AFM
Module 4 & 9
Warm-Up Day 1

Name: ______________________
Date: __________ Period: __________

NEWS BRIEF: A rare virus has been found to be highly contagious. Anyone infected with the virus becomes a zombie. Those infected with the virus are able to pass it through physical contact. Be forewarned, the first cases have been seen at Leesville Road High School. There is one student known to be carrying the virus and is spreading it throughout the school. The virus is spreading in such a way that every hour three times as many people are infected.

The Department of Health and Human Services Centers for Disease Control and Prevention has hired you to determine how long it would take to infect the following areas if the student infected is in your class and spreading it to the rest of the population. Since you're starting off with one infected student (hour 0) between the next hour 3 people will be infected with the virus and so on.

Hour x	# people infected
0	1
1	3

a. Population of your class: __________

No hope after _______ hours

b. Population of Leesville Road High School: 2,009 students

No hope after _______ hours

c. Population of Raleigh, NC: 326, 653 men, women, and children

No hope after _______ hours

d. Population of Wake County, NC: 719, 520 men, women, and children

No hope after _______ hours

e. Population of North Carolina: 8,541,221 men women and children

No hope after _______ hours

... Data will be collected (number of tears, amount of paper remaining) ... the number of sections of paper as the paper is ... 1) indicating 0 tears and 1 piece of paper. The first data point is (0, 1) indicating 0 tears and 1 piece of paper. Take a sheet of paper and tear/cut it in half. The data point will be (1, ½) indicating after 1 tear, there is only on half of the paper left. Collect at least 6 data points.

PROCEDURE:

1. **Collect data in a table.**

x	y

2. **Enter data in graphics calculator and set up a scatter plot.** Sketch the graph on your paper, accurately labeling domain and range. Explain why you should or should not connect the points on the graph? Note the shape of the graph. Describe what will happen to the shape of the data on the graph if you continue collecting data.

3. **Find the Exponential Regression Equation:** State the equation on your paper. Explain the meaning of each coefficient in the equation: y = a*b^x. How do you determine *b* from the original data in the table? How do you determine the value of the coefficient *a* from the original data in the table? Would you call the value of the coefficient *b* a growth or decay factor?

4. **Evaluating the Model:** How do you determine whether this model is a good fit and valid to use for making predictions? Explain your answer in more than one way.

5. **Use the Model to make a Prediction:** How many sections would there be after 15 folds or cuts. After 30? How do you interpret your answer with the activity?

challenges. Each week, the tribe votes to remove the contestant whom they feel has not adequately met the challenges of island life. Eventually, only one of the tribe members will remain on the island and will win a large monetary prize. Which one of you will be the ultimate survivor?

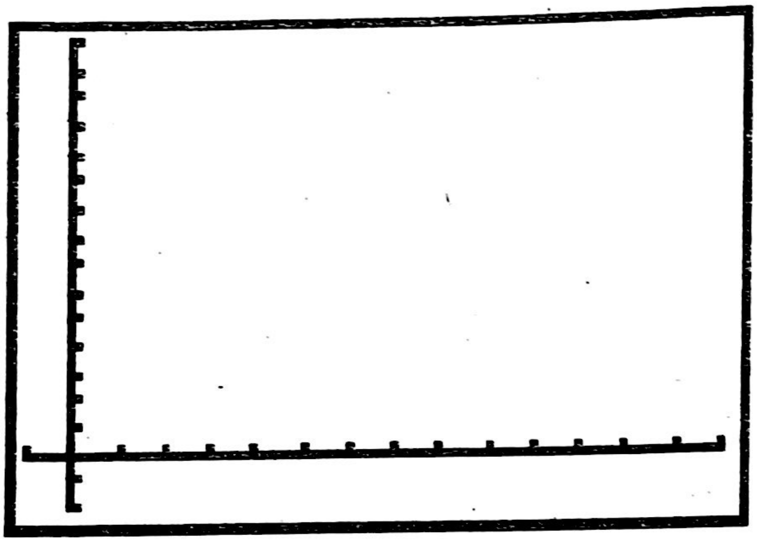
Activity: Dice will be used to simulate the voting to remove contestants each week. Everyone gets a die and stands up. When told to "roll", everyone rolls the die to determine his/her removal from the island for that week. You will remain on the island if you roll a 1 through 5. If you roll a 6, you must extinguish your torch and leave the island (and sit down). Once you are removed from the island, you cannot roll the die again. This process continues until only one ultimate survivor remains standing.

Data Collection:

1. For each week, record the number of the number of people still remaining on the island. Record this information in the table below. This process may require more, or less, than the 14 weeks listed in the table.

Week	Number Remaining on Island
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

2. Enter the number of the week into L_1 and the number of people into L_2.
   (Stat – Edit – enter values into lists)
3. Set up your StatPlot for a scatter plot. (Be sure to clear Y_1.) Use **ZoomStat.**
4. Return to the "home" screen (2^{nd} Quit) Be sure your Diagnostics are turned on.
5. Choose the regression model which best models this data.
   (Stat–Calc–choose model)
6. Graph the data in the box below. Be sure to label axes, window and scale.



