Chapter 1 Study Guide

Name: Key Date: _____

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

1.1	1.2	1.3	1.4	1.5	1.6	1.7
Slope Point-Slope Form Parallel Lines Perpendicular Lines	Functions Range & Domain Evaluate $f(x)$ Domain Algebraically Difference Quotient Range & Domain graphically	Constant/Increase /Decrease Relative Min/Max Even or Odd	Parent Functions Transformations	$f(x)$ Operations: -add -subtract -multiply -divide -composition	Finding Inverses Verifying: -Algebraically -Graphically -Numerically Horizontal Line Test One-to-One Graphs of Inverse	Scatterplots Regression Lines Predictions

Lesson 1.1— Find the slope.

1. (1, –3) and (–1, 5) -4
2. (–2, 4) and (1, 3) $-\frac{1}{3}$
3. (–3, –3) and (7, 2) $\frac{1}{2}$

Lesson 1.1— Write an equation in slope-intercept form for the line that satisfies each set of conditions.

4. slope 3, passes through (1, –3) $y = 3x - 6$
5. slope 3, passes through (2, 0) $y = 3x - 6$
6. passes through (–1, –2) and (–3, 1) $y = \frac{-3}{2}x - \frac{7}{2}$
7. passes through (–2, –4) and (1, 8) $y = 4x + 4$
8. passes through (3, –1), perpendicular to the graph of $y = -\frac{1}{3}x - 4$. $y = 3x - 10$
9. parallel to $y = \frac{2}{3}x + 6$, passes through (6, 7) $y = \frac{2}{3}x + 3$
10. parallel to $y = -\frac{1}{4}x - 2$, x-intercept at 4 $y = -\frac{1}{4}x + 1$
11. perpendicular to $y = -4x + 1$, passes through (–8, –1) $y = \frac{1}{4}x + 1$

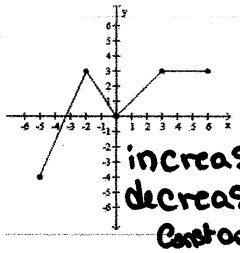
Lesson 1.2— Find the domain.

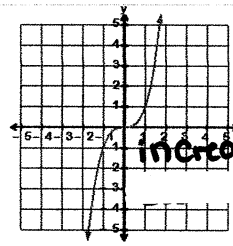
12. $f(x) = 5x^2 + 2x - 1$ $\mathbb{R}$
13. $h(t) = \frac{4}{t}$ $\mathbb{R}$ except 0 $(t \neq 0)$
14. $g(t) = \frac{1}{(2x+1)}$ $\mathbb{R}$ except $-\frac{1}{2}$ $(x \neq -\frac{1}{2})$

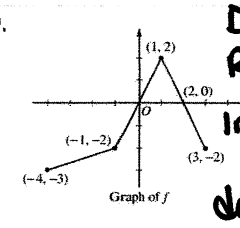
Lesson 1.2— Find the difference quotient.

15. $f(x) = 2x$, $\frac{f(x+c)-f(x)}{c}$, $c \neq 0$ 2
16. $f(x) = x^2 - 4x + 7$, find $\frac{f(x+h)-f(x)}{h}$ $h - 2x - 4$
17. $f(x) = x^3 + x$, find $\frac{f(x+c)-f(x)}{c}$ $3x^2 + c^2 + 3cx + 1$

Lesson 1.3— Find the domain and range graphically, state which sections are constant, or increasing, or decreasing.

18. 
D: $[-5, 6]$
R: $[-4, 3]$
increase: $[-5, -2]$ $[0, 3]$
decrease: $[-2, 0]$
Constant: $[3, 6]$

19. 
D: $(-\infty, \infty)$
R: $(-\infty, \infty)$
increase: $(-\infty, 0]$ and $[0, \infty)$

20. 

Graph of f
D: $[-4, 3]$
R: $[-3, 1]$
In: $[-4, -1]$ $[-1, 1]$
dec: $[1, 3]$

Lesson 1.3— Find the relative minimum and maximum for each.

