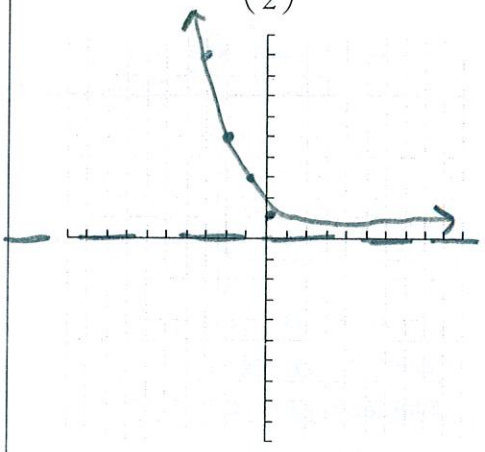
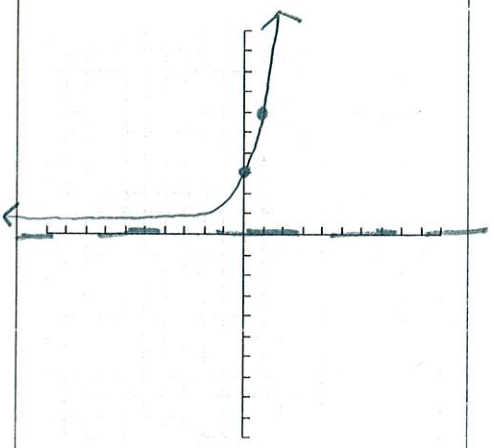
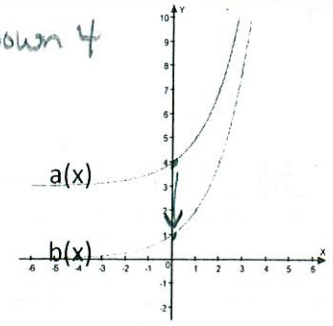
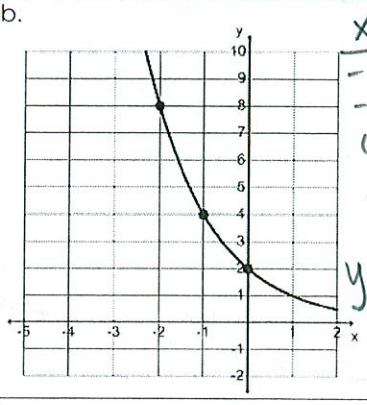
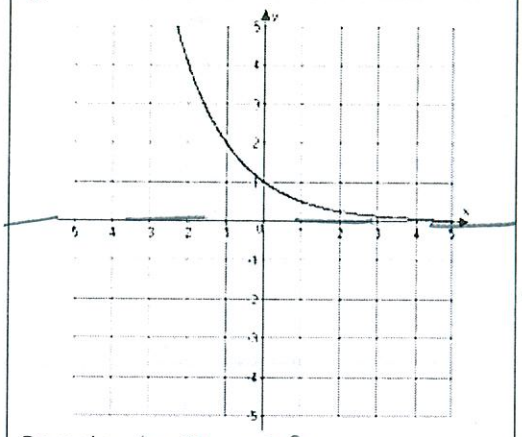
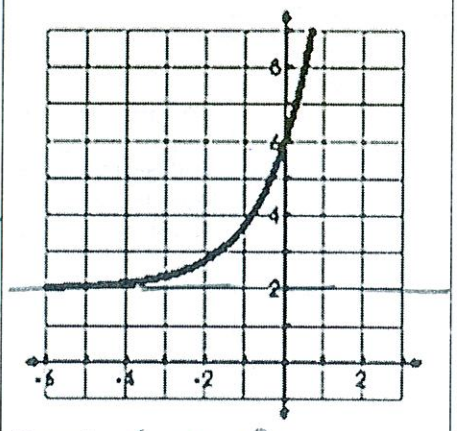
Algebra 1
Review Boxes

