

Student Name: \_\_\_\_\_

Show all relevant work (use back of pages for scratch paper, if needed). **CIRCLE FINAL ANSWERS.**

1. [7 pts each] Evaluate each expression (do not use a calculator or decimal places):

a)  $\log_6 18 + \log_6 12$

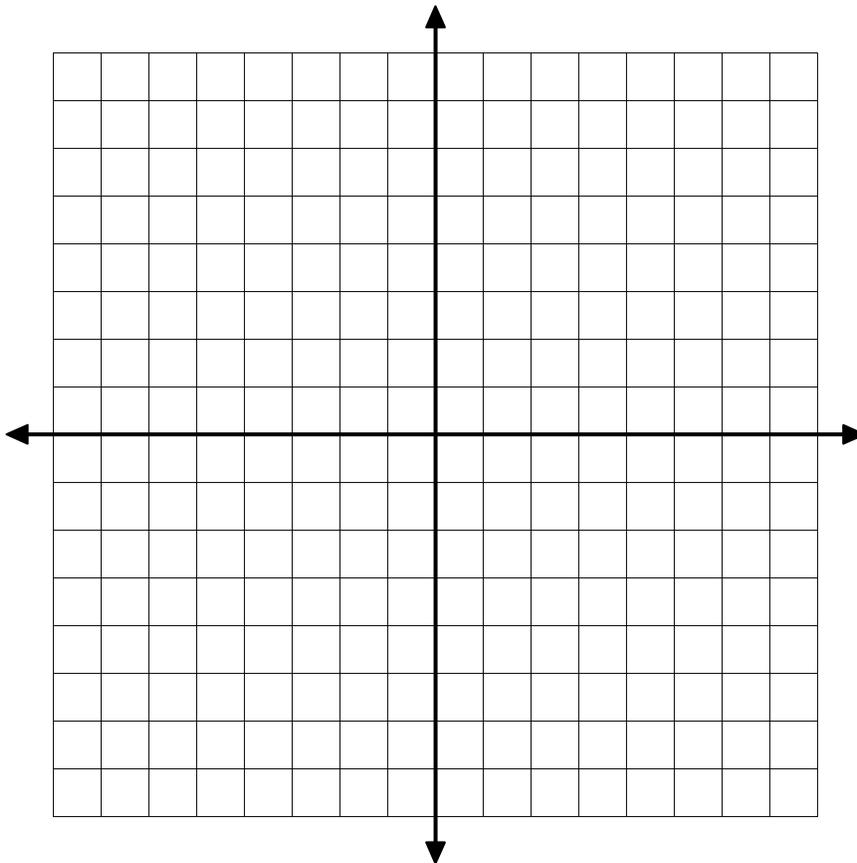
b)  $\log_7 30 - \log_7 14 - \log_7 105$

2. [7 pts] Use a calculator to evaluate  $\log_{13} 1278$  rounded to four decimal places:

3. [7 pts] Imagine a science fiction scenario in which an outbreak of zombies occurs. Experts from the Center for Disease Control establish the following growth model to predict the population of zombies where  $t$  is the number of days since the beginning of outbreak:  $z(t) = \frac{8900}{0.01 + 12.7 e^{-0.059t}}$ . How many zombies would one expect there to be after 30 days?

4. [7 pts] Combine  $\ln 2 + \ln(x+1) - 4 \ln(3x+7)$  into a single logarithm and simplify, if possible:

5. [7 pts] On the grid provided, sketch and label the graph of  $h(x) = 4 - \left(\frac{1}{2}\right)^{x+2}$



6. [7 pts each] A sum of \$1000 is invested at an interest rate of 8% per year. Find the time (in years, to two decimal places) required for the money to triple if the interest is compounded:

a) quarterly (that is, four times per year).

b) continuously

7. [14 pts] The initial population of a colony of rabbits is 106, and it is known to double every 47 days.

a) Write a function that models the population of this specific colony of rabbits after  $t$  days.

b) How many rabbits would you expect to be in the colony after 230 days?

c) Calculate the relative growth rate,  $r$ , of the colony.

8. [7 pts] A wooden artifact discovered at a burial ground contains 82% of the carbon-14 that is present in living trees. How long ago was the artifact made? (The half-life of carbon-14 is 5730 years).

9. [7 pts each] Find the solution to each equation; you may leave the answer in exact form, or rounded to three decimal places:

a)  $3^{x+2}=17$

b)  $2 \log_5(3x-4)=6$

c)  $\log_3(x+15) - \log_3(x-1) = 2$

d)  $e^{2x} - 9e^x + 20 = 0$