

1. (8pts) Evaluate without using the calculator:

$$\log_8 64 = \quad \log_3 \frac{1}{9} = \quad \ln \sqrt[3]{e} = \quad \log_4 32 =$$

2. (4pts) Use your calculator to find $\log_{13} 0.13$ with accuracy 4 decimal places. Show how you obtained your number.

3. (12pts) Write as a sum and/or difference of logarithms. Express powers as factors. Simplify if possible.

$$\log_7 \left(\frac{49y^3}{\sqrt[8]{x^3}} \right) =$$

$$\log_9((x^2 - 6x + 9)(x^2 + 10x + 25)) =$$

4. (12pts) Write as a single logarithm. Simplify if possible.

$$3 \log(6x^2) + 2 \log(3x^4) =$$

$$\log_2(x + 3) + \log_2(x - 7) - 2 \log_2(x^2 - 4x - 21) =$$

5. (7pts) In November 1755, Lisbon (Portugal) was destroyed by an earthquake which released 8×10^{17} joules of energy. Find the magnitude of this earthquake using the Richter scale. (Recall that magnitude is given by $M = \frac{2}{3} \log \left(\frac{E}{E_0} \right)$, where $E_0 = 10^{4.4}$, the energy released by a reference earthquake.)

6. (7pts) How much should you invest in an account bearing 5.25%, compounded monthly, if you wish to have \$1,500 in four years?

7. (8pts) Draw the general shape of the graph for these functions. Indicate the x - and y -intercepts. What are the horizontal or vertical asymptotes of the graphs?

$$f(x) = b^x, b > 1$$

$$f(x) = \log_b x, b > 1.$$

Solve the equations.

8. (10pts) $2^{x^2+3x-8} = 16^{x+3}$

9. (12pts) $\log_2(x - 1) - \log_2(x - 3) = 3$

10. (10pts) $4^{x+2} = 5^{x+3}$

11. (10pts) Suppose you invest \$2,000 at a 3% interest rate, compounded continuously. How long will it take until your investment has value \$4,000? (Recall that $A = Pe^{rt}$.)

Bonus (10pts) The population of the Mushroomton is given by the formula $N(t) = 103e^{rt}$ (in thousands), where t is the number of years since 2003, and r is the growth rate.

a) If the population was 143,270 in 2006, find the growth rate r .

b) If the city continues to grow at the same rate, what will be its population in 2011?