Name: KEY
Date: _____ Period _____

Unit 4 Exponential Functions Review

Skill	Things to remember	Examples	
1. Determine if representations are exponential. Explain why or why not	Exponential Functions: -Variable in exponent -Constant Ratios -Graph is a curve Linear Functions: -Constant differences -Graph is a line	a. Determine if the points are exponential or linear: a. x: -3, -2, -1, 0, 1 y: 0.16, 0.8, 4, 20, 100 — Exp ×5 ×5 b. (-2, 5) (-1, 4) (0, 3) (1, 2) (2, 1) Linear -1 -1	b. Determine if the equations are linear or exponential: a. $y = 3^x - 4$ Exp b. $y = 2^2$ Linear c. $y = 6^{2x}$ Exp
2. Determine if a function is exponential growth or decay and explain why.	0 < b < 1: Decay b > 1: Growth	a. $y = .75\left(\frac{3}{2}\right)^x$ Growth $\frac{3}{2} = 1.5$ greater than 1	b. $y = \left(\frac{1}{2}\right)^x$ Decay $\frac{1}{2}$ is less than 1
		c. What is the function growing by? $Y = 3(2)^x$ 2	d. What is constant ratio? $Y = 3(4.5)^x$ 4.5
3. Graph an exponential function.	$y = ab^x$ Create a table with values for x of -2, -1, 0, 1, and 2 (you may have to include other x-values if needed)	a. Graph: $f(x) = \left(\frac{1}{2}\right)^x$ 	b. Graph: $f(x) = 3 \cdot 2^x$ 
4. Describe the transformations of an exponential function.	$f(x) = a(b)^{x-h} + k$ **a** stretches or shrinks AND reflects **k** moves the function up and down. **h** moves the function left and right. The new asymptote is the line y = k.	a. Given the function $f(x) = 2^x$ write a new equation after a transformation of left 7 and up 3. $f(x) = 2^{x+7} + 3$	b. Given the function $g(x) = 2^x$, write a new equation after a transformation of right 9 and reflect across the x-axis. $f(x) = -2^{x-9}$
		c. Describe the transformation $h(x) = 10^x$ to $k(x) = 4(10)^{x+1} - 5$. Stretch 4 Left 1 Down 5	d. Describe the transformation from a(x) to b(x).

			Down 4 
5. Create equations from a graph or table	y = y-int(constant ratio)^x	a. $y = a(b)^x$ ↑ y-int ↑ rate $y = \frac{1}{16}(4)^x$	b.  $y = 2(\frac{1}{2})^x$
6. Determine characteristics of exponential functions.	$(-1,4)$ $(0,6)$ $\frac{6-4}{0+1} = \frac{2}{1}$ $(-2,4)$ $(0,1)$ $\frac{1-4}{0+2} = \frac{-3}{2}$	a.  Domain: $(-\infty, \infty)$ Range: $(0, \infty)$ x-Intercept: None y-intercept: $(0,1)$ Interval of Increase: Interval of Decrease: $(-\infty, \infty)$ Asymptote: $y = 0$ End Behavior: as $x \to -\infty$, $f(x) \to \infty$ as $x \to \infty$, $f(x) \to 0$ ROC from -2 to 0: $-3/2$	b.  Domain: $(-\infty, \infty)$ Range: $(2, \infty)$ x-Intercept: None y-intercept: $(0,6)$ Interval of Increase: $(-\infty, \infty)$ Interval of Decrease: Asymptote: $y = 2$ End Behavior: as $x \to -\infty$, $f(x) \to 2$ as $x \to \infty$, $f(x) \to \infty$ ROC from -1 to 0: 2
7. Determine the y-intercept and asymptote from an equation	You can always substitute 0 in for x to find a y-intercept Asymptote: y = k No 'k' value, the asymptote is y = 0.	a. Determine the y-intercept and asymptote of the function $y = 3(2)^x$. $y: (0,3)$ Asy: $y = 0$	b. Determine the y-intercept and asymptote of the function $y = 4(\frac{1}{2})^x - 2$. $y: (0,2)$ Asy: $y = -2$

