Lesson #6.1: Exponential and Logarithmic Functions

Investigation #1A

x	$y = 2^x$	$\Delta_1 y$	$\Delta_2 y$	$\Delta_3 y$
0	1	1	1	1
1	2	2	2	2
2	4	4	4	4
3	8	8	8	8
4	16	16	16	
5	32	32		
6	64			

	$f(x) = 2^x$	Inverse of f
Domain	$x \in \mathbb{R}$	$x > 0, x \in \mathbb{R}$
Range	$y > 0, y \in \mathbb{R}$	$y \in \mathbb{R}$
x-intercept	NONE	1
y-intercept	1	NONE
Intervals for which $f(x)$ is positive	always	$x > 1$
Intervals for which $f(x)$ is increasing	always	always
Equation of asymptote	$y = 0$	$x = 0$

- Using the STAT Editor, in L1, enter values from –4 to 4, increasing by .1.
- In L2, enter 2^L1
- Plot L1 vs L2
- Plot the inverse of this: vs .

Compare with table.
Graph Y1 = X. What is the importance of this line?

Investigation #1B

Interval		Average Rate of Change	Instantaneous Rate of Change at A, m_A	Instantaneous Rate of Change at B, m_B
A	B			
x = 0	x = 1	1	0.69	1.36
x = 1	x = 2	2	1.36	2.77
x = 2	x = 3	4	2.77	5.53
x = 3	x = 4	8	5.53	11.06
x = 4	x = 5	16	11.06	22.22

Example #1:

a) Which of the following is an exponential function? Write an equation for the data that is exponential.

i)

x	y	
1	2	6
2	8	10
3	18	14
4	32	

NOT exponential (Quadratic)

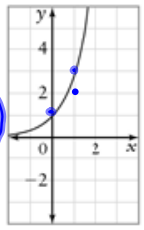
ii)

x	y	
1	5	20
2	25	100
3	125	500
4	625	

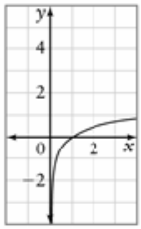
Exponential $y = 5^x$

Example #2: Match each graph a), b), and c) with its inverse i), ii), or iii). Then, write an equation for each function in the left column.

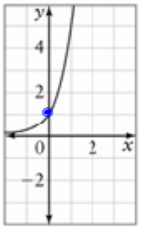
$y = b^x$

a) 

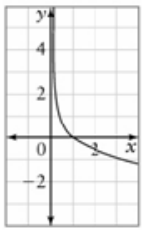
(iii)

:) 

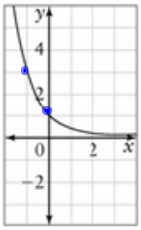
a) $y = 3^x$

b) 

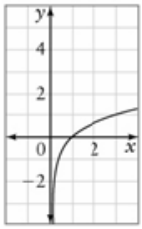
(i)

i:) 

b) $y = 4^x$

c) 

(ii)

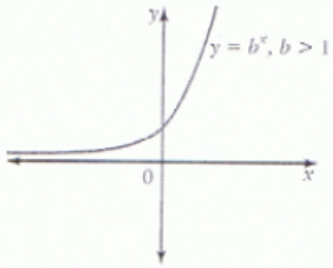
ii:) 

c) $y = (3)^{-x}$, or $y = \left(\frac{1}{3}\right)^x$

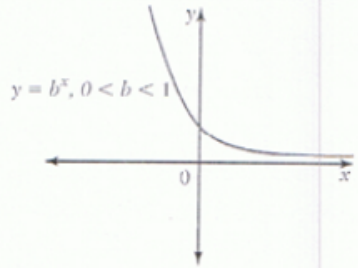
Homework: pg 319; #1, 2, 5–8, 10–16, 19, 21

KEY CONCEPTS

- An exponential function of the form $y = b^x$, $b > 0$, $b \neq 1$, has
  - a repeating pattern of finite differences
  - a rate of change that is increasing proportional to the function for $b > 1$
  - a rate of change that is decreasing proportional to the function for $0 < b < 1$
- An exponential function of the form $y = b^x$, $b > 0$, $b \neq 1$,
  - has domain $\{x \in \mathbb{R}\}$
  - has range $\{y \in \mathbb{R}, y > 0\}$
  - has y-intercept 1
  - has horizontal asymptote at $y = 0$

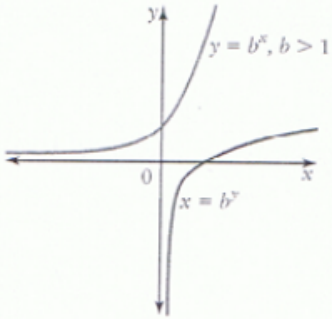


- is increasing on its domain when $b > 1$



- is decreasing on its domain when $0 < b < 1$

- The inverse of $y = b^x$ is a function that can be written as $x = b^y$. This function
  - has domain $\{x \in \mathbb{R}, x > 0\}$
  - has range $\{y \in \mathbb{R}\}$
  - has x-intercept 1
  - has vertical asymptote at $x = 0$
  - is a reflection of $y = b^x$ about the line $y = x$



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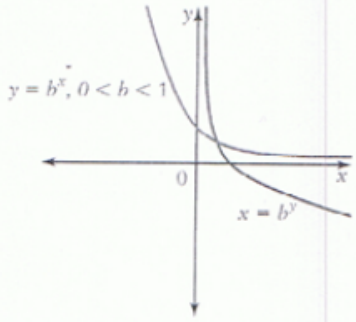

- is decreasing on its domain when $0 < b < 1$