21. $f(x) = 5x^2 + 2x - 1$ min: $(-.2, -1.2)$
22. $h(t) = x^3 - 2x$ max: $(-.82, 1.09)$ min: $(.82, -1.09)$
23. $g(x) = -2|x - 4|$ max: $(4, 0)$

Lesson 1.3— Determine if each is even, odd, or neither.

24. $f(x) = 5 - 3x$ neither
25. $h(t) = x^3 - 2x^2$ neither
26. $g(x) = x^2 + 6$ even

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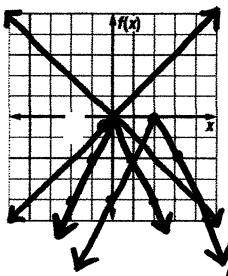
Lesson 1.4— Graph the following functions. State the parent functions and describe the transformations.

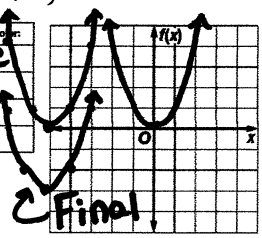
27. $g(x) = -2|x-2|$

Description of Transformation:	Color:
Parent Function: abs value	
reflect x	-
vertical Stretch	2
right 2	



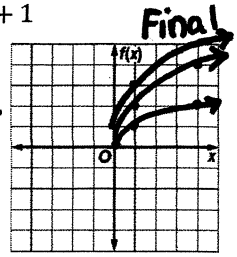
28. $g(x) = (x+5)^2 - 3$

Description of Transformation:	Color:
Parent Function: quadratic	
left 5	
down 3	



29. $g(x) = 2\sqrt{x} + 1$

Description of Transformation:	Color:
Parent Function: Sq. Root	
vertical stretch 2	
up 1	



Lesson 1.5— Find each value if $f(x) = 2x - 1$ and $g(x) = 2 - x^2$.

30. $(f+g)(4)$ -7

31. $(g-f)(x+1)$ $-x^2-4x$

32. $(fg)(2)$ -6

33. $\left(\frac{f}{g}\right)(-1)$ -3

34. $(f \circ g)(x)$ $3-2x^2$

35. $(g \circ f)(3)$ -23

Lesson 1.6— Find the inverses.

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

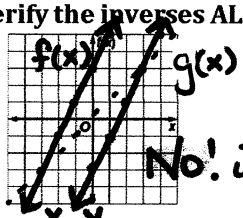
37. $f(x) = \frac{x-4}{3}$ $f^{-1}(x) = 3x+4$

38. $f(x) = 5x^2$ $f^{-1}(x) = \sqrt{\frac{x}{5}}$

Lesson 1.6— Verify the inverses ALGEBRAICALLY, GRAPHICALLY, and NUMERICALLY.

39. $f(x) = 2x + 3$
$g(x) = 2x - 3$

$f(g(x))$ $g(f(x))$
$2(2x-3)$
$4x-12$
No!



x	y
-1	-1
0	1
1	3
5	5

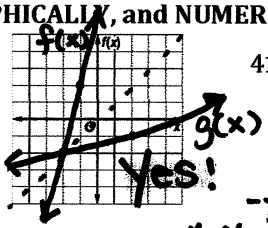
→

x	y
-1	1
3	3
5	7

No!

40. $f(x) = 4x + 6$
$g(x) = \frac{x-6}{4}$

$f(g(x))$ $g(f(x))$
$4\left(\frac{x-6}{4}\right)+6$ $\frac{4x+6-6}{4}$
$x-6+6$ $\frac{4x}{4}$
✗ ✓



x	y
-3	-6
-2	-2
-1	2

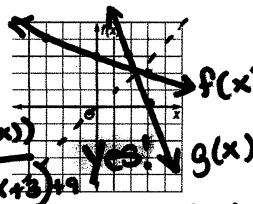
Yes!

x	y
-6	-3
-2	-2
2	-1

Yes

41. $f(x) = -\frac{1}{3}x + 3$
$g(x) = -3x + 9$

$f(g(x))$ $g(f(x))$
$-\frac{1}{3}(-3x+9)+3$ $-3\left(-\frac{1}{3}x+3\right)+9$
✗ ✓



Yes!

