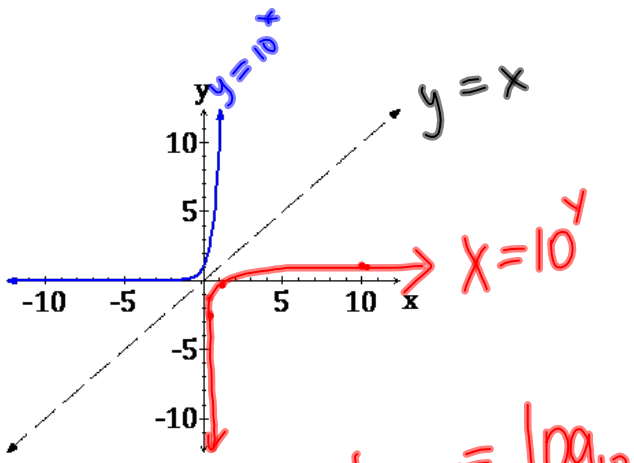
Unit Seven: Logarithmic Functions

7.1 Characteristics of Logarithmic Functions with Base 10 and Base e $\doteq 2.718$

1. Use technology to graph the exponential function $y = 10^x$.
2. Complete the table of values for $y = 10^x$.
3. How can you use this table to create a table of values for the new function $x = 10^y$? Switch x and y
4. Sketch the graph of $x = 10^y$ on the same axes.
5. How are these two functions related? What is the connection to the line $y = x$?
6. The equation of the second function, $x = 10^y$, can be rewritten in another form called **logarithmic** form: or

$y = 10^x$	
x	y
-2	$\frac{1}{100}$
-1	$\frac{1}{10}$
0	1
1	10
2	100

$x = 10^y$	
x	y
$\frac{1}{100}$	-2
$\frac{1}{10}$	-1
1	0
10	1
100	2



$y = 10^x$

INVERSE

$x = 10^y$

$\log_{10} x = y$

$\log = \log_{10}$

Common log

7. Compare the characteristics of both functions

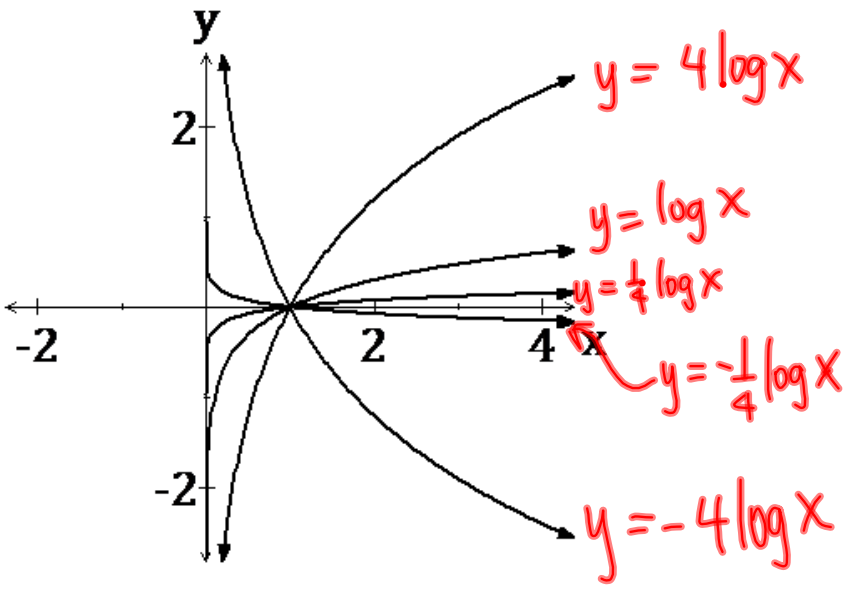
	Exponential $y=10^x$	Logarithmic $y=\log_{10} x$
Domain	$x \in R$	$x > 0$
Range	$y > 0$	$y \in R$
y-intercept	(0,1)	NONE
x-intercept	NONE	(1,0)
Increasing/ Decreasing	Increasing	Increasing
End behaviour	Q2 to Q1	Q4 to Q1

8. Use graphing technology to graph the following functions and match them with those provided on the graph below

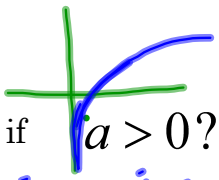
A: $y = \log_{10} x$ B: $y = 4\log_{10} x$ C: $y = \frac{1}{4}\log_{10} x$

