Math 141 **version A** Name: _____
6/9/2011

Test 3
100 points

Directions: In order to ensure full credit, you must show your work or indicate how you got your answer. You may use your graphing calculator on the test, but NO homework, notes, books, or resources. Equations need to be solved exactly and leave answers in exact form (e.g. in terms of log or square roots) where appropriate.

Raise your hand if you have a question. Points for each problem given in [ ].

You can use as scratch paper if you wish.

You may want to use the following equations on the test:

$$A = P\left(1+\frac{r}{n}\right)^{nt} \qquad A = Pe^{rt} \qquad n = n_0 e^{rt} \qquad T(t) = T_s + D_0 e^{-kt} \qquad P(t) = \frac{c}{1+ae^{-bt}}$$

$$M = \log\left(\frac{I}{S}\right) \qquad pH = -\log\left[H^+\right] \qquad dB = 10\log\left(\frac{I}{I_0}\right)$$

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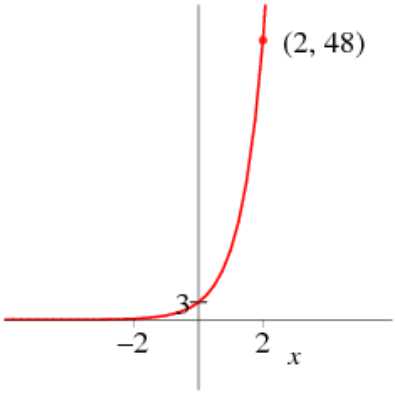
1. [5 pts] Find a function of the form $f(x) = Ca^x$ whose graph is given. Then answer the questions below.



Function: _____

Domain: _____

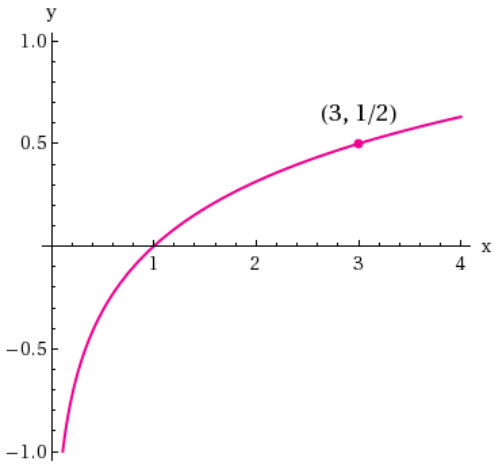
Range: _____

x-intercept: _____

y-intercept: _____

asymptote: _____

2. [5 pts] Find a function of the form $f(x) = \log_a x$ whose graph is given. Then answer the questions below.



Function: _____

Domain: _____

Range: _____

x-intercept: _____

y-intercept: _____

asymptote: _____

3. [3 pts] Express $\log_8 x = y$ in exponential form.

4. [3 pts] Express $4^{3/2} = y$ in logarithmic form.

5. [3 pts each] Use log properties to evaluate:

a) $\log_a \frac{1}{a^2}$ b) $a^{\log_a \sqrt{5}}$ c) $\log_2 32$

Answer: _____ Answer: _____ Answer: _____

6. [5 pts] Find the domain of $f(x)=\log_3\left(x^2-4\right)$. Show work and use proper notation.

7. [5 pts] Express $\frac{1}{2}\log_b x+4\log_b y-3\log_b z$ as a single logarithm.

8. [5 pts] Express $\ln\left(\frac{x^3}{x^4-2}\right)$ as a sum and/or difference of logarithms with powers as factors if possible.

9. [4 pts] In 1971, Los Angeles had an earthquake that measured 6.7 on the Richer scale. What was the intensity of the earthquake in Los Angeles?

10. [3 pts] The intensity of a car alarm 6.2×10^{-9} W/m^2. How loud in decibels is this sound level?

11. **Solve** for *x* **algebraically** and leave answers in **EXACT** form (no decimals). Show work. [5 pts each]

a) $2^{x-1} = 4^x$

b) $3\left(10^{x-1}\right) = 12$

c) $\log_4(x+3) + \log_4(x-3) = 2$

d) $2\ln x = 7$

e) $e^{2x} - 3e^x + 2 = 0$

12. [7 pts] The population in California in 1940 was 6.9 million people. In 1950 the population in California was 10.6 million people. If the population grows at a constant exponential rate, how many people will live in California in 2020? (Must give and use formula; give exact answer and then rounded decimal answer).

13. [7 pts]Radioactive radium has a half-life of 1620 years. If you start with 25 grams of radium, how long will it take until you only have 5 grams left? Show all steps, including the equation used.

14. [7 pts] A culture contains 1300 bacteria initially and doubles every 30 minutes.
    a. Find a function that models the number of bacteria $n(t)$ after t minutes.

    b. After how many minutes will the culture contain 5000 bacteria? (Give exact answer and then answer rounded to 2 decimal places)

15. [7 pts] A hot bowl of soup is served at a dinner party. It starts to cool according to Newton's Law of Cooling so that its temperature at time t is given by

$$T(t) = 70 + 150e^{-0.05t}$$

where t is measured in minutes and T is measured in °F.

(a) What is the initial temperature of the soup?

(b) After how long will the temperature be 100°F? Round your final answer to 2 decimal places.