Chapter 3 Study Guide

Name: Key Date: ________

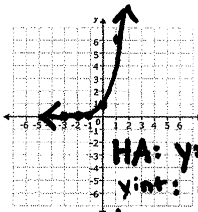
******THIS IS NOT HOMEWORK*******

3.1	3.2	3.3	3.4	3.5
Definition of Exponentials Evaluating Exponentials Graphing Exponentials The Natural Base *e*	Definition of Logarithms Evaluating Logarithms with base *a* Graphing Logarithms with base *a* Evaluating Natural Logarithms	Change of Base Formula Product Property Quotient Property Power Property Expanding & Condensing	One-to-One vs. Inverse Properties Solving Exponential Equations Solving Logarithmic Equations Applications	Recognize the five most common types of models involving exponentials or logarithmic functions Use each model to solve real-life problems

Lesson 3.1— Graph the exponential function by hand. Identify asymptotes and intercepts and determine whether the graph is increasing or decreasing.

1. $f(x) = 6^x$

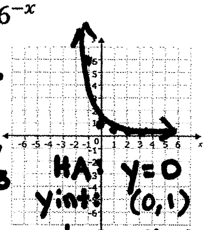
x	y
-3	.005
-2	.03
-1	.17
0	1
1	6
2	36



HA: y=0
yint: (0,1)
increasing

2. $f(x) = 6^{-x}$

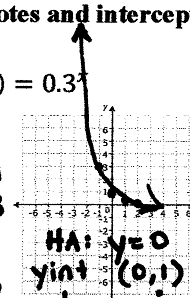
x	y
-2	36
-1	6
0	1
1	.17
2	.03



HA: y=0
yint: (0,1)
decreasing

3. $f(x) = 0.3^x$

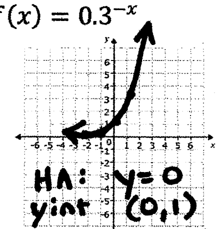
x	y
-2	11.1
-1	3.3
0	1
1	.3
2	.09



HA: y=0
yint (0,1)
decreasing

4. $f(x) = 0.3^{-x}$

x	y
-2	.09
-1	.3
0	1
1	3.3

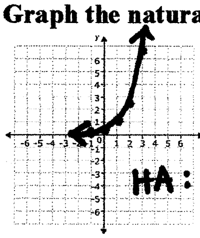


HA: y=0
yint (0,1)
increasing

Lesson 3.1— Graph the natural base e exponential function. Identify asymptotes

5. $f(x) = e^{x-1}$

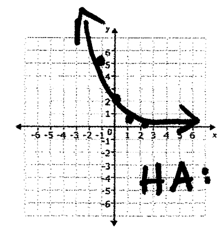
x	y
-1	.14
0	.37
1	1
2	2.7
3	7.4



HA: y=0

6. $f(x) = 2 + e^{-x}$

x	y
-2	14.8
-1	5.4
0	2
1	.7
2	.3



HA: y=0

Lesson 3.1— Complete the table to determine the balance *A* for $10,000 invested at a rate of 8% for *t* years, compounded continuously.

7.

t	1	20	50
A	$10,832.87	$49,530.32	$545981.50

$A = Pe^{rt}$

$A = 10000e^{.08(1)}$

$A = 10000e^{.08(20)}$

$A = 10000e^{.08(50)}$

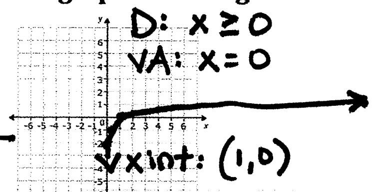
Lesson 3.2— Sketch the graph of the logarithmic Function. Find the domain, VA, and x-intercept

8. $f(x) = -\log_2 x + 5$

$-(y-5) = \log_2 x$

$2^{-y-5} = x$

x	y
.3	-2
	-1
	0
1	
32	2



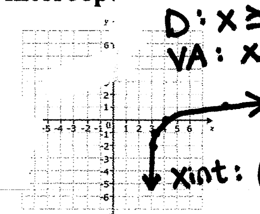
D: $x \geq 0$
VA: $x = 0$
xint: (1,0)

9. $f(x) = \log_5(x-3)$

$5^y = x-3$

$5^y + 3 = x$

x	y
3.04	-2
3.2	-1
4	0
8	1



D: $x \geq 3$
VA: $x = 3$
xint: (4,0)

Lesson 3.3— Evaluate using the change-of-base formula. Do this for common and natural logs.

10. $\log_4 9$ $\quad \frac{\log 9}{\log 4} = \boxed{1.585} \quad \frac{\ln 9}{\ln 4} = \boxed{1.585}$

11. $\log_{\frac{1}{2}} 8$ $\quad \frac{\log 8}{\log 1/2} = \boxed{-3} \quad \frac{\ln 8}{\ln 1/2} = \boxed{-3}$

Lesson 3.3— Expand the following.

