Name: _Key_

Hours:_____

Logarithms Demystified

1. Use your calculator to find the logarithms in the table to the nearest hundredth (try graphing $f(x) = \log(x)$ and looking at the table).

n	1	2	3	4	5	6	7	8	9
$\log n$	0	.301	.477	.602	.699	.778	.845	.903	.954

n	10	20	30	40	50	60	70	80	90
$\log n$	1	1.301	1.4771	1.602	1.699	1.778	1.845	1.903	1.954

n	100	200	300	400	500	600	700	800	900
$\log n$	2	2.301	2.477	2.602	2.699	2.778	2.845	2.903	2.954

2. What patterns do you notice going across each row?

They're growing more slowly as n increases

3. What patterns do you notice going down each column?

As n grows by a power of 10, $\log_n$ increases by 1.

4. Use the tables you created to complete the following problems adding logs.

$\log 2 + \log 3 = \log 6$	$\log 3 + \log 20 = \log 60$
$\log 5 + \log 8 = \log 40$	$\log 30 + \log 10 = \log 300$
$\log 8 + \log 10 = \log 80$	$\log 50 + \log 60 = \log 3000$

5. What patterns do you notice? Write a rule for the addition of logarithms with the same base.

$$\log a + \log c = \log a \cdot c$$

6. Use your tables to complete the following problems for subtracting logs.

$\log 10 - \log 5 = \log 2$	$\log 9 - \log 3 = \log 3$
$\log 200 - \log 20 = \log \frac{200}{20} = \log 10$	$\log 30 - \log 10 = \log 3$
$\log 90 - \log 3 = \log \frac{90}{3} = \log 30$	$\log 20 - \log 4 = \log 5$

7. What patterns do you notice? Write a rule for the subtraction of logarithms with the same base.

$$\log a - \log c = \log \frac{a}{c}$$

8. Using the previous tables, complete the following problems involving multiplication.

$\log 3 + \log 3 + \log 3 = \log 3^3 = \log 27$	$3 \times \log 3 = \log 3^3$
$\log 2 + \log 2 + \log 2 + \log 2 = \log 2^4$	$4 \times \log 2 = \log 2^4$
$\log 5 + \log 5 = \log 5^2$	$2 \times \log 5 = \log 5^2$
$6 \times \log 7 = \log 7^6$	$5 \times \log 4 = \log 4^5$

9. What patterns do you notice? What rule can you write involving the properties from the table in question 8?

$$k \log a = \log a^k$$

10. Summarize. All of these logarithms had the same base (10). Write the three rules you discovered here for logarithms with the same base.