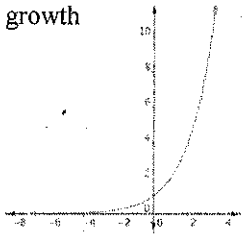
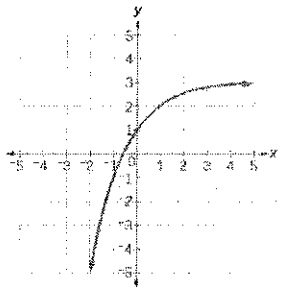
Algebra 1
Unit 4 Review Guide

Name: Key
Date:

Exponential Functions Unit 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. Tell if the following are exponential decay, growth, refelcted decay, or reflected growth  growth  Reflected growth	b. Determine if the equations ar linear or exponential: a. $y = 3^x - 4$ Exponential b. $y = 2x - 3$ Linear c. $y = 6^{2x}$ Exponential
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 $b > 1$	b. $y = \left(\frac{1}{2}\right)^x$ decay $0 < b < 1$
		c. $Y = 3(2)^x$ growth $b > 1$	d. $Y = 3(1-.5)^x$ decay $0 < b < 1$

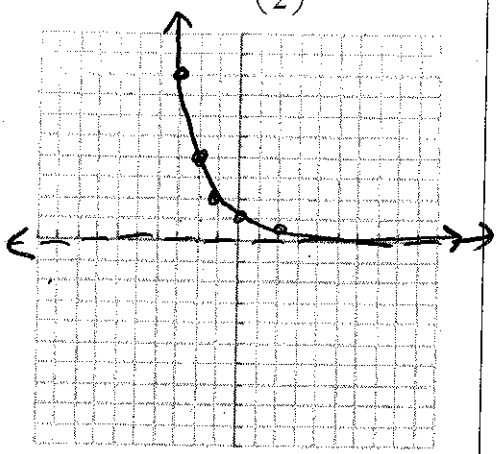
3. Graph an exponential function.

$y = ab^x$

Create a table with values and graph.

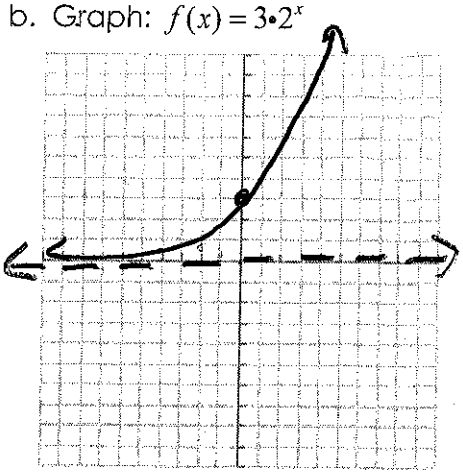
Remember to represent the asymptote as a dotted line.

a. Graph: $f(x) = \left(\frac{1}{2}\right)^x$



X	Y
-3	8
-2	4
-1	2
0	1
2	1/2

b. Graph: $f(x) = 3 \cdot 2^x$



X	Y
-2	3/4
-1	3/2
0	3
1	6

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.

$f(x) = 2^{x+7} + 3$

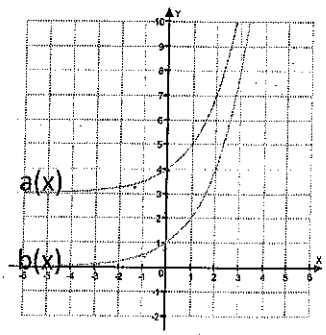
b. Given the function $g(x) = 2^x$, write a new equation after a transformation of right 9 and reflect across the x-axis.

$g(x) = -2^{x-9}$

c. Describe the transformation $h(x) = 10^x$ to $k(x) = 4(10)^{x+1} - 5$.

- stretch of 4
- left 1
- down 5

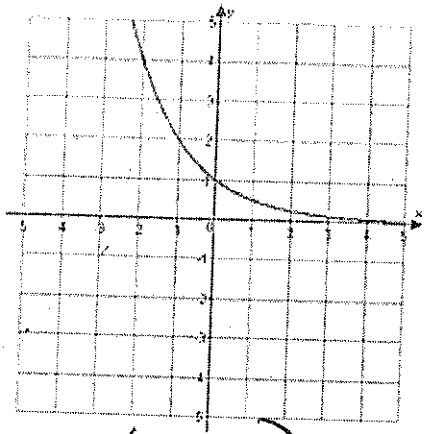
d. Describe the transformation from a(x) to b(x).



- down 3

5. Determine characteristics of exponential functions.

a.