Follow-Up Questions:

1. What mathematical model best simulates this data?________________

2. Write an equation to fit the model________________________

3. What is the correlation coefficient that corresponds with your model?________
   What is the coefficient of determination for your model?____________
   Do you consider this model to be a "good fit" for your data? ______ Explain. ____

   ____

4. If there were 10 people remaining on the island, what was the corresponding week number? ________________________________

5. Based upon your model, at the 5^{th} week, how many people were on the island?______

6. If contestants were removed from the island every half week, how many survivors would be left on the island at the 4.5 week mark?________________

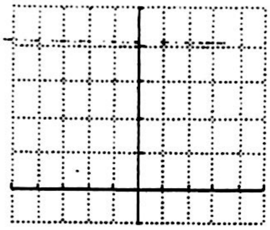
Section 6.2 - The Natural Exponential Function

Name: ____________________

Date: ______ Period: ______

Definition:

Graph:



State the domain, range, and asymptote for the following graphs.

1. $y = -e^x$

2. $y = 1 + e^x$

3. $y = e^{x-2}$

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

Compound Interest

Formula:

$A(t) =$

$P =$

$r =$

$n =$

$t =$

Example: A sum of $1000 is invested at an interest rate of 12% per year. Find the amounts in the account after 5 years if interest is compounded annually, semiannually, quarterly, monthly, and daily.

Annually:

Semiannually:

Quarterly:

Monthly:

Daily:

Continuously Compounded Interest

Formula:

Example: Find the amount after 5 years if $1000 is invested at an interest rate of 12% per year, compounded continuously.

Exponential Growth (Population)

Formula:

$n(t) =$
$n_0 =$
$r =$
$t =$

Example #1: The initial bacterium count in a culture is 500. A biologist later makes a sample count of bacteria in the culture and he finds that the relative rate of growth is 40% per hour.

a) Find a function that models the number of bacteria after t hours.

b) What is the estimated count after 10 hours?

Example #2: Under ideal conditions, a certain type of bacteria has a relative growth rate of 220% per hour. A number of these bacteria are introduced accidentally into a food product. Two hours after contamination, a bacterium count shows that there are about 40,000 bacteria in the food.

a) Find the initial number of bacteria introduced into the food.

b) Estimate the number of bacteria in the food 3 hours after contamination.

Exponential Functions Practice
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Name: ____________________
Date: ______ Period: _______

1. Below is a chart of the weight of a radioactive material on given days.

Day	0	1	2	3	4	5	6	7
Weight	1,000	897.1	802.5	719.8	651.1	583.4	521.7	468.3

(a) Find a model (linear, exponential, or quadratic) for the data. What is your equation? (Find the regression equation!)

(b) What do the values a and b represent?

(c) What will the weight be after 15 days?

2. State the domain, range, and asymptote for the following functions.

(a) $f(x) = -2^x$
Domain: _______
Range: _______
Asymptote: _______

(b) $g(x) = 2 + 5^{x-1}$
Domain: _______
Range: _______
Asymptote: _______

(c) $h(x) = -4 - 3^x$
Domain: _______
Range: _______
Asymptote: _______

(d) $f(x) = 3^{x+2}$
Domain: _______
Range: _______
Asymptote: _______

(e) $g(x) = 4^{-x}$
Domain: _______
Range: _______
Asymptote: _______

(f) $h(x) = 2 - 4^x$
Domain: _______
Range: _______
Asymptote: _______

3. Sketch the graph of the given functions by making a table of values.

(a) $f(x) = (1.2)^x$

x	y

(b) $f(x) = (0.2)^x$

x	y

a) Use the equation below to find the value of y when $x = 2$.

$Y = 12.3(2.8)^x$ y = ____________________

b) Use the equation below to find the value of y when $x = 5$.

$Y = 14.6(1.8)^x$ y = ____________________

5.

a) If $13,500 is invested at an interest rate of 6.27% per year, compounded monthly, find the value of the investment after 7 years.

Amount: ____________________

b) If $9,400 is invested at an interest rate of 2.45% per year, compounded quarterly, find the value of the investment after 9 years.

Amount: ____________________

6.

a) The population of zombies has a relative growth rate of 5.62% per year. The population in 2004 was 11,455. Find the projected population of zombies for the year 2015.

Population: ____________________

b) The population of zombies has a relative growth rate of 9.68% per year. The population in 2010 was 9,756. Find the projected population of zombies for the year 2020.

Population: ____________________

Practice Problems
6.5 Exponential and Logarithmic Functions

Name: ______________________

Date: ______ Period: ______

I. Solve the following exponential equations for x. Round to four decimal places if necessary.

1) $3^x = 8$

2) $3^{(x+4)} = 27$

3) $2^{(x+2)} = 20$

4) $6e^{2x} = 40$

II. Solve the following logarithmic equations for x. Round to four decimal places if necessary.

1) $\log_3(x - 5) = 4$

2) $\ln x = 9$

3) $\log_2(30 - x) = 4$

4) $\log(x + 2) + \log(x - 1) = 1$

5) $4 + 2\log_2(3x) = 18$

6) $\log_5 x + \log_5(x + 1) = \log_5 20$

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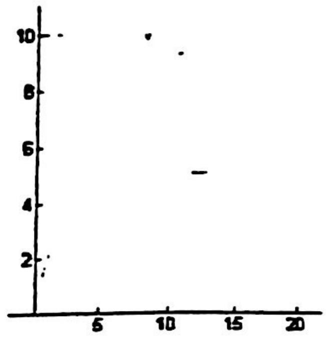
Modules 4 & 9
Practice Problems #3

Name: ______________________
Date: ________ Period: ________

1. A typical worker at a supermarket bakery can decorate $f(t)$ cakes per hour after t days on the job, where $f(t) = 10\left(1 - e^{-0.25t}\right)$.



a) Sketch a graph of $f(t)$. Restrict the domain to meaningful values of t.

