Name ______________________ Date ________

6.3 Notetaking with Vocabulary

I can use and model exponential functions.

I can identify and evaluate exponential functions.

I can graph exponential functions.

Write the meaning of each vocabulary term.

exponential function – a non-linear function of the form $y = a \cdot b^x$ (variable) where $a \neq 0$, $b > 0$ and $b \neq 1$.

signature – As x increases by a constant amount, y is multiplied by a constant factor.

Notes:

Linear

$m = \frac{y_2 - y_1}{x_2 - x_1} = \underline{y_2 - y_1}$ → the difference b/t consecutive y's is constant will be m

$x_2 > x_1$

$x_2 - x_1 = 1$

x's go ↑ by 1

if constant linear

$y = mx + b$

Exponential

$\frac{y_2}{y_1}$ – the ratio of consecutive y's if constant, we have exponential

ratio = base $= \frac{y_2}{y_1}$

$y = a \cdot b^x$

Identifying and Evaluating Exponential Functions

In Exercises 1–4, determine whether the table represents a *linear* or an *exponential* function. Explain.

1.

x	y
1	8
2	4
3	2
4	1

2.

x	y
1	3
2	7
3	11
4	15

3. guess? linear

x ↑ by 1

x	y
−1	12
0	9
1	6
2	3

−3, −3, −3

$y_2 - y_1$

$9 - 12 = -3$

$6 - 9 = -3$

$3 - 6 = -3$

slope

constant

function is linear

$y = mx + b$

$y = -3x + 9$

4. Guess - exp.

x ↑ by 1

x	y
−1	0.125
0	0.5
1	2
2	8

·4, ·4, ·4

$y_2 - y_1$

$8 - 2 = 6$

$2 - .5 = 1.5$

not constant

not linear

$y = a \cdot b^x$ (y-int.)

$y \quad .4^x$

$y = .5(4)^x$

$\frac{y_2}{y_1}$

$\frac{8}{2} = 4$

$\frac{2}{.5} = 4$

$\frac{.5}{.125} = 4$

constant exponential

base = 4

In Exercises 5–7, evaluate the function for the given value of x.

5. $y = 3^x; x = 5$

$y = 3^5$

$y = 243$

6. $y = \left(\frac{1}{4}\right)^x; x = 3$

$y = \left(\frac{1}{4}\right)^3$

$y = \frac{1}{64}$

7. $y = 3(4)^x; x = 4$

$y = 3 \cdot 4^4$

$y = 3 \cdot 256$

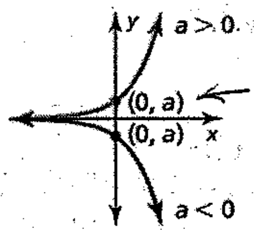
$y = 768$

$y = a \cdot b^x$

parent for every base $a = 1$ $y = b^x$ $y = 3^x$ $y = \left(\frac{1}{2}\right)^x$

Graphing $y = ab^x$ When $b > 1$

$y = 2^x$



a is the y-int.

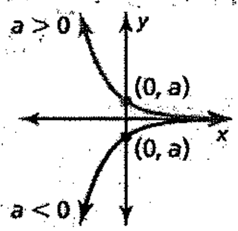
D: $-\infty < x < \infty$

D: $\mathbb{R}$ = the set of all real numbers

R: $\{y > 0\}$

Graphing $y = ab^x$ When $0 < b < 1$

$y = \left(\frac{1}{2}\right)^x$



D: $\mathbb{R}$

R: $\{y > 0\}$

points on all parent function:

x	y
-1	$\frac{1}{a}$
0	1
1	a

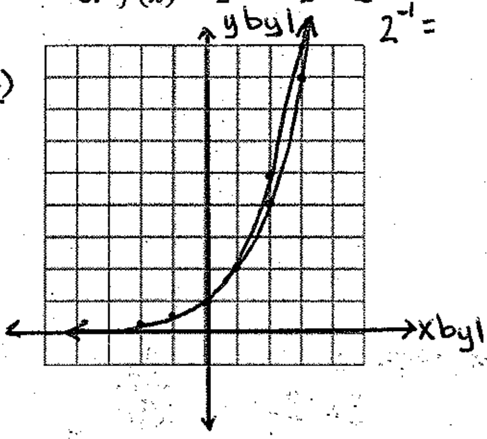
the reciprocal of a

In Exercises 8 and 9, graph the function. Describe the domain and range of f.