D: $y = -4\log_{10} x$ E: $y = -\frac{1}{4}\log_{10} x$

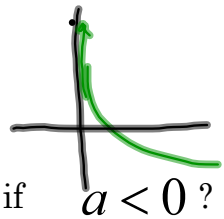
$y = a\log x$



What is the effect on the graph of $y = a\log_{10} x$ if $a > 0$? if $a < 0$?



increasing Q4 to Q1



decreasing Q1 to Q4

Does a affect the x-coordinate or the y-coordinate? Is this a vertical or a horizontal transformation?

Which point is easily identified from the graph?

x-int at x=1

Which characteristics of the graphs of logarithmic functions differ from the graphs of exponential functions?

pretty well everything!

Use technology to graph the exponential function $y = e^x$.

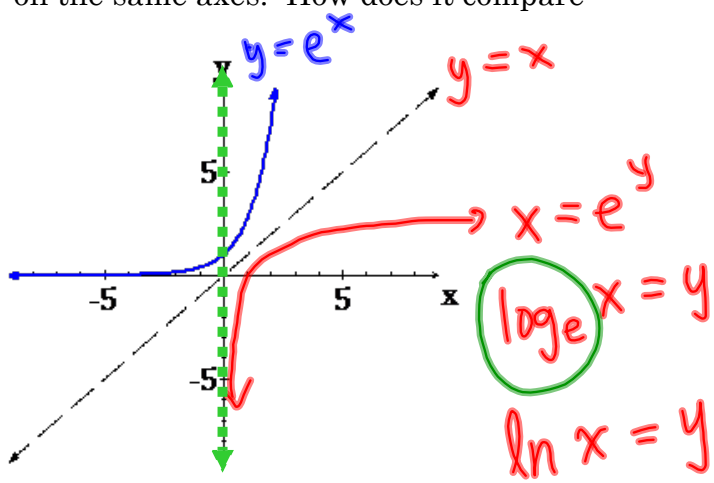
. Complete the tables for $y = e^x$ and $x = e^y$. $\log_e x = y$

$\log_e = \ln$

$y = e^x$	
x	y
-2	.135
-1	.368
0	1
1	2.718
2	7.3

$x = e^y$	
x	y
.135	-2
.368	-1
1	0
2.718	1
7.3	2

. Sketch the graph of $x = e^y$ on the same axes. How does it compare to $y = e^x$?



. The equation of the second function, $x = e^y$, can be rewritten in another form called **logarithmic** form: $y = \log_e x$ or $y = \ln x$

.

Compare the characteristics of both functions:

	Exponential ($y=e^x$)	Logarithmic ($y=\ln x$)
Domain	$x \in \mathbb{R}$	$x > 0$
Range	$y > 0$	$y \in \mathbb{R}$
y-intercept	$(0,1)$	NONE
x-intercept	NONE	$(1,0)$
Increasing/ Decreasing	Increasing	Increasing
End behaviour	Q2 to Q1	Q4 to Q1

Horizontal Asymptote Vertical Asymptote

How do the characteristics of the function $y = \ln x$ compare to those of $y = \log_{10} x$? (i.e. Does it matter if the base is 10 or *e*?)

All same, NO!

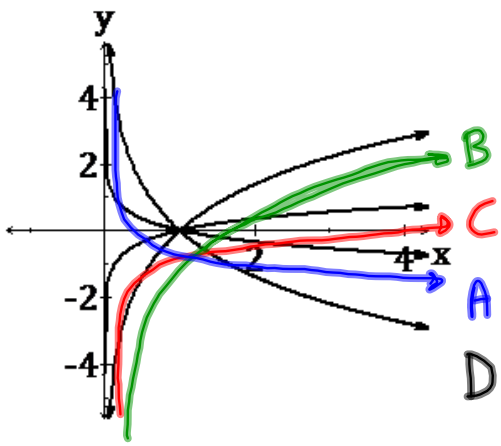
. Match each function below with its graph

A: $y = -\frac{1}{2}\ln x$

B: $y = 2\ln x$

C: $y = \frac{1}{2}\ln x$

D: $y = -2\ln x$



P. 420-425 # 2,3,5,6,8