

1) $\log_2 16 = 4$ $_{2^4=16}$

2) $\log_3 9 = 2$

$_{3^2=9}$

3) $\log_4 \left(\frac{1}{16}\right) = -2$ $_{4^{-2}=1/16}$

4)* $\log 100 = 2$ $_{10^2=100}$

5) $\ln 1 = 0$ $_{e^0=1}$

6) $\ln e = 1$

7) $3^5 = 243$ $\log_3 243=5$

8) $2^7 = 128$ $\log_2 128=7$

8) $10^5 = 100,000$ $\log 100,000=5$

9) $e^{.69315} = 2$ $\ln 2=.69315$

10) $\log_4 64 = 3$

11) $\log_4 \left(\frac{1}{64}\right) = -3$

14) $\log_2 2^3 = 3$

15) $\log_5 5^6 = 6$

16) $\ln e^4 = 4$

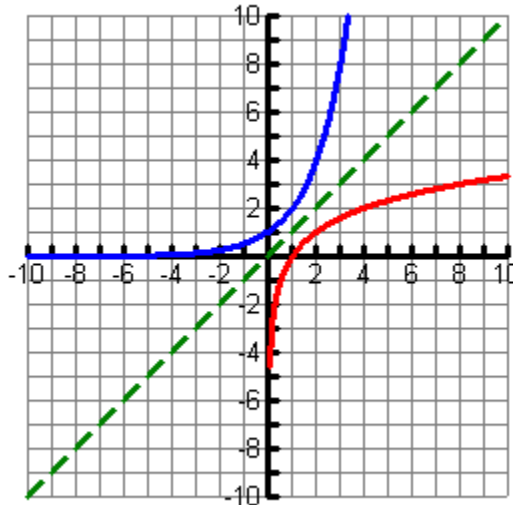
17) \times

18) 81

19) 1,000

20) \times

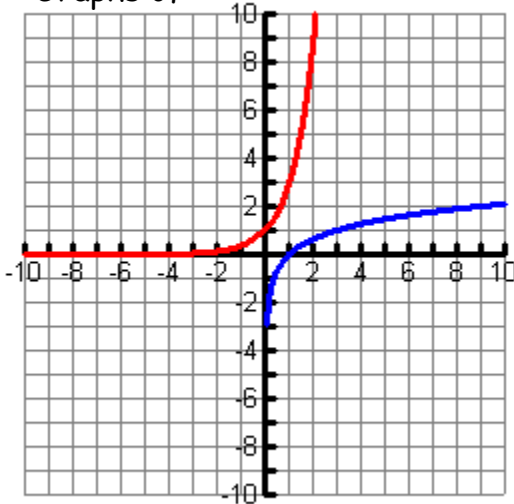
- The general shape of the graphs of the exponential and logarithmic functions:



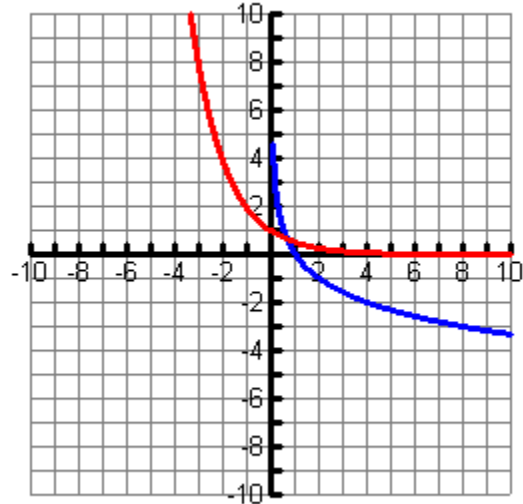
The diagram shows how the graphs of $y = 2^x$ and $y = \log_2 x$ are reflections of each other about the dashed line $y = x$.

21) How do the graphs above relate? The red lines are reflected over the y axis. The blue lines are reflected over the x-axis. The left graphs are for $a > 1$. The right are for $0 < a < 1$.

Graphs of $y = a^x$ and $y = \log_a x$.



When $a > 1$



When $0 < a < 1$

22) Discuss the domain and range of the exponential and logarithmic functions.