$f(-1) = \left(\frac{1}{4}\right)^{-1} = \left(\frac{4}{1}\right)^1$

8. $f(x) = 2^x$ $2^1 = 2$ $2^{-1} =$

x	f(x)
1	2
0	1
-1	$\frac{1}{2}$
2	4
-2	$\frac{1}{4}$



D: $\mathbb{R}$

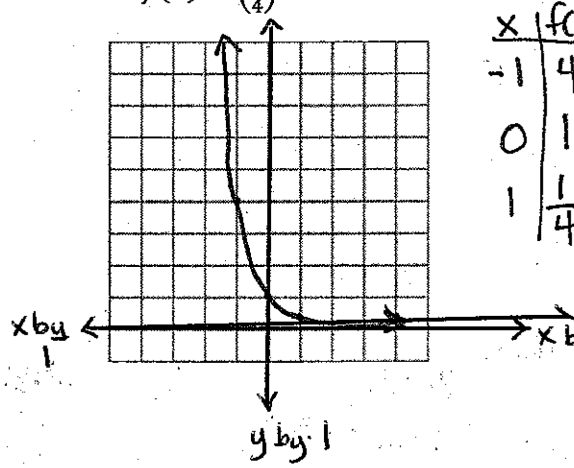
R: $\{y > 0\}$

R: $\{y \mid y > 0\}$

9. $f(x) = \left(\frac{1}{4}\right)^x$

x	f(x)
-1	4
0	1
1	$\frac{1}{4}$

$\left(\frac{1}{4}\right)^0 = 1$



D: $\mathbb{R}$

R: $y > 0$

① ID the parent

In Exercises 10 and 11, graph the function. Compare the graph to the graph of the parent function. Describe the domain and range.

f(x) is a vertical stretch by a factor of 4 and a shift left 1 of $y = \left(\frac{1}{2}\right)^x$.

$4^{-1} - 2 = \frac{1}{4} - 2$

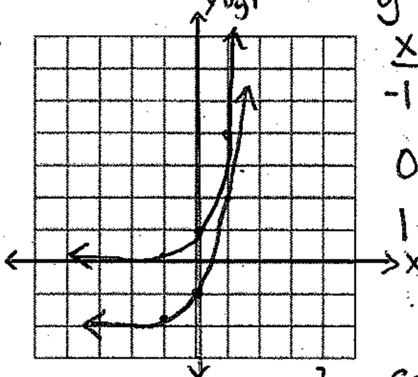
10. $f(x) = 4^x - 2$

$y = 4^x$

x	y
-1	$\frac{1}{4}$
0	1
1	4

$y = 4^x - 2$

x	f(x)
-1	$-1\frac{3}{4}$
0	-1
1	2



D: ℝ R: {y > -2}

f(x) is a vertical shift down 2 of $y = 4^x$.

11. $f(x) = 4\left(\frac{1}{2}\right)^{x+1}$

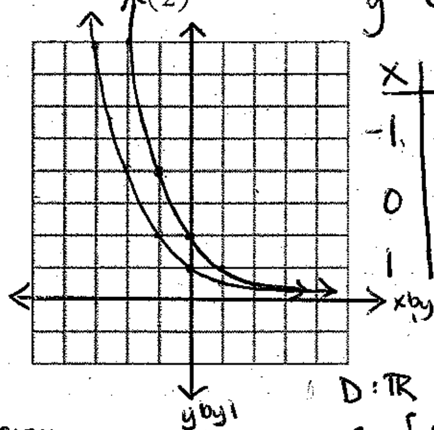
v. stretch by 4 ← h. shift left 1

$y = \left(\frac{1}{2}\right)^x$ $y = \left(\frac{1}{2}\right)^{-1} = \left(\frac{2}{1}\right)^1$

x	y
-1	2
0	1
1	$\frac{1}{2}$

$f(x) = 4\left(\frac{1}{2}\right)^{x+1}$

x	f(x)
-1	4
0	2
1	1



D: ℝ

R: {y > 0}

$f(-1) = 4\left(\frac{1}{2}\right)^{-1+1} = 4 \cdot 1 = 4$

$f(0) = 4\left(\frac{1}{2}\right)^{0+1} = 4\left(\frac{1}{2}\right) = 2$

In Exercises 12 and 13, write an exponential function represented by the table or graph.

$y = a \cdot b^x$

y-int. base $\frac{y_2}{y_1}$

12.

x	0	1	2	3
f(x)	3	18	108	648

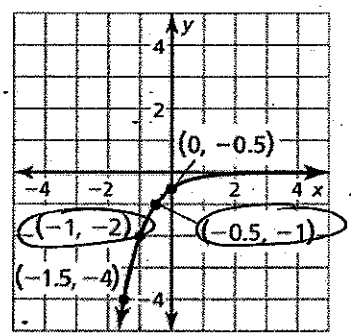
y-int. x_2

$a = 3$ $\frac{18}{3} = \frac{y_2}{y_1} = 6$

$y = 3 \cdot 6^x$

$y = 3(6)^x$

13.

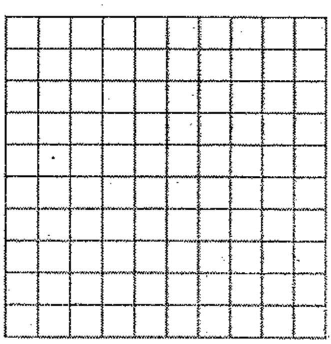


$a = -0.5$

$\frac{y_2}{y_1} = \frac{-1}{-2} = \frac{1}{2} = .5$

$y = -.5(.5)^x$

14. Graph the function $f(x) = 2^x$. Then graph $g(x) = 2^x + 3$. How are the y-intercept, domain, and range affected by the translation?



-1. reflections: v. reflect over x, h. reflect over y

multiplication/div. stretches/compression: v. h.

+/− shifts: v. h.