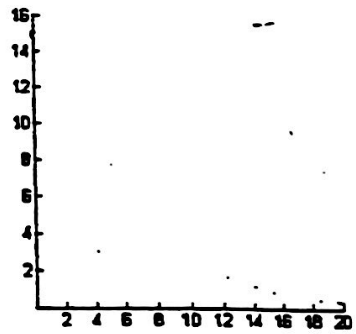
b) How many cakes can a newly employed worker decorate in an hour?

c) After eight days, how many cakes can a worker decorate in an hour?

d) Based on this graph, after a worker has decorated cakes for a very long time, how many cakes can he or she decorate in an hour?

2. Rheumatoid arthritis patients are treated with large doses of aspirin. Research has shown that the concentration of aspirin in the bloodstream increases for a short period of time after the drug is administered and then decreases exponentially. For a typical patient, this relationship is given by $a = 14.91e^{-0.18t}$, where t represents the number of hours since peak concentration and a represents the concentration of aspirin measured in milligrams per cubic centimeter of blood.

a) Graph the function over an appropriate domain. Label the coordinates of the points that correspond to $t = 0$ and $t = 1$.



b) Determine the peak concentration of aspirin.

c. Determine the amount of aspirin remaining four hours after peak concentration.

d. Use graphing technology to determine the time at which the concentration of aspirin is 5mg per cc of blood.

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Logarithm Quiz Practice

Name ____________________

1. A person's typing speed is modeled by the function $W = 80\left(1 - e^{-0.08t}\right)$, where W is the number of words per minute and t is the number of weeks of practice. How many words can by typed after 6 weeks of practice? Round your answer to the nearest tenth.

2. If $17,570 is invested at an interest rate of 2.38% per year, find the amount of the investment at the end of 4 years for the following compounding methods:

a. Monthly

b. Weekly

c. Quarterly

d. Continuously

3. Express the following in logarithmic form.

a. $16384 = 16^{\left(\frac{7}{2}\right)}$

b. $\frac{1}{8} = 2^{-3}$

4. Write the equation in exponential form: $\log_a 5.6 = w$

5. Rewrite the following expressions as a single logarithm.

a. $2\log_5 k + 3\log_5 g$

b. $2\log_2 k + 0.5\log_2 g - 4\log_2 m$

6. Use the Law of Logarithms to rewrite the expressions with no product, quotient, or power.

a. $\log_x (d^3 k^4 w)^2$

b. $\log_4 \left(\frac{d^4 k^6 g}{m} \right)^3$

7. Solve each of the following for x. Round your answers to the nearest hundredth.

a. $15(4^x) = 750$

b. $13(e^{-2x}) = 620$

c. $\ln(8 + x) = 4$

d. $\log_x 5417 = 6$

8. Evaluate each of the following. Round your answers to the nearest hundredth.

a. $\log_{2.1} 5.89$

b. $\ln 58.47$

c. $e^{\ln 2}$

State the domain, range, and asymptote of each function.

9. $f(x) = \log_4 (x + 3)$ Domain ________ Range ________ Asymptote ________

10. $f(x) = 8 - \log x$ Domain ________ Range ________ Asymptote ________

11. $f(x) = \log(2x - 7)$ Domain ________ Range ________ Asymptote ________

12. $f(x) = e^{3x} + 2$ Domain ________ Range ________ Asymptote ________

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AFM Name________________________________

6.3 Logarithms

Date________________ Period____

Rewrite each equation in exponential form.

1) $\log_2 8 = 3$

2) $\log_6 216 = 3$

3) $\log_{18} 324 = 2$

4) $\log_3 1 = 0$

5) $\log_{14} 196 = 2$

6) $\log_{17} 289 = 2$

7) $\log_{14} \frac{1}{196} = -2$

8) $\log_7 49 = 2$

Rewrite each equation in logarithmic form.

9) $18^2 = 324$

10) $243^{\frac{1}{5}} = 3$

11) $\left(\frac{1}{14}\right)^2 = \frac{1}{196}$

12) $15^1 = 15$

13) $10^{-1} = \frac{1}{10}$

14) $7^2 = 49$

15) $11^2 = 121$

16) $3^2 = 9$

Use a calculator to approximate each to the nearest thousandth.

17) $\ln 32$

18) $\log_5 8$

19) $\log_5 33$

20) $\log_7 3.7$

Quiz Day Warm-up

1. $y = \log_3(x-1)$

Domain: ______________

Range: ______________

Asymptote: __________

2. $y = 2 - \log_2 x$

Domain: ______________

Range: ______________

Asymptote: __________

3. If $12,000 is invested at an interest rate of 2.75% per year, find the amount of the investment at the end of 3 years for each compounding method.

a) Daily

b) Semiannually

c) Continuously

4. Write in exponential form: $\log_6 37 = x$ ______________________

5. Write in logarithmic form: $e^k = m$ ______________________

6. Evaluate: $\log_2 128$ ______________

7. Solve: $\log_x 243 = 5$ x = __________

8. Write as a single logarithm: $\log x + \log(x^2 y) + 3\log y$ ____________________

9. Write in a form with no logarithms of products, quotients, or powers: $\log_2(x\sqrt{x^2+1}$

____

Write each equation in logarithmic form.

A.

