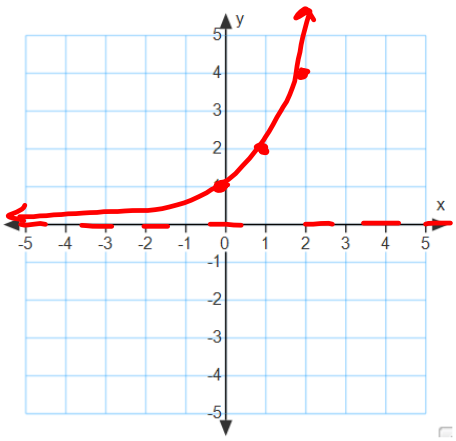
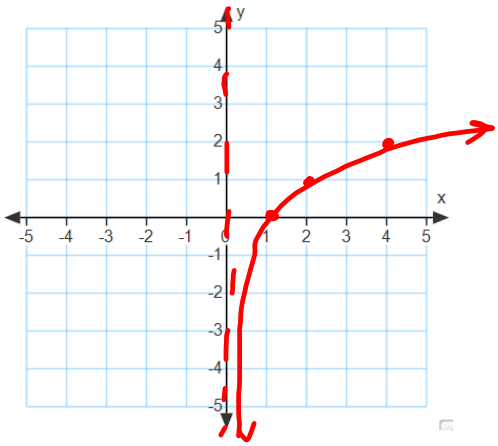
I. Sketch a rough graph of the functions, including any asymptotes, intercepts, and at least one other point.

1. $y = 2^x$



2. $y = \log_2 x$



II. State the properties of logarithms.

3. $\log_a MN =$ $\log_a M + \log_a N$

4. $\log_a \frac{M}{N} =$ $\log_a M - \log_a N$

5. $\log_a M^P =$ $p \cdot \log_a M$

III. Evaluate the logarithmic expression.

6. $\ln e =$ 1

7. $\log_3 \frac{1}{27} =$ -3

8. $\log 100 =$ 2

9. $\log_5 1 =$ 0

10. Prove that the function $f(x) = 5(x-1)^2 + 4$ is <u>not</u> one-to-one.

need to find 2 different x's that have the same function value

$x=0 \Rightarrow f(0) = 5(0-1)^2 + 4 = 5 \cdot 1 + 4 = 9$

$x=2 \Rightarrow f(2) = 5(2-1)^2 + 4 = 5 \cdot 1 + 4 = 9$

Since $0 \neq 2$, but $f(0) = 9 = f(2)$, f is <u>not</u> one-to-one.

f is one-to-one if

$f(a) = f(b) \Rightarrow a = b$ ← use to show f is 1-1

or $a \neq b \Rightarrow f(a) \neq f(b)$ ← use to show f is not 1-1

11. Determine the inverse $f^{-1}(x)$ of the function $f(x) = \frac{1}{x-1}$.

1. replace f(x) w/ y

$y = \frac{1}{x-1}$

2. interchange x & y

$x = \frac{1}{y-1}$

3. solve for y

$x(y-1) = 1$

$y - 1 = \frac{1}{x}$

$y = \frac{1}{x} + 1$

4. replace y w/ $f^{-1}(x)$

$\boxed{f^{-1}(x) = \frac{1}{x} + 1} = \frac{1+x}{x}$

24. $e^x - 6e^{-x} = 1$

$a^m a^n = a^{m+n}$

$e^x - \frac{6}{e^x} = 1$

$e^x\left(e^x - \frac{6}{e^x}\right) = 1 \cdot e^x$

$e^x e^x - \cancel{e^x} \cdot \frac{6}{\cancel{e^x}} = e^x$

$e^{x+x} - 6 = e^x$

$e^{2x} - 6 = e^x$

$e^{2x} - e^x - 6 = 0$

$(e^x)^2 - e^x - 6 = 0$

Let $u = e^x$

$u^2 - u - 6 = 0$

$(u-3)(u+2) = 0$

$u = 3, \; u = -2$

$e^x = 3, \; e^x = -2$

$\ln(e^x) = \ln 3, \; \ln(e^x) = \ln(-2)$

$x = \ln 3, \; \cancel{x = \ln(-2)}$

26. $\frac{5^x - 5^{-x}}{5^x + 5^{-x}} = 8$

$5^x - 5^{-x} = 8(5^x + 5^{-x})$

$5^x - 5^{-x} = 8 \cdot 5^x + 8 \cdot 5^{-x}$

$0 = 8 \cdot 5^x - 1 \cdot 5^x + 8 \cdot 5^{-x} + 1 \cdot 5^{-x}$

$(0 = 7 \cdot 5^x + 9 \cdot 5^{-x}) \cdot 5^x$

$0 = 7 \cdot 5^x \cdot 5^x + 9 \cdot 5^{-x} \cdot 5^x$

$0 = 7 \cdot 5^{x+x} + 9 \cdot 5^{-x+x}$

$0 = 7 \cdot 5^{2x} + 9$

$-9 = 7 \cdot 5^{2x}$

$\frac{-9}{7} = 5^{2x}$

$\ln\left(\frac{-9}{7}\right) = \ln(5^{2x})$

$\ln\left(\frac{-9}{7}\right) = 2x \ln 5$

$\cancel{\frac{\ln(-9/7)}{2\ln 5} = x}$

no solution

34. $\log_5(8-7x)=3$

$5^{\log_5(8-7x)}=5^3$

$8-7x=125$

$-7x=117$

$\boxed{x=\frac{-117}{7}}$

38. $\log(x+5)-\log(x-3)=\log 2$

$\log\frac{x+5}{x-3}=\log 2$

$10^{\log_{10}\frac{x+5}{x-3}}=10^{\log_{10}2}$

$\frac{x+5}{x-3}=2$

$x+5=2(x-3)$

$x+5=2x-6$

$\boxed{11=x}$

42. $\ln x - \ln(x-4) = \ln 3$

$\ln \frac{x}{x-4} = \ln 3$

$\frac{x}{x-4} = 3$

$x = 3(x-4)$

$x = 3x - 12$

$12 = 2x$

$\boxed{6 = x}$

46. $\log_5(x+4) + \log_5(x-4) = 2$

$\log_5[(x+4)(x-4)] = 2$

$\log_5(x^2-16) = 2$

$5^{\log_5(x^2-16)} = 5^2$

$\boxed{\log_a b = c \Leftrightarrow a^c = b}$

$x^2 - 16 = 25$

$x^2 = 41$

$\cancel{x = \pm\sqrt{41}}$ $\boxed{x = \sqrt{41}}$

48. $\log_3 x + \log_3(x+1) = \log_3 2 + \log_3(x+3)$

$\log_3[x(x+1)] = \log_3[2(x+3)]$

$x(x+1) = 2(x+3)$

$x^2 + x = 2x + 6$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$\boxed{x = 3}$, $\cancel{x = -2}$

HW #8 (due Fri. 10/3)

4.3 #1-8 all sketch graphs of logarithmic functions
#9-33 odd evaluate log expressions without a calculator
#35-53 odd convert between logarithmic and exponential expressions
#69-77 odd apply change of base formula & calculator to approximate log expressions
#83-90 all graph logarithmic functions using transformations

4.4	# 31,33, 49-55 odd; 65-75 odd; 107	applying log rules
4.5	# 1-25 odd;	solving exponential equations
	#27-47	odd solving logarithmic equations

Due Mon 10/6
4.6 #5,7,9,15,17 application problems

Test #3 - Wed 10/8