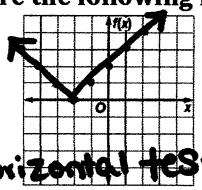
x	y
3	2
0	3
-3	4

✓

x	y
2	3
3	0
4	-3

Lesson 1.6— Are the following functions one-to-one?

42. **Graphically?**
$f(x) = |x+2|$



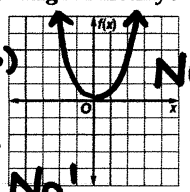
No;
fails the horizontal test!

43. **Algebraically?**
$f(x) = x + 1$

$f(a) \stackrel{?}{=} f(b)$
$a+1 = b+1$
$a = b$ ✓

Yes!

44. **Graphically? Algebraically?**
$f(x) = x^2$

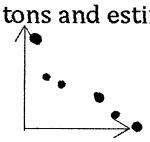


$f(a) = f(b)$
$a^2 = b^2$
$\sqrt{a^2} = \sqrt{b^2}$
$\pm a = \pm b$
No!

Lesson 1.7— For the following, use a calculator.

45. The table gives the weights in tons and estimates the fuel economy in miles per gallon for several cars.

a. Sketch the scatterplot.



Weight (tons)	1.3	1.4	1.5	1.8	2	2.1	2.4
Miles per Gallon	29	24	23	21	?	17	15

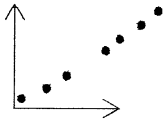
b. Find the correlation coefficient, and describe the correlation. $r = -.95$ negative / Strong

c. Find the regression equation. $y = -11.18x + 41.06$

d. Use your equation to predict the missing value. $y = 18.7$

46. Alton has a treadmill that uses the time on the treadmill to estimate the number of Calories he burns during a workout. The table gives workout times and Calories burned for several workouts.

a. Sketch the scatterplot.



Time (min)	18	24	30	40	42	48	52	60
Calories Burned	260	280	320	380	400	440	475	?

b. Find the correlation coefficient, and describe the correlation. $r = 1$ positive / Strong

c. Find the regression equation. $y = 6.4x + 132.95$

d. Use your equation to predict the missing value. $y = 516.95$

Chapter 2 Study Guide

Name: _____ Date: _____

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

2.1	2.2	2.3	2.4	2.5
Quadratics Standard Form Vertex X-Intercepts Writing Equations	Parts of Polynomial End Behavior Leading Coefficient Zeros/Multiplicity Sketching Graphs	Long Division Synthetic Division Rational Zeros Test Descartes' Rule of Signs Calculator—Zeros	Complex Numbers • Equality • Adding • Subtracting • Multiplying • Dividing	Fundamental Theorem of Algebra Finding the polynomial given the zeros Finding zeros given any polynomial

Lesson 2.1— Describe the graph of the function and identify the vertex. Identify any x-intercepts.

1. $f(x) = (x-4)^2 - 4$ V: (4, -4) X-Int: (6,0) (2,0)

2. $f(x) = 3x^2 - 12x + 11$ $3(x^2-4x+4) - 3(4) + 11$ $3(x-2)^2 - 1$ V: (2, -1) X-int: (1.42, 0) (2.58, 0)

Lesson 2.1— Write the standard form of the function that has the indicated vertex and passes through the point.

3. Vertex: (2,3) Point: (0,2) $2 = a(0-2)^2 + 3$ $-1 = 4a$ $a = -1/4$ $f(x) = \frac{-1}{4}(x-2)^2 + 3$

4. Vertex: (1, −4) Point: (2, −3) $-3 = a(2-1)^2 - 4$ $1 = a$ $f(x) = 1(x-1)^2 - 4$

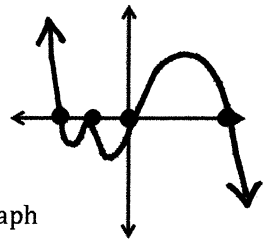
Lesson 2.2— State the constant, degree, leading coefficient, and number of terms. Describe the end behavior.

