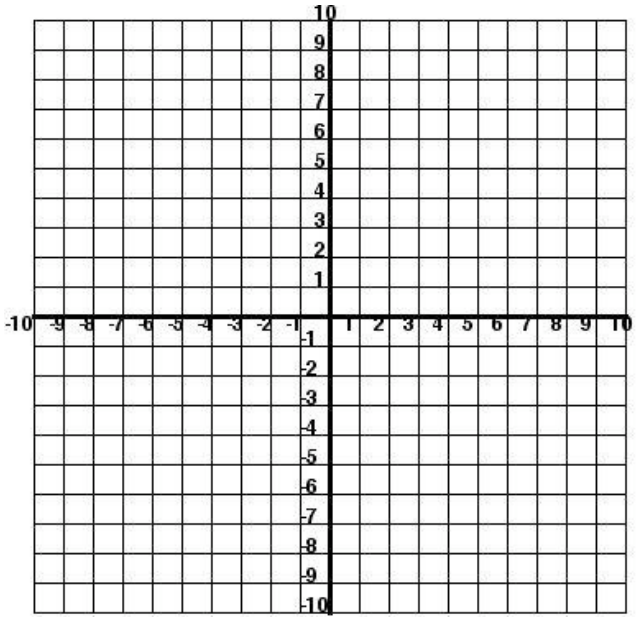
1. $y = \log_4 x$ 2. $y = \log_4(x+5)$ 3. $y = \log_4 x + 3$

Use for #1,2, 3



4.) $y = \log_2 x$ 5. $y = \log_2 x - 3$ 6. $y = \log_2(x-4)$

Use for #4,5,6



FCC3 - - Review Exponents and Logs

1. Write an equivalent logarithmic equation for $x^5 = 32$. 1. _____

2. Write an equivalent exponential equation for $\ln x = \sqrt{5}$ 2. _____

4. The log 0.034 is between what two consecutive integers? 4. _____

5. Given log 8.1 = 0.9085, find the log 8100. 5. _____

Simplify Completely:

6. $\log_8 \frac{1}{64}$ 7. $\ln e^9$ 8. $\log_2 4^{\frac{3}{2}}$ 9. $\log_8 4$ 10. $27^{-\log_3 5}$

Solve the following:

11. $\log_x 1 = 0$ 12. $\log_{1000} 100 = x$ 13. $\log_4(\log_5 25) = \log_3 x$

14. $4^{x-2} = 8^{\pi+1} \div 8^{\pi-1}$ 15. $\log(\log_2(\log_3 x)) = 0$ 16. $\log_x 8 = 6$

17. $9^{x+1} = 27^{2x}$ 18. $\left(\frac{1}{2}\right)^{2x-3} = 4^{x+2}$ 19. $1000 = 10^{3+2x}$

20. $\log_2(\log_9 81) = \log_x 7$ 21. $\log_5 (x-1) = 2$ 22. $\log_3(x-4) = \log_3(2x)$

23. $x^{\frac{3}{2}} = 27$ 24. $2(x+1)^{\frac{4}{3}} = 32$ 25. $2^4 + \log_3 81 = x + 20$

26. To the nearest dollar, what amount must be invested at 6% compounded continuously for 14 years in order for a balance to be $23,140? ($A = Pe^{rt}$)

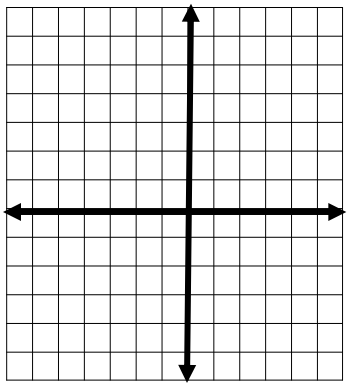
27. A tractor that 4 years ago cost $8,000, now is worth only $3200. Find the average annual rate of depreciation. ($y = a(1 \pm r)^t$)

28. The population of a certain colony of bacteria doubles every 5 hours. How long will it take for the population to triple? ($y = ab^x$)

28. A radioactive substance has a half life of 21 days. How long will it take 100 grams to become 12.5 grams?

($y = a(.5)^{\frac{t}{h}}$)

29. Graph $f(x) = 2^x$ List Domain and Range



30. Graph $f(x) = \log_4 x$. List Domain and Range