Math 2
Module 3, Day 1

Name: _____
Date: _____ Period: ____

Multipliers and Exponents

Show all work and reasoning. Use a pencil and highlight your answers.

Recall from Math 1 that a *multiplier* is the *change factor* in *exponential functions*. You can take any value and multiply by the change factor to get the value of the next term. You always start with 100% because we begin with 100% of the original value. If the function is decreasing, then subtract the percent decrease from 100% to get a multiplier that will show the remaining value each time. If the function is increasing, then add the percent to 100% to get the original value along with the percent increase. Use a decimal rather than a percent as the multiplier.

EXAMPLES:

a) Leila has \$1000 saved on the 1st month of the year, and she spends 9% each month thereafter

100%
- 9%
91%

Multiplier = 0.91

Function: $S(t) = 1000(0.91)^{t-1}$

Month	Total \$
1	1000
2	910
3	828.10

b) Connor borrowed \$1500 with a 4.3% annual interest on the loan

100.0%
+ 4.3%
104.3%

Multiplier = 1.043

Function: $L(t) = 1500(1.043)^{t}$

Year	Total \$
0	1500
1	1564.50
2	1631.77

c) There were 600 crimes in Oceanside, but the number of crimes lowers by 3.9% per year

100.0%
- 3.9%
96.1%

Multiplier = 0.961

Function: $C(t) = 600(0.961)^{t}$

Year	Crimes
0	600
1	577
2	554

1. Write the multiplier for each scenario. Show work!

a) 6.3% jump in approval for the president

b) 45% off sale at Sears

c) 12.4% drop in cases of flu

d) 9.25% sales tax in Los Angeles

e) 200% increase in tardies

2. Write explicit and recursive functions for each scenario, and make a table showing the first 4 values of the scenario.

a) There were 23 bacteria on the 1st hour with a 13.5% increase in population each hour thereafter

c) A company has a profit of \$2 million this year, and the profit grows by 47% each year.

d) A \$90 shirt at Nordstrom's goes on sale next week with 25% reduction in price and every week thereafter

Refer to the rules of exponents below. Assume bases in the denominator are not equal to 0.

Rule #1: $a^m \bullet a^n = a^{m+n}$ Rule #2: $\left(a^m\right)^n = a^{mn}$ Rule #3: $(ab)^n = a^n \bullet b^n$

Rule #4: $\left(a^m b^n\right)^p = a^{mp} \bullet b^{np}$ Rule #5: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

3. Simplify each expression. Assume that any variables in the denominator are not equal to 0.

$a^3 \bullet a^5$	$\left(b^2\right)\left(b^4\right)$	$x^{-6} \bullet x^{10}$	$\left(3^{-2}\right)\left(3^{11}\right)$
$2^4 \bullet 2^8 \bullet 2^3$	$(y)\left(y^7\right)\left(y^{10}\right)$	$\left(2x^3\right)\left(-3x^4\right)$	$\left(c^5 d^2\right)\left(c^9 d^4\right)$
$\left(5^2\right)^3$	$\left(7^8\right)^4$	$\left(x^5\right)^9$	$\left(h^{11}\right)^2$
$\left(x^4 y^3\right)^2$	$\left(s^6 t^5\right)^4$	$\left(3x^8\right)^5$	$\left(5mp^7\right)^3$
$\left(\frac{x}{y}\right)^4$	$\left(\frac{q^9}{r^4}\right)^3$	$\left(\frac{5}{4}\right)^6$	$\left(\frac{2x^3}{3y^4}\right)^5$

Refer to the rules of exponents below. Assume that variables are not equal to 0

Rule #6: $\frac{a^m}{a^n} = a^{m-n}$ Rule #7: $a^{-n} = \frac{1}{a^n}$ or $\frac{1}{a^{-n}} = a^n$ Rule #8: $x^0 = 1$

4. Simplify each expression. Assume that variables are not equal to 0. Make sure your answers do not have any negative exponents remaining.

$\frac{x^{10}}{x^4}$	$\frac{b^{700}}{b^{200}}$	$\frac{6^5}{6^3}$	$\frac{(-3)^7}{(-3)^6}$
$\frac{a^3 b^8}{ab^2}$	$\frac{p^{15} q^{20}}{p^{14} q^{16}}$	$\frac{2^7 \bullet x^{12}}{2^2 \bullet x^3}$	$\frac{5^{20} \bullet 11^{17}}{5^2 \bullet 11^{10}}$
5^{-2}	m^{-6}	$\frac{1}{x^{-3}}$	$\frac{1}{13^{-5}}$
$8c^0$	$\frac{2^5}{2^5}$	$6a^{-4}$	$\frac{-3}{y^{-2}}$