5. $f(x) = -4x^3 - 8x + 21$ C: 21 D: 3 LC: −4 #: 3 odd negative

6. $f(x) = x(x-5)^4(x+3)^3(x-1)^2$ C: NA D: 10 LC: 1 #: NA even positive

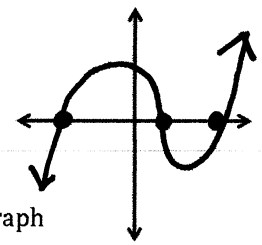
Lesson 2.2— Use the function, $f(x) = -x(x+2)^3(x-3)^3(x+1)^2$ to answer the following.

7. State the degree and leading coefficient
   9 → odd −1 → negative
8. Determine the real zeros.
   x=0 x=-2 x=3 x=-1
9. State the multiplicity of each zero.
   Cross Cross Cross Bounce
10. Graph the x-intercept points and sketch the polynomial graph



Lesson 2.2— Use the function, $f(x) = x^3 - x^2 - 4x + 4$ to answer the following.

11. State the degree and leading coefficient
    3 → odd 1 → positive
12. Determine the real zeros.
    x = -2 x = 1 x = 2
13. State the multiplicity of each zero.
    Cross Cross Cross
14. Graph the x-intercept points and sketch the polynomial graph



$x^2(x-1) - 4(x-1)$
$(x-1)(x^2-4)$
$(x-1)(x+2)(x-2)$

Lesson 2.3— Dividing using Long Division or Synthetic Division.

15. $(2x^5 - 15x^3 - 9x^2 + 11x + 12) \div (x+2)$ $2x^4 - 4x^3 - 7x^2 + 5x + 1 + \frac{10}{x+2}$
16. $(x^4 - x^3 - 19x^2 - 3x - 19) \div (x-5)$ $x^3 + 4x^2 + x + 2 - \frac{9}{x-5}$
17. $(10x^4 - 4x^3 + 14x^2 - 14x - 16) \div (2x-2)$ $5x^3 + 3x^2 + 10x + 3 - \frac{10}{2x-2}$
18. $(9x^5 - 9x^4 - x^3 - 12x^2 + x - 11) \div (3x-5)$ $3x^4 + 2x^3 + 3x^2 + x + 2 - \frac{1}{3x-5}$
19. $(16x^4 + 4x^3 + 2x^2 - 12x + 7) \div (4x-1)$ $4x^3 + 2x^2 + x - 3 + \frac{4}{4x-1}$
20. $(6x^5 + 21x^4 - 14x^3 - 8x^2 + x - 6) \div (x+4)$ $6x^4 - 3x^3 - 2x^2 + 1 - \frac{10}{x+4}$

Lesson 2.3— Use the Rational Zero Test to list all possible rational zeros of f.

PRZ = $\frac{\pm1\ \pm2\ \pm3\ \pm6}{\pm1\ \pm2\ \pm5\ \pm10}$

21. $f(x) = 4x^3 - 11x^2 + 10x - 3$

PRZ = $\frac{\pm1\ \pm3}{1\ 2\ 4}$

f(1) = 0 ~~f(1/2) =~~ ~~f(1/4) =~~

~~f(-1) =~~ ~~f(-1/2) =~~ ~~f(-1/4) =~~

~~f(3) =~~ ~~f(3/2) =~~ ~~f(3/4) =~~

~~f(-3) =~~ ~~f(-3/2) =~~ f(-3/4) = 0

1 and $-3/4$

22. $f(x) = 10x^3 + 21x^2 - x - 6$

$-2, -\frac{3}{5}, \frac{1}{2}$

Lesson 2.3— Use Descartes' Rule of Signs to determine the possible numbers of +&− real zeros of the function.

23. $g(x) = 5x^3 - 6x + 9$

① ②

2 positive

$g(-x) = -5x^3 + 6x + 9$

①

1 negative

24. $f(x) = 2x^5 - 3x^2 + 2x - 1$

① ② ③

3 positive

$f(-x) = -2x^5 - 3x^2 - 2x - 1$

0 negative

Lesson 2.4— Find .