Domain: $(-\infty, \infty)$

Range: $(0, \infty)$

x-Intercept: None

y-intercept: $(0,1)$

Interval of Increase: None

Interval of Decrease: $(-\infty, \infty)$

Asymptote: $y=0$

End Behavior:

as $x \to -\infty$, $f(x) \to \infty$

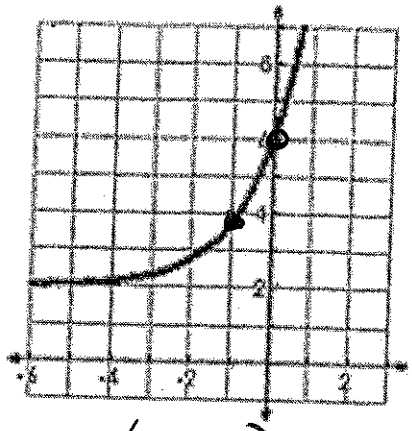
as $x \to \infty$, $f(x) \to 0$

ROC over interval -2 to 0:

$(-2,4)$ to $(0,1)$

$$m = \frac{4-1}{-2-0} = \boxed{\frac{3}{-2}}$$

b.



Domain: $(-\infty, \infty)$

Range: $(2, \infty)$

x-Intercept: None

y-intercept: $(0,6)$

Interval of Increase: $(-\infty, \infty)$

Interval of Decrease: None

Asymptote: $y=2$

End Behavior:

as $x \to -\infty$, $f(x) \to 2$

as $x \to \infty$, $f(x) \to \infty$

ROC over interval -1 to 0:

2

6. 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 $y = 3(2)^x$. $y = 0$ (asymptote) $(0, 3)$ y-int (a-value)	b. Determine the y-intercept an asymptote of the function $y = 4(\frac{1}{2})^x - 2$. $y = -2$ $(0, 2)$
7. Determine the growth/decay factor and Rate.	$(1 + r)$ and $(1 - r)$ represent the growth and decay factors	a. $y = 3(1.25)^x$ Determine if the function is growth or decay: growth Factor: 1.25 Rate: $1 + r = 1.25$ $r = .25$	b. $y = 2(.84)^x$ Determine if the function is growth or decay: decay Factor: .84 Rate: $1 - r = .84$ $r = .16$

8. Applications of exponential functions.

$y = p(1+r)^t$

$y = p(1-r)^t$

$A = P\left(1+\frac{r}{n}\right)^{nt}$

a. Luke Duke deposits $2000 into a bank account that pays 5% interest compounded monthly. Find the balance in the account after 4 years.

Equation: $A = 2000\left(1+\frac{.05}{12}\right)^{12\cdot 4}$

$A = \$2441.79$

Solution: $2441.79

b. The value of the Barbie Drea House is $125,000. This house is i 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?

Equation: $y = p(1+r)^t$

$y = 125,000(1+.07)^5$

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**? = 12 Mo.

Equation: $y = p(1-r)^t$

$y = 32(1-.21)^{12}$

Solution: 1.89 ounces

d. Michael is offered two jobs – Job A, which offers him a startin 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 on a 3% raise each year. Michael plans to work to work at the job for 7 years. Which job should he pick and why?

$y = P(1+r)^t$

Job A

$y = 20,000(1+.05)^7$

$28142

Job B

$y = 25,000(1+.03)^7$

$ 30746

9. Solving Exponential Functions

- Must have SAME base
- Set exponents = (don't forget to distribute)
- Solve for x

- $5^{3x+1} = 5^{x-9}$

$3x+1 = x-9$

$2x = -10$

$x = -5$

- $3^{x-8} = 9^x$

$3^{x-8} = (3^2)^x$

$x-8 = 2x$

$x = -8$

- $4^{3x} = 8^{x+1}$

$(2^2)^{3x} = (2^3)^{x+1}$

$6x = 3x+3$

$3x = 3$

$x = 1$

$4^{4x+8} = \left(\frac{1}{4}\right)^{x-18}$

$(2^2)^{4x+8} = (2^{-2})^{x-18}$

$8x+16 = -2x+36$

$10x = 20$

$x = 2$

10. Geometric Sequences

Geometric Explicit Formula: $a_n = a_1(r)^{n-1}$

Geometric Recursive Formula $a_n = a_{n-1}(r)$

Tell if the following is Geometric or Arithmetic

a. 8, 5, 2, -1... Arithmetic $d=-3$

b. 2, 6, 18, 54... Geometric $r=3$

Create an Explicit formula and then use it to find a certain term.

c. -81, 27, -9, 3, -1

Explicit formula: $a_n = -81(-3)^{n-1}$

$a_8 =$ $a_8 = -81(-3)^{8-1} = 177147$

d. 4, 12, 36, 108,...

Explicit formula: $a_n = 4(3)^{n-1}$

$a_9 =$ $a_9 = 4(3)^{9-1} = 26244$

Joe sells coffee at his work place and has recorded his weekly sales below.

week	Sales
1	50. 30
2	62.10
3	76.67

$1.23

Explicit formula: $a_n = 50.30(1.23)^{n-1}$

If the same trend continues, how much will he make in week 7?

$a_n = 50.30(1.23)^6$

$a_7 = \$174.18$