Name:_____ Date:_____

Math Club: Understanding Logarithms

1. Convert each of the following to logarithmic form

$a^b = c$	$2^3 = 8$	$a \times b^c = d$
$a^b \times a^c = d$	$16 \times 4^x = 32$	$25^{0.5} = 5$

2. Evaluate each of the following without a calculator:

$\log_2 32$	$\log_4 256$	$\log_5 \left(25^{2/3}\right)$
$\log_{n-1}(n-1)$	$\log_{2401} 343$	$\log_{3!} 216$

3. Solve for "x" for each of the following:

$12,000 = 10^x$	$50 \times (1.06)^x = 65$	$\log_9 x = -2$
$100 = 30(1+0.5)^x$	$75 = 10(1+0.6)^{2x}$	$-10 = 4(2)^x$
$\log_3(\log_8 x) = 2$	$3^x - 3^{x-2} = 24\sqrt{3}$	$\log_{x-2}\left(x^3 - 6x^2 + 12x - 8\right) = x$

4. Solve for "x" in terms of "y" $y = 3\left(10^{5x}\right)$

5. Solve (x,y) given the following equations: $\frac{4^x}{2^y} = 8$ and $\frac{3^{x+y}}{9^{2x}} = 81$

6. Which is larger? 2^{24} *or* 3^{16}? [Try to prove this by using logs]

7. Arrange the following numbers from least to greatest:
   $\log_2 8, \quad \log_6 16, \quad \log_{10} 21, \quad \log_{14} 45, \quad \log_{18} 100$

8. Suppose a bank pays 6% interest per year, compounded quarterly, meaning that it pays 1.5% interest every three months. How much money must be deposited so that at the end of the five years, there is exactly $1,000 in the account? Give your answer rounded to the nearest cent.

9. A train travels 2cm in the first second and increases its speed by 25% until it reaches a speed of 80km/hr. During which second of the trip will it reach a speed of 80km/hr?

10. Sharon starts a savings account with a deposit of $200. The bank pays 3.5% interest per year, compounded annually. If she leaves the money in the bank and makes no other deposits what amount will be in the account after ten years? Assume that the interest rate remains constant throughout the period.

11. Bacteria grows by division and it is possible for this to occur every 20min. One divides to two in 20min, and then to four in another 20miinutes. Suppose there is one bacterium in a culture at 9am and is full at 6pm.
    a. When was the culture half full?

    b. What percent of the culture was covered at 4pm?

12. A ball is dropped from a height of 2meters. After each bounce, the ball rises to 63% of its previous height.
    a. What is the height after 15bounces?

    b. After how many bounces will the ball rise less than 0.05cm?

13. Mark invests $200 at 6% compounded annually. Determine how much money Mary will have after 15 years?

14. Over the past few years college tuition has increased 10% each year. How many years will it take to double?

15. The value of a car depreciates by 10% per year. How much would a $65000 car cost after 12years?

16. Given $\log_9 20 = a$ and $\log_3 n = 4a$. Find the value of "n"

17. Given that $f(x) = a\log_b x$ and $f(16) = 14$ and $f(0.25) = -7$. Furthermore, "a" and "b" are positive integers with $2 \le b \le 72$. List all possible pairs (a,b).

18. A circle has a radius of $\log_{10}\left(a^2\right)$ and a circumference of $\log_{10}\left(b^4\right)$. What is $\log_a b$? AMC 200812B

19. What is the domain for the following? $y = \log_{2004}\left(\log_{2003}\left(\log_{2002}\left(\log_{2001} x\right)\right)\right)$ AMC 2004 12A

20. Square ABCD has area 36, and $\overline{AB}$ is parallel to the x-axis. Vertices "A", "B", and "C" are on the graphs of $y = \log_a x$, $y = 2\log_a x$, and $y = 3\log_a x$ respectively. What is the value of "a"? AMC 2007A