8. Determine the growth/decay factor and percent.	(1 + r) and (1 − r) represent the growth and decay factors	a. $y = 3(1.25)^x$ Determine if the function is growth or decay: Factor: 1.25 Percent: .25 or 25%	b. $y = 2(.84)^x$ Determine if the function is growth or decay: Factor: .84 Percent: .16 or 16%
9. Applications of exponential functions.	Growth and decay $y = a(1+r)^t$ $y = a(1-r)^t$ Compound interest: $A = P\left(1+\frac{r}{n}\right)^{nt}$	a. Luke Duke deposits $2000 into a bank account that pays 5% interest compounded monthly. Find the balance in the account after 4 years. Model: $y = 2000(1+\frac{.05}{12})^{12 \cdot 4}$ Solution: $2,441.79	b. The value of the Barbie Dream House is $125,000. This house is in a prime location and appreciates (increases in value) at a rate of 7% per year. How much will the Barbie Dream House be worth in 5 years? Model: $y = 125000(1+.07)^5$ Solution: $175,318.97
		c. A certain radioactive element decays at a rate of 21% per month. If the starting amount was 32 ounces, how much will be left after **1 year**? Model: $y = 32(1-.21)^t$ $t = 12$ months Solution: 1.89 oz $\approx$ 2 oz	d. Michael is offered two jobs – Job A, which offers him a starting salary of $20,000 a year with a 5% raise each year he works there and Job B, which offers him a starting salary of $25,000, but only a 3% raise each year. Michael plans to work to work at the job for 7 years. Which job should he pick and why? SKIP
10. Geometric sequences	Explicit formula $a_n = a_1 r^{n-1}$ $a_n = r(a_{n-1})$	a. Given 3, 6, 12, . . .,find: Explicit formula: $a_n = 3(2)^{n-1}$ 9th term: 768 Recursive formula: $a_1 = 3$ $a_n = 2 \cdot a_{n-1}$	b. Day 1, Mrs. Haggard found 2 pencils on the ground. Day 2, her collection had grown to 6 pencils. By day 3, she has 18 pencils. Explicit formula: $a_n = 2(3)^{n-1}$ How many pencils did she have on day 7? 1458 pencils Recursive formula: $a_1 = 2$ $a_n = 3 \cdot a_{n-1}$
			Day | pencils 1 | 2 2 | 6 3 | 18 ⋮ | ⋮

11. Exponent rules

$(x^a)(x^b) = x^{a+b}$

$(x^a)^b = x^{ab}$

$\frac{x^a}{x^b} = x^{a-b}$

$x^0 = 1 \qquad x^{-a} = \frac{1}{x^a}$

a. $(-3xy^3)(2x^2y^4)^2$

$-3xy^3 \cdot 2^2 x^4 y^8$

$\boxed{-12x^5y^{11}}$

c. $\frac{-10x^{-2}y^{-5}z^2}{5x^{-6}y^7z^{-6}}$

$\frac{-10x^6z^2z^6}{5x^2y^7y^5} = \boxed{\frac{-2x^4z^8}{y^{12}}}$

f. $\left(\frac{(-2x^{-3}y^{-4})^2(3x^4y^{-5})^{-3}}{(xy)^3(4x^{-1}y^2)}\right)^{-2}$

$\left[\frac{-2^2x^{-6}y^{-8} \cdot 3^{-3}x^{-12}y^{15}}{x^3y^3 \cdot 4x^{-1}y^2}\right]^{-2}$

$\left[\frac{-2^2x^{-18}y^7 \cdot 3^{-3}}{4x^2y^5}\right]^{-2}$

$\frac{-2^{-4}x^{36}y^{-14} \cdot 3^6}{4^{-2}x^{-4}y^{-10}}$

$\frac{3^6x^{36} \cdot 4^2x^4y^{10}}{-2^4 \cdot y^{14}}$

$\frac{729x^{40}y^{10} \cdot 16}{-16y^{14}}$

$\boxed{-\frac{729x^{40}}{y^4}}$

d. $\frac{4x^3y^5}{(2x^6y^2)^3}$

$\frac{4x^3y^5}{2^3x^{18}y^6} = \frac{4}{8x^{15}y} = \boxed{\frac{1}{2x^{15}y}}$

e. $\frac{(3x^{-1}y^3z^0)^2}{(2x^3y^{-4}z)^{-2}}$

$\frac{3^2x^{-2}y^6z^0}{2^{-2}x^{-6}y^8z^{-2}}$

$\frac{3^2 2^2 x^6 y^6 z^0 z^2}{x^2y^8}$

$\boxed{\frac{36x^4z^2}{y^2}}$