1. $3^4 = 81$
2. $4^3 = 64$
3. $\left(\frac{1}{2}\right)^7 = \frac{1}{128}$
4. $\left(\frac{1}{4}\right)^3 = \frac{1}{64}$
5. $\left(\frac{1}{3}\right)^{-4} = 81$
6. $\left(\frac{1}{15}\right)^{-2} = 225$
7. $5^{-3} = \frac{1}{125}$
8. $10^{-2} = 0.01$
9. $9^{-2} = \frac{1}{81}$

Write each equation in exponential form.

10. $\log_{14} 196 = 2$
11. $\log_7 2401 = 4$
12. $\log_8 \frac{1}{512} = -3$
13. $\log_6 \frac{1}{1296} = -4$
14. $\log_3 81 = 4$
15. $\log_2 256 = 8$
16. $\log_{17} 289 = 2$
17. $\log_{10} 0.0001 = -4$
18. $\log_{10} 10{,}000 = 4$

Find the value of v in each equation.

28. $v = \log_4 1024$
29. $v = \log_{13} 1$
30. $\log_6 \frac{1}{36} = v$
31. $4 = \log_5 v$
32. $\log_4 v = -3$
33. $-6 = \log_2 v$
34. $-3 = \log_v \frac{1}{27}$
35. $\log_v \frac{1}{625} = -4$
36. $7 = \log_v 128$

Evaluate each logarithmic expression to the nearest hundredth.

B.

1. $\log_2 51$
2. $\log_5 64$
3. $\log_6 0.5$
4. $\log_4 9$
5. $\log_9 14$
6. $\log_7 32$
7. $\log_8 0.23$
8. $\log_{\frac{1}{2}} 15$
9. $\log_2 0.72$
10. $\log_{\frac{1}{4}} 16$
11. $2 - \log_5 7$
12. $\log_9 10$
13. $\log_6 \frac{2}{3}$
14. $\log_8 50$
15. $3 + \log_3 22$
16. $\log_7 \frac{3}{4}$
17. $\log_8 \frac{1}{3}$
18. $\log_7 8$
19. $10 + \log_4 25$
20. $\log_{15} 40$
21. $\log_9 \frac{3}{4}$

Solve each equation. Round your answers to the nearest hundredth.

22. $5^x = 24$
23. $6^x = 44$
24. $8^x = 0.9$
25. $2^x = 3.5$
26. $9^x = 17$
27. $3^x = 41$
28. $8^{-x} = 0.25$
29. $4^x = 22$
30. $9^x = 2$
31. $2.5^x = 17$
32. $7^x = 3$
33. $12^x = 140$
34. $1 + 3^x = 14$
35. $3^{-x} = 0.9$
36. $4^{x+1} = 64$
37. $5^{2x} = 114$
38. $7 - 2^x = 1$
39. $4 + 4^x = 14$
40. $5^{x-2} = 70$
41. $5^x = 20.5$
42. $7^x = 22$

Solve each equation for x. Write the exact solution and the approximate solution to the nearest hundredth, when appropriate.

C.

1. $2^x = 2^5$
2. $\log_6 216 = x$
3. $3^{x-1} = 3^4$
4. $\log x = 2.1$
5. $x = \log_3 27$
6. $\log_9 x = 2$
7. $5 = \log_x 32$
8. $\log_x \frac{1}{4} = -1$
9. $3^x = 4$
10. $\log_4(x-2) = 2$
11. $10^{x-1} = 121$
12. $e^{x+1} = 14$
13. $e^{2x-1} = 9$
14. $\ln(x+1) = \ln 7$
15. $\ln(x-5) = \ln(3x+1)$
16. $2\ln\left(x+\frac{1}{[illegible]}\right) = \ln\frac{1}{[illegible]}$
17. $e^{-3x+4} = 22$
18. $2\ln x = \ln(2x-1)$

17

D. Evaluate each expression, if possible, to the nearest thousandth.

1. e^3
2. e^{-2}
3. $e^{4.5}$
4. $e^{0.6}$
5. $e^{\sqrt{3}}$
6. $\ln 17$
7. $\ln \sqrt{7}$
8. $\ln 45$
9. $\ln(-12)$
10. $\ln(-5)$
11. $\ln 0.8$
12. $\ln \sqrt{3}$

Write an equivalent logarithmic or exponential equation.

13. $e^{3.22} \approx 25.03$
14. $e^5 \approx 148.41$
15. $\ln 50 \approx 3.91$
16. $\ln 3.6 \approx 1.28$
17. $e^{3.4} \approx 29.96$
18. $\ln 5 \approx 1.61$
19. $\ln 25 \approx 3.22$
20. $e^{\frac{1}{2}} \approx 1.65$
21. $e^{\frac{2}{3}} \approx 1.95$
22. $e^{-7} \approx 0.000912$
23. $\ln\left(\frac{1}{4}\right) \approx -1.39$
24. $\ln\left(\frac{3}{4}\right) \approx -0.29$

Solve each equation for *x* by using the natural logarithm function. Round your answers to the nearest hundredth.

25. $15^x = 27$
26. $4.2^x = 15$
27. $7^{-x} = 120$
28. $0.5^x = 11$
29. $8^{\frac{-x}{2}} = 21$
30. $9^{-x} = 0.2$
31. $\left(\frac{1}{3}\right)^{-2x} = 125$
32. $\left(\frac{2}{3}\right)^x = 12$
33. $1.5^{3x} = 1500$
34. $2.3^x = 15$
35. $7^x = 14{,}000$
36. $11^{-2x} = 15{,}000$

37. An investor puts \$5000 in an account that earns 6.5% annual interest which is compounded continuously. Find the amount that will be in the account at the end of 5 years if no deposits or withdrawals are made.

