

Name \_\_\_\_\_

Block (please circle) D G

November 29, 2001

Honors Pre-Calculus Test

Chapter 3

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Part A (30%) _____
Part B (45%) _____
Part C (25%) _____
overall _____

Write complete, fully explained solutions, except where directions say otherwise. If you use your graphing calculator for a significant step, tell what you did on the calculator.

## Part A. Properties of logarithmic functions

For problem 1, you may assume all of the properties of exponents and logarithms, except for the log-of-a-power property.

1. Prove that  $n \ln a = \ln(a^n)$ .

For problem 2, you may assume all of the properties of exponents and logarithms, except for the change-of-base formula.

2. Prove that  $\log_b x = \frac{\ln x}{\ln b}$ .

3. a. If the [LN] key on your graphing calculator were broken, explain how you could get a value for  $\ln 7$  using the [LOG] key instead.

b. If both the [LN] and [LOG] keys on your graphing calculator were broken, explain how you could still get a value for  $\ln 7$ .



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3. A population is modeled using a logistic function that satisfies these conditions:

- initial population = 1000
- population after 5 years = 1300
- maximum sustainable population = 2000

a. Sketch a graph of this logistic function.

b. Determine a formula for this logistic function.

c. Using this logistic model, predict the population after 10 years.

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## Part C. Exponential functions and equations

1. Identify, in the correct order, the two transformations needed to transform the graph of  $f(x) = b^x$  into the graph of  $g(x) = b^{2x+3}$ .
- first transformation: \_\_\_\_\_  
\_\_\_\_\_
- second transformation: \_\_\_\_\_  
\_\_\_\_\_

Problem 1 counts for 5% of the test; problems 2 and 3 count 10% each.
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2. Show how to solve the equation  $2^{3x} = e$  algebraically.

3. Re-express the function  $f(x) = 100 \cdot 4^x$  in the form  $f(x) = a \cdot e^{kx}$ .