25. $(2 - 4i)(-6 + 4i)$ $4 - 16i$

26. $(1 - 7i)^2$ $-48 - 14i$

27. $(-3 + 6i) - (-5 - 3i) - 8i$ $2 + i$

28. $(3 + 3i) + (8 - 2i) - 7$ $4 + i$

29. $\frac{4-9i}{-6i}$ $\frac{54}{36} + \frac{24i}{36}$

30. $\frac{-3+10i}{-2-6i}$ $\frac{-54}{40} - \frac{38i}{40}$

31. $\frac{2i}{2+3i}$ $\frac{6}{13} + \frac{4i}{13}$

Lesson 2.5— A polynomial function with rational coefficients has the follow zeros, find the polynomial.

32. $-1,\ 1 + 3i$

$f(x) = (x+1)(x-1-3i)(x-1+3i)$

$f(x) = x^3 - x^2 + 7x + 9$

33. $-3, -3, 2\sqrt{2}$

$f(x) = (x+3)(x+3)(x-2\sqrt{2})$

$f(x) = x^3 + (2\sqrt{2}+6)x^2 + (9-12\sqrt{2})x - 18\sqrt{2}$

$f(x) = x^3 + 3.17x^2 - 7.97x - 25.46$

34. $1 - i,\ \sqrt{7}$

$f(x) = (x-\sqrt{7})(x-1+i)(x$

$f(x) = x^3 - 4.6x^2 + 7.3x$

Lesson 2.5— Find all the zeros of the function and write the polynomial as a product of linear factors. .

33. $f(x) = x^4 - 16$

$f(x) = (x+2)(x-2)(x+2i)(x-2i)$

$x = -2, 2, -2i, 2i$

36. $f(x) = x^3 - 3x^2 + 4x - 2$

$f(x) = (x-1)(x-(1+i))(x-(1-i))$

$x = 1, 1+i, 1-i$

34. $f(x) = x^5 - 3x^4 + x^3 + x^2 + 4$

$f(x) = (x+1)(x-2)(x-2)(x+i)(x-i)$

$x = -1, 2, 2, i, -i$

37. $f(x) = x^4 + 6x^3 + 18x^2 + 54x + 81$

$f(x) = (x+3)(x+3)(x+3i)(x-3i)$

$x = -3, -3, 3i, -3i$

35. $f(x) = x^3 + 4x^2 - 7x - 10$

$f(x) = (x+5)(x+1)(x-2)$

$x = -5, -1, 2$

38. $f(x) = 4x^2 + 25$ $= \sqrt{4x^2} - \sqrt{-25}$

$f(x) = (2x - 5i)(2x + 5i)$

$x = \frac{5i}{2}, -\frac{5i}{2}$

Chapter 3 Study Guide

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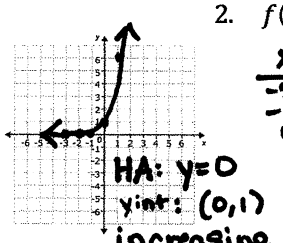
******THIS IS NOT HOMEWORK*******

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.