E. **Write each expression as a sum or difference of logarithms. Then simplify, if possible.**

1. $\log_3 9x$
2. $\log_3 27x$
3. $\log_4(2 \cdot 3 \cdot 4)$
4. $\log_2 \frac{16}{y}$
5. $\log_5 \frac{4}{5}$
6. $\log_{10} \frac{xy}{10}$

Write each expression as a single logarithm. Then simplify, if possible.

7. $\log_2 3 + \log_2 7$
8. $\log_6 12 + \log_6 15 - \log_6 5$
9. $2 \log_4 5 - \log_4 6$
10. $\log_9 x - 3 \log_9 y$
11. $3 \log_5 3 - \log_5 5.4$
12. $\frac{1}{2} \log_b 25 + 3 \log_b z$

Evaluate each expression.

13. $\log_3 3^4 - \log_8 8^4$
14. $\log_7 7^5 + \log_6 6^3$
15. $4^{\log_4 87} + \log_5 25$
16. $8^{\log_8 9} - \log_4 16$
17. $\log_3 \frac{1}{81} + \log_4 64$
18. $\log_2 64 - 7^{\log_7 1}$

Solve for *x*, and check your answers. If the equation has no solution, write *no solution*.

19. $\log_8(x+1) = \log_8(2x-2)$
20. $\log_3(3x-4) = \log_3(8-5x)$
21. $\log_7(6x+4) = \log_7(-3x-5)$
22. $\log_{10}(6x+3) = \log_{10} 3x$
23. $\log_2 x + \log_2(x-4) = 5$
24. $\log_8(3x+1) + \log_8(x-1) = 2$
25. $2 \log_b x = \log_b 2 + \log_b(2x-2)$
26. $2 \log_b x = \log_b(x-1) + \log_b 4$

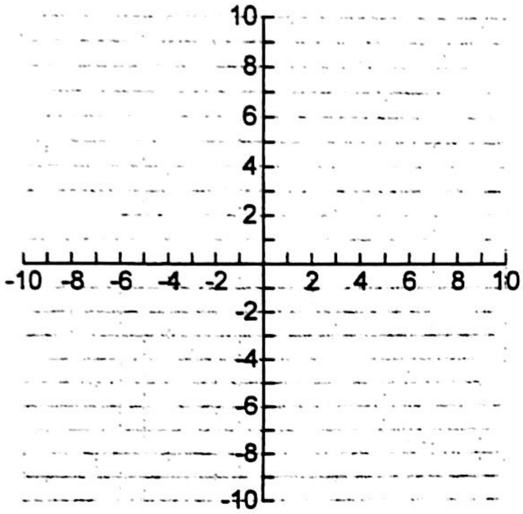
AFM Module

Module 4 & 9 Test Review Date:______________________ Pd:__________

1. Find the value of x when $y = 100$ in the following equation: $y = 12(3.7)^x$

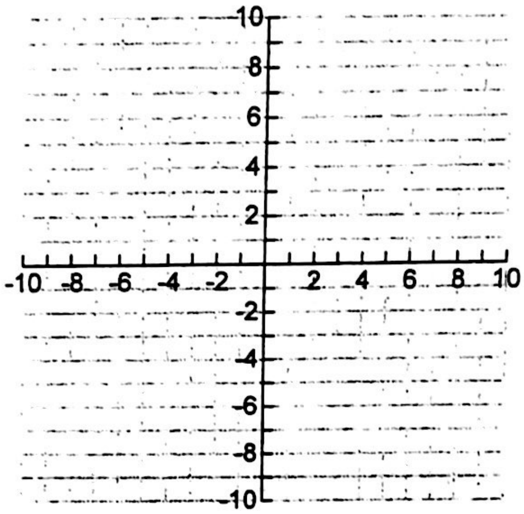
2. Sketch the graphs of the following functions. State the domain, range, and asymptote of the function.

a. $f(x) = 2 - (4)^{x+1}$



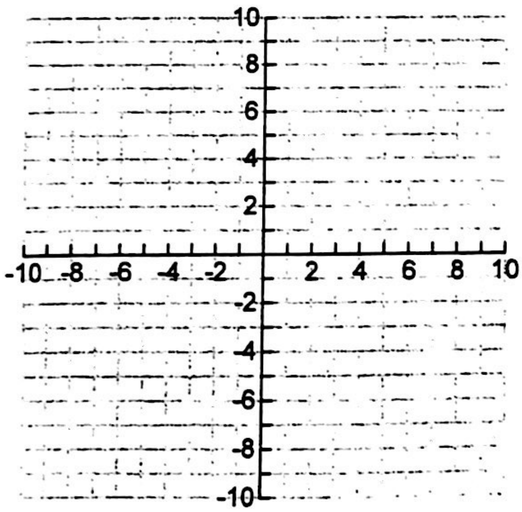
Domain:______________________
Range:______________________
Asymptote:______________________