Function	Domain	Range
$y = a^x$	All reals	All reals greater than 0
$y = \log_a x$	All reals greater than 0	All reals

23) What is the x-intercept of the graph of $y = \log_a x$? (1,0) Y-intercept? None

24) Horizontal Asymptotes? Vertical Asymptotes? None, $x=0$

25) When is the graph increasing? When $a > 1$ Decreasing? $0 < a < 1$

26) Name 3 points on the graph of $f(x) = \log_a x$. (1,0), (a,1), (1/a,-1)

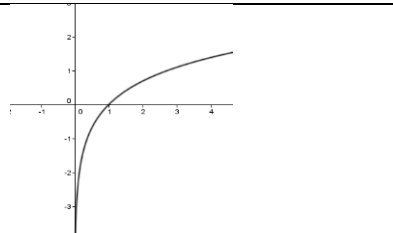
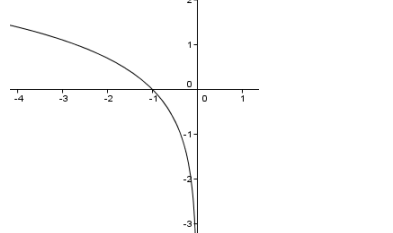
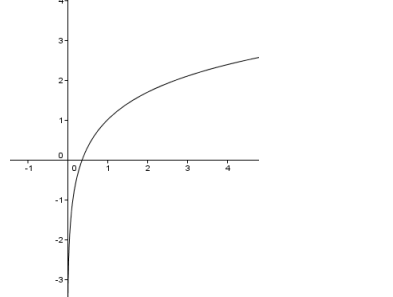
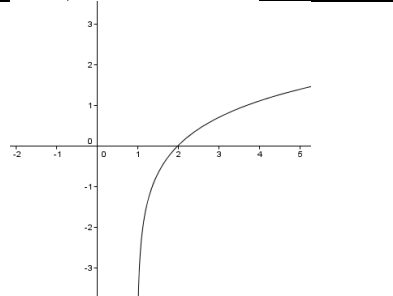
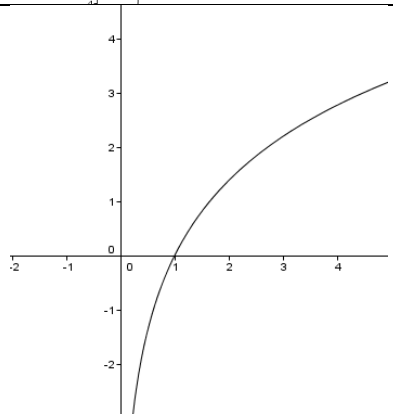
Find the domain of each function:

27) $f(x) = \log_2(2x + 3)$ $2x + 3 > 0 \Rightarrow x > -3/2$

28) $g(x) = \log\left(\frac{1}{x-2}\right)$ $\frac{1}{x-2} > 0 \Rightarrow x - 2 > 0 \Rightarrow x > 2$

TRANSFORMATIONS ON THE GRAPH OF LOGARITHMIC FUNCTIONS

29) Complete the table below using the graph of the function $f(x) = \ln x$ as your reference. Make a sketch and describe the transformation.

	<i>Sketch</i>	<i>Describe transformation</i>
$f(x) = \ln x$		<i>none</i>
$f(-x) = \underline{\hspace{2cm}}$ or $\ln(-x)$ or $-\ln(-1/x)$ $\underline{\hspace{2cm}}$		Flipped over the y axis
$f(x) + 1 = \underline{\hspace{2cm}}$		Shifted up 1
$f(x - 1) = \underline{\hspace{2cm}}$		Shifted right 1
$2 \cdot f(x) = \underline{\hspace{2cm}}$		Vertically stretched

30) Describe the transformations that have taken place on the graph of $y = \ln(x + 1) + 2$ as compared to the graph of $y = \ln x$.

Shifted left one and up 2

SOLVING A LOGARITHMIC EQUATION

31) Solve $\log_4(3x - 5) = 2$

$16 = 3x - 5 \Rightarrow x = 7$

32) $\log_x 125 = 3$ $x^3 = 125 \Rightarrow x = 5$

33) $\log_x \left(\frac{1}{8}\right) = 3$ $x^3 = \frac{1}{8} = \frac{1^3}{2^3} \Rightarrow x = \frac{1}{2}$

34) $\log_3 243 = 2x + 1$ $3^{2x+1} = 3^5 \Rightarrow x = 2$

35) $e^{2x+5} = 8$

$\ln 8 = 2x + 5$

$2.0794 = 2x + 5 \Rightarrow x = -1.4603$

36) $e^{-2x+1} = 13$

$\ln 13 = -2x + 1$

$2.5649 = -2x + 1 \Rightarrow x = -.7825$

37) $\log_5(x^2 + x + 4) = 2$

$25 = x^2 + x + 4 \Rightarrow 0 = x^2 + x - 21 \Rightarrow x = \frac{1 \pm \sqrt{85}}{2}$

38) What is $\log_4 \sqrt[4]{4}$? $4^x = 4^{1/4}$ $x = 1/4$