Algebra 2/Trigonometry Name: ANSWER KEY

UNIT 6: Exponential & Logarithmic Functions - REVIEW Date: _____

Section 1: Given each function, provide an example of a graph that will match each description (NC). Then, graph only the exponential equations (all f(x) equations).

1.) DESCRIPTION	$f(x) = 3^x$	$g(x) = \log(x)$
a) Horizontal shift LEFT 3 units	$f(x) = 3^{x+3}$	$g(x) = \log(x+3)$
b) Horizontal shift RIGHT 2 units	$f(x) = 3^{x-2}$	$g(x) = \log(x-2)$
c) Vertical shift UP 4 units	$f(x) = 3^x + 4$	$g(x) = \log(x) + 4$
d) Vertical shift DOWN 5 units	$f(x) = 3^x - 5$	$g(x) = \log(x) - 5$
e) Reflection over the x-axis	$f(x) = -3^x$	$g(x) = -\log(x)$
f) Reflection over the y-axis	$f(x) = 3^{-x}$	$g(x) = \log(-x)$

See last page for graphs of f(x)

SECTION 2: Rewrite each exponential equation in logarithmic form

2.) $5^x = 625$ $\log_5 625 = x$

3.) $10^x = 1000$ $\log_{10} 1000 = x$

4.) $e^3 = 20.085$ $\ln 20.085 = 3$

5.) $u^v = w$ $\log_u w = v$

SECTION 3: Rewrite each logarithmic equation in exponential form

6.) $\log_2 \frac{1}{8} = -3$ $2^{-3} = \frac{1}{8}$

7.) $\ln 143 = x$ $e^x = 143$

8.) $\log_4 64 = 3$ $4^3 = 64$

9.) $\log \frac{1}{100} = -2$ $10^{-2} = \frac{1}{100}$

SECTION 4: Evaluate

10.) $\log_4 4^2 =$ 2

11.) $\ln e^3 =$ 3

12.) $\log 10^2 =$ 2

13.) $2^{\log_2 5} =$ 5

14.) $e^{\ln 12} =$ 12

15.) $10^{\log 4} =$ 4

16.) $\log_3 8 = \frac{\log 8}{\log 3} = 1.893$

17.) $\log_5 12 = \frac{\log 12}{\log 5} = 1.544$

18.) $\log_2 7 = \frac{\log 7}{\log 2} = 2.807$

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SECTION 5: Expand each logarithmic expression. Your answer may not contain any expressions or radicals.

19.) $\log\left(\frac{x^3\sqrt{y+1}}{z^2}\right)$

$3\log x + \frac{1}{2}\log(y+1) - 2\log z$

20.) $\ln\left(\frac{yz\sqrt{x}}{w}\right)$

$\ln y + \ln z + \frac{1}{2}\ln x - \ln w$

SECTION 6: Condense each logarithmic expression

21.) $3\log x + 2\log y + \frac{1}{2}\log z$

$\log\left(x^3y^2\sqrt{z}\right)$

22.) $3\ln x + 2\ln 5 - \ln(x+2)$

$\ln\left(\frac{25x^3}{x+2}\right)$

SECTION 7: Solving Exponential Equations

23.) $3^{x-2} = 27$

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

24.) $e^{x+5} = e^7$

$x + 5 = 7$
$x = 2$

25.) $4^x = 42$

$\log_4 4^x = \log_4 42$
$x = \log_4 42$
$x = \frac{\log 42}{\log 4} = 2.696$

26.) $4(5^{x+2}) = 32$

$5^{x+2} = 8$
$\log_5 5^{x+2} = \log_5 8$
$x + 2 = \log_5 8$
$x = \log_5 8 - 2$
$x = \frac{\log 8}{\log 5} - 2 = -0.708$

27.) $e^x = 18$

$\ln e^x = \ln 18$
$x = \ln 18 = 2.89$

28.) $3e^x = 24$

$e^x = 8$
$\ln e^x = \ln 8$
$x = \ln 8 = 2.079$

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SECTION 8: Solving Logarithmic Equations

29.) $\log_4(x-1)=2$

$4^{\log_4(x-1)}=4^2$
$x-1=16$
$x=17$

30.) $\ln x=2$

$e^{\ln x}=e^2$
$x=e^2=7.389$

31.) $\log x=6$

$10^{\log x}=10^6$
$x=10^6$
$x=1{,}000{,}000$

32.) $\log_3(x+5)=5$

$3^{\log_3(x+5)}=3^5$
$x+5=3^5$
$x=3^5-5=238$

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

$\log_3 x(x-8)=2$

$3^{\log_3 x(x-8)}=3^2$

$x(x-8)=9$

$x^2-8x-9=0$

$(x-9)(x+1)=0$

$x=9$ (x = -1 is an extraneous solution)

34.) $\log_4 x-\log_4(x-1)=\frac{1}{2}$

$\log_4\left(\frac{x}{x-1}\right)=\frac{1}{2}$

$4^{\log_4\left(\frac{x}{x-1}\right)}=4^{\frac{1}{2}}$

$\left(\frac{x}{x-1}\right)=2$

$x=2(x-1)$

$x=2x-2$

$x=2$

35.) $\log_3(5x-1)=\log_3(x+7)$

$5x-1=x+7$

$4x=8$

$x=2$

36.) $\log_6(3x+14)-\log_6 5=\log_6 2x$

$\log_6\left(\frac{3x+14}{5}\right)=\log_6 2x$

$\left(\frac{3x+14}{5}\right)=2x$

$3x+14=10x$

$7x=14$

$x=2$

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SECTION 9: Application Problems

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

Continuous Compound Interest: $\boldsymbol{A = Pe^{rt}}$

37.) Emily plans to put her graduation money into an account and leave it there for 4 years while she goes to college. She receives $1,050 in graduation money to college that she puts into an account that earns 4.25%. How much money will be in Emily's account at the end of four years if it is compounded?

a.) Quarterly? $A = 1050\left(1 + \frac{0.0425}{4}\right)^{4*4} = \$1{,}243.45$

b.) Monthly? $A = 1050\left(1 + \frac{0.0425}{12}\right)^{12*4} = \$1{,}244.20$

c.) Continuously? $A = 1050e^{0.0425*4} = \$1{,}244.57$

38.) The number of people infected by the flu in a particular region after t hours is given by: $P(t) = 5e^{0.03t}$ where $t \geq 0$.

a.) Is this a growth or decay problem? *Growth problem*

b.) What is the initial population of people infected by the flu? 5 *people*

c.) What is the population of people infected by the flu after 12 hours? 7.17 *people*

d.) What is the population of people infected by the flu after 1 day? 10.27 *people*

39.) The population of mosquitoes after t days is given by: $P(t) = 500e^{-0.055t}$ where $t \geq 0$.

a.) Is this a growth or decay problem? *Decay problem*

b.) What is the initial population of mosquitoes? 500 *mosquitoes*

c.) What is the population of mosquitoes after 1 day? 473.24 *mosquitoes*

d.) What is the population of mosquitoes after 72 hours? 423.95 *mosquitoes*