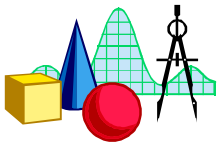
MATH DEPT.
TUTORIAL 10



Tutorial 10: **Logarithms: graph of log function, change of base, solution of equations.**

1. Evaluate each of the following without the use of a calculator

   (i) $\log_2 16$ (iii) $\log_7 1$ (v) $\log_{27} 9$

   (ii) $\text{Log}_5 \frac{1}{25}$ (iv) $\log_{10} 0.01$ (vi) $\log_2 \frac{1}{8}$

2. Write the given expression in logarithmic form

   (i) $5^3 = 125$ (iii) $9^{3/2} = 27$

   (ii) $81^{1/4} = 3$ (iv) $10^{-3} = 0.001$

3. Rewrite each of the following as the logarithm of a single expression

   (i) $\log_4 z - \log_4 4$ (iii) $4 \ln z + 4 \ln(z+5) - 2 \ln(z-5)$

   (ii) $2\ln 8 + 5 \ln z$ (iv) $\ln(x-2) - \ln(x+2)$

4. Given that $\log_{10} 2 = 0.30$, $\log_{10} 3 = 0.48$ and $\log_{10} 5 = 0.70$ find

   (i) $\log_{10} 6$ (iii) $\log_{10} (0.6)$ (v) $\log_{10} \frac{1}{27}$

   (ii) $\log_{10} 30$ (iv) $\log_{10} 8$

5. Use your calculator to find

   (i) $\log_4 12$ (ii) $\log_6 317$ (iii) $\log_2 19$

6. Solve each of the following without the use of a calculator

   (i) $\log_4 x = 3$ (iv) $\ln(x+3) - \ln(x-1) = \ln x$

   (ii) $\log_5 5x = 2$ (v) $\log_4 x - \log_4(x-1) = 1/2$

   (iii) $\log_2 (x+8) - \log_2(x^2 +1) = 1$

7. Solve each of the following with the aid of a calculator (if necessary). Round to three decimal places.

   (i) $e^x = 10$ (iii) $3^{2x} = 80$

   (ii) $4\, e^{2x} = 60$ (iv) $4^{3x-5} = 2^{2x}$

8. Sketch the graph of each of the following.

   (i) $f(x) = \log_4 x$ (iii) $h(x) = -\log_4 x$

   (ii) $g(x) = \log_4 (x-3)$ (iv) $t(x) = -\log_4 (x+2)$

9. Sketch the graph of f(x) and g(x) on the same coordinate plane.

   (i) $f(x) = 3^x$, $g(x) = \log_3 x$ (ii) $f(x) = 10^x$, $g(x) = \log_{10} x$

10. The population of a city is given by $P = 105{,}300\, e^{0.015t}$ where t is the time in years, with t = 0 corresponding to 1990. According to this model, in what year will the city have a population of 150,000 ?

11. The number of bacteria N in a culture is given by the model $N = 250\, (2^{kt})$ where t is the time in hours, with t = 0 corresponding to the initial population of 250 and N = 330 to the time t = 10. How long will it take for the population to double in size ?