b. $f(x) = 3^{-x-3}$



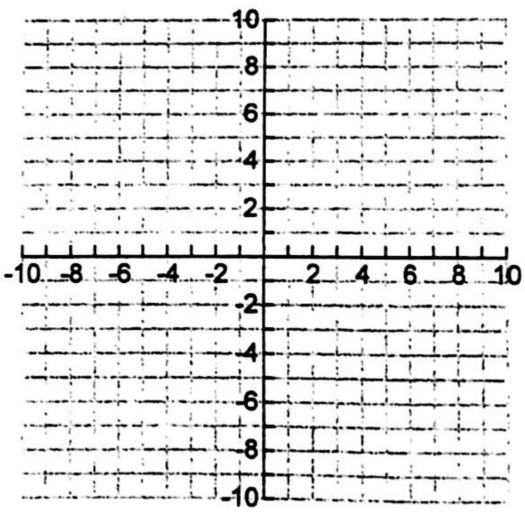
Domain:______________________
Range:______________________
Asymptote:______________________

c. $f(x) = -\log_3 x$



Domain:______________________
Range:______________________
Asymptote:______________________

d. $f(x) = \log_4(x - 1) - 3$



Domain:______________________
Range:______________________
Asymptote:______________________

7. Expre

3. Given the following function, $y = 1 + e^{x-1}$, state the domain, range and asymptote.

Domain:______________

Range:______________

Asymptote:______________

4. The number of bacteria in a culture is given by the formula n(t)$n(t) = 1200e^{0.35t}$, where "t" is measured in hours.
   a. What is the relative rate of growth of this bacterial population?
   b. What is the initial population of the culture?
   c. How many bacteria will the culture contain after 3 hours?
   d. How long will it take the bacteria to reach a population of 10,500?

5. The following data below represents the amount of money an investor has in an investment account each year for 10 years. She wishes to determine the effective rate of return on her investment.

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Value of Account	\$10,000	\$10,573	\$11,260	\$11,733	\$12,242	\$13,269	\$13,969	\$14,823	\$15,297	\$16,539

   a. Find an exponential model for this data.

   b. If the investor plans to retire in 2020, what will the predicted value of this account be?

6. Express the following equations in exponential form:

a. $\log_6 1 = 0$

b. $\log_{27} 9 = \frac{4}{3}$

c. $\log_2 M = \pi$

d. $\ln x = 4$

e. $\ln 4 = x$

7. Express the following equations in logarithmic form:

a. $16^{(\frac{1}{2})} = 4$

b. $10^5 = 100{,}000$

c. $5^{-1} = \frac{1}{5}$

d. $e^5 = x$

e. $10^m = n$

8. Evaluate the expression $\log_8 16$.

9. Rewrite the expressions as single logarithms.

a. $\log_4(x^2 - 1) - \log_4(x - 1)$

b. $\frac{1}{3}(\log_4 x + 3\log_4 y - 2\log_4 z)$

10. Use the Law of Logarithms to rewrite the expressions in a form with no logarithms of products, quotients, or powers.

a. $\log_3(\frac{x}{4})$

b. $\log_6 \sqrt[5]{13}$

c. $\log_a(xy)^7$

d. $\log_4 \sqrt{\frac{(x+2)}{x}}$

e. $\ln \sqrt{b^2 d^5}$

f. $\log_4(\frac{\sqrt{k}}{m^2})$

11. Find the solution to four decimal places

a. $8^{1-x} = 5$

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

12. If $4,000 is borrowed at a rate of 14% interest per year, compounded daily, find the amount the end of 4 years.

13. Vince wants to invest $3,000 in savings certificates that bear an interest rate of 8.25% compounde semiannually. How long a time period should she choose in order to save an amount of $5,000?

14. A culture starts with 680 bacteria. After just 30 minutes the count is 3250.

a. Find a formula for the number of bacteria after "t" hours.

b. Find the number of bacteria after 3.5 hours.

c. After how many hours will the number of bacteria be triple?

Pg. 384 # 2-14 even, 15-25

DAY 1 HW

6.1 EXERCISES

1–8 ■ Sketch the graph of the function by making a table of values. Use a calculator if necessary.

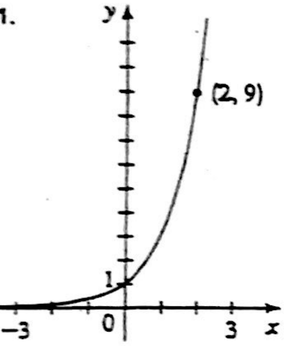
1. $f(x) = 2^x$
2. $g(x) = 8^x$
3. $h(x) = 6^x$
4. $h(x) = (0.8)^x$
5. $f(x) = \left(\frac{1}{3}\right)^x$
6. $h(x) = (1.1)^x$
7. $g(x) = \left(\frac{1}{4}\right)^x$
8. $f(x) = \left(\frac{3}{2}\right)^x$

9–10 ■ Graph both functions on one set of axes.

9. $y = 4^x$ and $y = 7^x$
10. $y = \left(\frac{2}{3}\right)^x$ and $y = \left(\frac{4}{3}\right)^x$

11–14 ■ Find the exponential function $f(x) = a^x$ whose graph is given.

11.