12. $\ln \frac{xy^5}{\sqrt{z}}$ $\quad \ln(xy^5) - \ln\sqrt{z}$

$(\ln x + \ln y^5) - \ln z^{1/2}$

$\boxed{(\ln x + 5\ln y) - \frac{1}{2}\ln z}$

13. $\log_{10} \frac{5\sqrt{y}}{x^2}$ $\quad \log_{10}(5\sqrt{y}) - \log_{10} x^2$

$\boxed{(\log_{10} 5 + \frac{1}{2}\log_{10} y) - 2\log_{10} x}$

14. $\log_4 16xy^3$ $\quad \log_4 16 + \log_4 x + \log_4 y^3$

$\boxed{\log_4 16 + \log_4 x + 3\log_4 y}$

15. $\ln \frac{x}{4}$ $\quad \boxed{\ln x - \ln 4}$

Lesson 3.3— Condense the following.

16. $\log_2 9 + \log_2 x$ $\quad \boxed{\log_2 9x}$

17. $\frac{1}{2}\ln(2x-1) - 2\ln(x+1)$

$\ln\sqrt{2x-1} - \ln(x+1)^2 = \boxed{\ln \frac{\sqrt{2x-1}}{(x+1)^2}}$

18. $\ln 3 + \frac{1}{3}\ln(4-x^2) - \ln x$

$\ln 3 + \ln\sqrt[3]{4-x^2} - \ln x$

$\ln 3\sqrt[3]{4-x^2} - \ln x$

$\boxed{\ln \frac{3\sqrt[3]{4-x^2}}{x}}$

19. $3[\ln x - 2\ln(x^2+1)] + 2\ln 5$

$3\ln\frac{x}{(x^2+1)^2} + 2\ln 5$

$\ln\left(\frac{x}{(x^2+1)^2}\right)^3 + \ln 5^2 = \boxed{\ln 5^2\left(\frac{x}{(x^2+1)^2}\right)^3}$

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Lesson 3.4— Solve the following equations.

20. $2^{x+1} = \frac{1}{16}$

$\log_2 \quad \log_2$

$x+1 = \log_2 \frac{1}{16}$

$x+1 = \frac{\log 1/16}{\log 2}$ $\boxed{x = -5}$

21. $log_8 x = 4$ $\boxed{x = 4096}$

22. $e^{\ln(x-1)} = e^3$ $\boxed{x = 21.086}$

23. $\frac{3e^{-5x}}{3} = \frac{132}{3}$

ln ln

$\boxed{x = -.757}$

24. $e^{2x} - 7e^x + 10 = 0$

$(e^x-5)(e^x-2)=0$

$e^x-5=0$ $e^x-2=0$

$\boxed{x = .693}$ $\boxed{x = 1.609}$

25. $log_4(x-1) = log_4(x-2) - log_4(x+2)$

$x-1 = \frac{(x-2)}{(x+2)} \rightarrow (x-1)(x+2) = x-2$

$x^2+x-2 = x-2$

$x^2=0$

$\boxed{x=0}$

26. $\ln x - \ln 3 = 0$

$\cancel{\ln} x = \cancel{\ln} 3$ $\boxed{x = 3}$

27. $2e^{x-3} - 1 = 4$

$e^{x-3} = \frac{5}{2}$ $\boxed{x = 3.916}$

28. $log_{10}(-x-4) = 2$

$100 = -x-4$

$\boxed{x = -104}$

29. $e^{\ln\sqrt{x+40}} = e^3$

$x+40 = (e^3)^2$

$\boxed{x = 363.429}$

Lesson 3.5—Solve the following word problems.

30. The populations P in thousands) of North Caroline from 1990 through 2008 can be modeled by $P = 6707.7e^{kt}$, where t is the year, with t=0 corresponding to 1990. In 2008, the population was about 9,222,000.

a. Find the value of k, and then $9222 = 6707.7e^{k(18)}$

$\boxed{k = .0177}$

b. Use the result to predict the population in the year 2020. → $t = 30$

$y = 6707.7e^{.0177(30)}$

$\boxed{y = 11407.3 \text{ thousands}}$

31. The scores for a biology test follow a normal distribution modeled by $y = 0.0499e^{-(x-74)^2/128}$, where x is the test score and $40 \leq x \leq 100$.

a. Use a graphing utility to graph the function (*use the given domain and use .05 as YMAX and -.001 as YMIN*)

b. Use the graph to estimate the average test score. $\boxed{x = 74}$

32. The average number N of words per minute that the students in first grade class could read orally after t weeks of school is modeled by $N = \frac{62}{1+5.4e^{-.24t}}$. Find the numbers of weeks it took the class to read at average rates of

a. 40 words per minute $40 = \frac{62}{1+5.4e^{-.24t}}$ $\boxed{t = 9.5}$

b. 60 words per minute $60 = \frac{62}{1+5.4e^{-.24t}} =$ $\boxed{t = 21.19}$

33. On the Richter scale, the magnitude R of an earthquake of intensity I is modeled by $R = log_{10}\frac{I}{I_0}$ where $I_0 = 1$ is the minimum intensity used for comparison. Find the intensities I of the following earth quakes measuring R on the Richter scale.

a. $R = 7.1$ $7.1 = \log_{10} I$ $\boxed{I = 10^{7.1}}$

b. $R = 5.5$ $5.5 = \log_{10} I$ $\boxed{I = 10^{5.5}}$