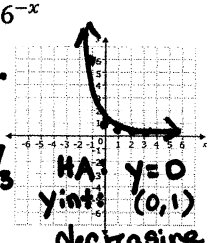
1. $f(x) = 6^x$

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



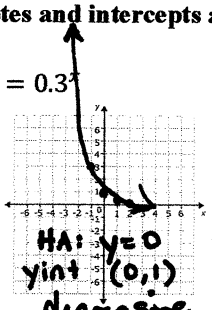
2. $f(x) = 6^{-x}$

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



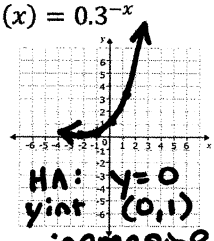
3. $f(x) = 0.3^x$

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



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

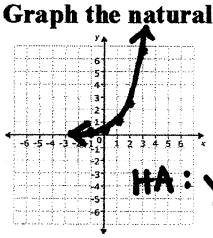
x	y
-2	.09
-1	.3
0	1
1	3.3



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

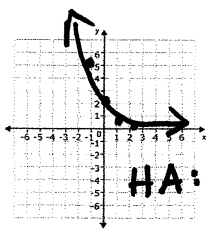
5. $f(x) = e^{x-1}$

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



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

x	y
-2	14.8
-1	5.4
0	2
1	1.7
2	2.3



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

$A = Pe^{rt}$

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

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

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

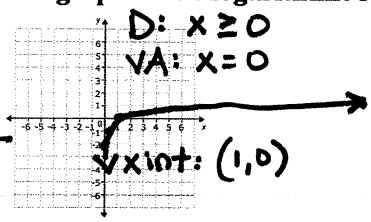
Lesson 3.2— Sketch the graph of the logarithmic Function. Find the domain, VA, and x-intercept

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

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

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

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

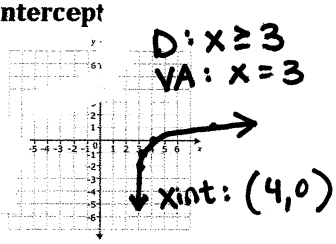


9. $f(x) = \log_5(x-3)$

$5^y = x - 3$

$5^y + 3 = x$

3.04	-2
3.2	-1
4	0
8	1



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

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

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

Lesson 3.3— Expand the following.

12. $\ln \frac{xy^5}{\sqrt{z}}$ $\ln(xy^5) - \ln\sqrt{z}$ $(\ln x + \ln y^5) - \ln z^{1/2}$ $(\ln x + 5\ln y) - \frac{1}{2}\ln z$

13. $\log_{10} \frac{5\sqrt{y}}{x^2}$ $\log(5\sqrt{y}) - \log x^2$ $(\log_{10} 5 + \frac{1}{2}\log_{10} y) - 2\log_{10} x$

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

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

Lesson 3.3— Condense the following.

16. $\log_2 9 + \log_2 x$ $\log_2 9x$

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

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

19. $3[\ln x - 2\ln(x^2+1)] + 2\ln 5$ $3\ln \frac{x}{(x^2+1)^2} + 2\ln 5$ $\ln\left(\frac{x}{(x^2+1)^2}\right)^3 + \ln 5^2 = \ln 5^2\left(\frac{x}{(x^2+1)^2}\right)^3$

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Lesson 3.4— Solve the following equations.

20. $2^{x+1} = \frac{1}{16}$ → $x+1 = \log_2 \frac{1}{16}$ → $x+1 = \frac{\log 1/16}{\log 2}$ → $x = -5$

21. $\log_8 x = 4$ → $x = 4096$

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

23. $3e^{-5x} = 132$ → $\frac{3e^{-5x}}{3} = \frac{132}{3}$ → $\ln e^{-5x} = \ln 44$ → $x = -.757$

24. $e^{2x} - 7e^x + 10 = 0$ → $(e^x - 5)(e^x - 2) = 0$ → $e^x - 5 = 0$ → $x = .693$; $e^x - 2 = 0$ → $x = 1.609$

25. $\log_4(x-1) = \log_4(x-2) - \log_4(x+2)$ → $x-1 = \frac{(x-2)}{(x+2)}$ → $(x-1)(x+2) = x-2$ → $x^2 + x - 2 = x - 2$ → $x^2 = 0$ → $x = 0$

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

27. $2e^{x-3} - 1 = 4$ → $e^{x-3} = \frac{5}{2}$ → $x = 3.916$

28. $\log_{10}(-x-4) = 2$ → $100 = -x - 4$ → $x = -104$

29. $\ln\sqrt{x+40} = 3$ → $e^{\ln\sqrt{x+40}} = e^3$ → $x + 40 = (e^3)^2$ → $x = 363.429$

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 $9222 = 6707.7e^{k(18)}$ → $k = .0177$

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

$y = 6707.7e^{.0177(30)}$ → $y = 11407.3$ 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. $x = 74$

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 $40 = \frac{62}{1+5.4e^{-.24t}}$ → $t = 9.5$

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

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

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