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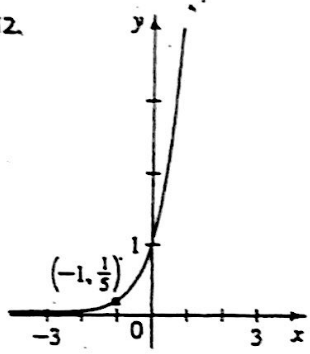

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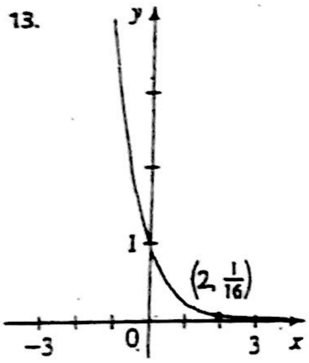

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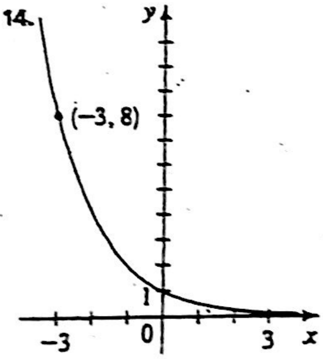
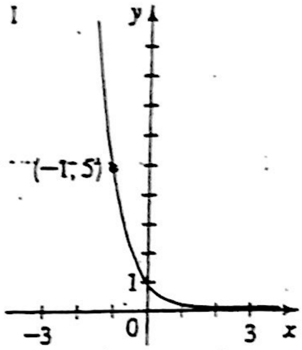


15–20 ■ Match the exponential function with one of the graphs labeled I–VI.

15. $f(x) = 5^x$
16. $f(x) = -5^x$
17. $f(x) = 5^{-x}$
18. $f(x) = 5^x + 3$
19. $f(x) = 5^{x-3}$
20. $f(x) = 5^{x+1} - 4$

I



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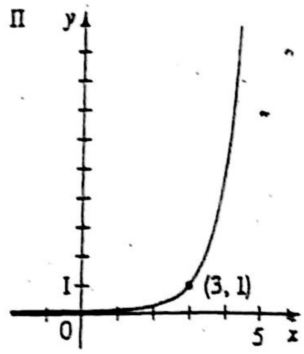
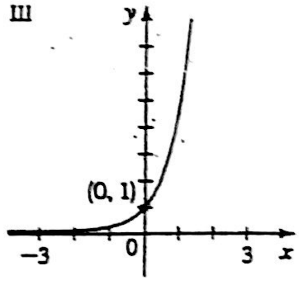


III



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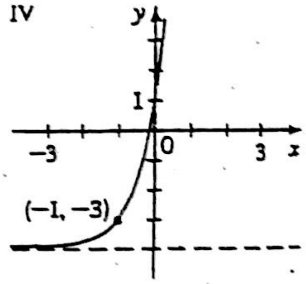
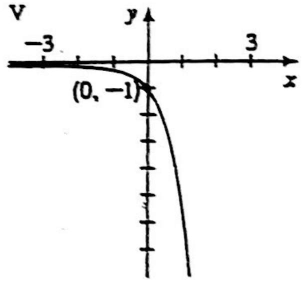
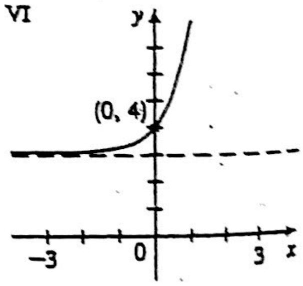


V



VI



21–36 ■ Graph the function, not by plotting points, but by starting from the graphs in Figure 4. State the domain, range, and asymptote.

21. $f(x) = -3^x$
22. $f(x) = 10^{-x}$
23. $g(x) = 2^x - 3$
24. $g(x) = 2^{x-3}$
25. $h(x) = 4 + \left(\frac{1}{2}\right)^x$
26. $h(x) = 6 - 3^x$
27. $f(x) = 10^{x+3}$
28. $f(x) = -\left(\frac{1}{5}\right)^x$
29. $f(x) = -3^{-x}$

AFM Exponential & Log Homework Day 2
Book Page 394
Page 394 #11-12, 17-24

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Date ____________________

11. If $3000 is invested at an interest rate of 9% per year, find the amount of the investment at the end of 5 years for the following compound methods:

a. Annual

b. Semiannual

c. Monthly

d. Weekly

e. Daily

f. Hourly

g. Continuously

12. If $4000 is invested in an account for which interest is compounded quarterly, find the amount of the investment at the end of 5 years for the following interest rates:

a. 6%

b. 6.5%

c. 7%

d. 8%

17. The number of bacteria in a culture is given by the function

$$n(t) = 500e^{0.45t}$$

where *t* is measured in hours.

a. What is the relative rate of growth of the rat population? Express your answer as a percentage.
b. What is the initial population of the culture (at t = 0)?
c. How many bacteria will the culture contain at time t = 5?

18. The rat population in New York City is given by the function

$$n(t) = 54e^{0.12t}$$

where *t* is measured in years since 1990 and n(t) is measured in millions.

a. What is the relative rate of growth of the rat population? Express your answer as a percentage.
b. What was the rat population in 1990?
c. What is the rat population in the year 2000?

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19. The fox population in a certain region has a relative growth rate of 8% per year. It is estimated that population in 2000 was 18,000.

a. Find a function that models the population *t* years after 2000.

b. Use the function from part (a) to estimate the fox population in the year 2008.

20. The population of a certain city has a relative growth rate of 5% per year. The population in 1988 has 421,000. Find the projected population of the city for each year:

a. 2000

b. 2030

21. The population of a country has relative growth rate of 3% per year. The government is trying to reduce the growth rate to 2%. The population in 1995 was approximately 100 million. Find the projected population for the year 2020 for the following conditions:

a. The relative growth rate remains at 3% per year.

b. The relative growth rate is reduced to 2% per year.

22. The population of a certain city was 680,000 in the year 2000 and is growing at the relative growth rate of 12% per year.

a. Find the function that models the population of this city *t* years after 2000.

b. Estimate the population in 2008.

23. The population of the world in 1987 was 5 billion and the relative growth rate was estimated at 2% per year. Assuming that the world population follows an exponential growth model, find the projected world population in 1995. (The actual world population was 5.7 billion in 1995).

24. The relative growth rate for a certain bacteria population is 80% per hour. A small culture is formed, and 3 hours later a count shows approximately 21,500 bacteria in the culture.

a. Find the initial number of bacteria in the culture.

b. Estimate the number of bacteria in 5 hours from the time the culture was started.

AFM Exponential & Log Homework Day 3
Book Page 405
Page 405 #14-28 even, 37-42

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Date____________

aluate the expression.

14. (a) $\log_3 3$ (b) $\log_3 1$ (c) $\log_3 3^2$

16. (a) $\log_2 32$ (b) $\log_8 8^{17}$ (c) $\log_6 1$

18. (a) $\log_5 125$ (b) $\log_{49} 7$ (c) $\log_9 \sqrt{3}$

20. (a) $e^{\ln \pi}$ (b) $10^{\log 5}$ (c) $10^{\log 87}$

22. (a) $\log_4 \sqrt{2}$ (b) $\log_4 \frac{1}{2}$ (c) $\log_4 8$

Use the definition of logarithmic function to find x.

24. (a) $\log_2 x = 5$ (b) $\log_2 16 = x$

26. (a) $\log_x 1000 = 3$ (b) $\log_x 25 = 2$

28. (a) $\log_x 6 = \frac{1}{2}$ (b) $\log_x 3 = \frac{1}{3}$

Match the logarithmic function with one of the graphs labeled I-VI.

37. $f(x) = -\ln x$

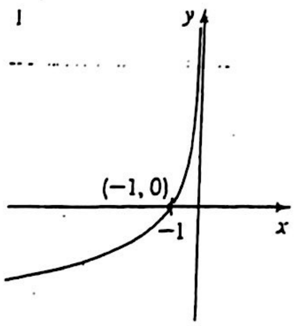
38. $f(x) = \ln(x-2)$

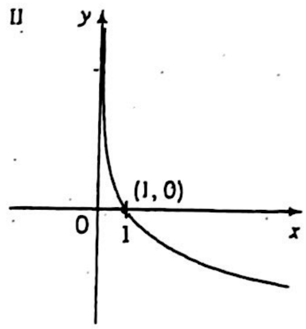
39. $f(x) = 2 + \ln x$

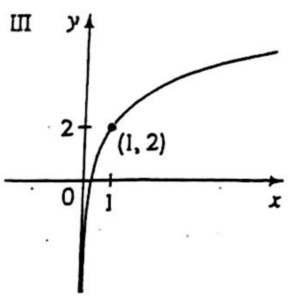
40. $f(x) = \ln(-x)$

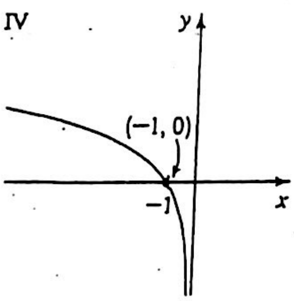
41. $f(x) = \ln(2-x)$

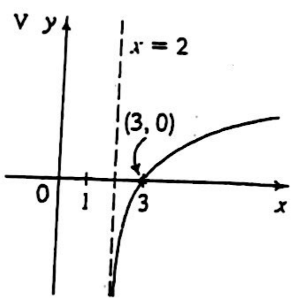
42. $f(x) = -\ln(-x)$

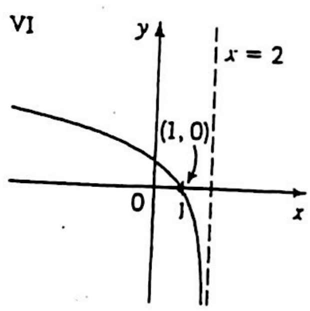












AFM Exponential & Log Homework Day 4
Book Page 411 & 418
Page 411 #2-14 even, 36 – 42 even, Page 418 #34-46 even

Name ____________________
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age 411:

Use the Laws of Logs to rewrite the expression in a form with no logarithm of a product, quotient or power.

2. $\log_5(\frac{x}{2})$

4. $\ln(\pi x)$

6. $\log_6 \sqrt[4]{17}$

8. $\log_2(xy)^{10}$

10. $\log_a\left(\frac{x^2}{yz^3}\right)$

12. $\ln \sqrt[3]{3r^2s}$

14. $\log\left(\frac{a^2}{b^4\sqrt{c}}\right)$

Rewrite the expression as a single logarithm.

36. $\log 12 + \frac{1}{2}\log 7 - \log 2$

38. $\log_5(x^2 - 1) - \log_5(x - 1)$

40. $\ln(a + b) + \ln(a - b) - 2 \ln c$

42. $2(\log_5 x + 2\log_5 y - 3\log_5 z)$

Page 418:

Solve the logarithmic equation for x.

34. $\ln(2+x) = 1$

36. $\log(x - 4) = 3$

38. $\log_3(2 - x) = 3$

40. $\log_2(x^2 - x - 2) = 2$

42. $2 \log x = \log 2 + \log(3x - 4)$

44. $\log_5 x + \log_5(x+1) = \log_5 20$

46. $\log x + \log(x - 3) = 1$