3.6 #15-39odd	Solving polynomial inequalities
#47, 53-61odd	Solving rational inequalities
3.7: #23-37 odd	Variation
4.1 #17-23 odd	prove f is one-to-one; prove g is not one-to-one
#59-63 odd	determine if f is on-to-one and if so, determine its inverse
#77-81 odd	sketch the inverse function by reflecting over y=x
#83-87 odd	use composition to show that the functions are inverses
4.2 #5-10all	match an exponential function to its graph
#11-41odd	sketch graphs of exponential functions using transformations
#43a,b,c,45,47	compound interest word problems
4.3 #1-8all	sketch graphs of logarithmic functions
#9-33odd	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

Review:

In the expression $\log_a b=c$, $\leftrightarrow a^c=b$

__c__ is the power to which we raise __a__ to get __b__.

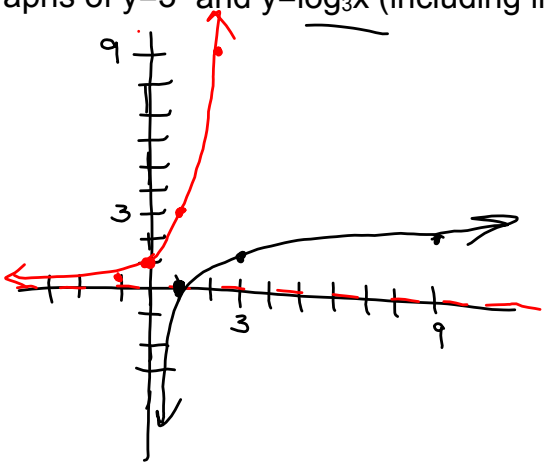
Evaluate the following: $2^{-2}=\frac{1}{2^2}=\frac{1}{4}$

$\log_2 16=$ 4 $\log_2(1/4)=$ −2 $\log(100)=$ 2 $=\log_{10}100$

$\log(1/10)=$ −1 $\ln(e)=$ 1 $\ln(1)=$ 0

$\log_{10}$ to $\log_e e$ $\log_e 1$

Sketch rough graphs of $y=3^x$ and $y=\log_3 x$ (including intercepts & asymptotes!)



x	$\log_3 x$	
1	0	$3^0=1$
3	1	$3^1=3$
9	2	$3^2=9$

4.4 Properties of Logarithmic Functions

Review-Properties of Exponents

$$a^m a^n = a^{m+n} \qquad \sqrt[n]{a} = a^{1/n} \qquad \sqrt[n]{a^m} = a^{m/n}$$

$$(a^m)^n = a^{mn} \qquad a^{-n} = \frac{1}{a^n}$$

$$\frac{a^m}{a^n} = \frac{a^{m-n}}{1} = \frac{1}{a^{n-m}}$$

Product Rule

$$\log_a(M \cdot N) = \log_a M + \log_a N$$

$M, N > 0$

Power Rule

$$\log_a(M^p) = \log_a(\underbrace{M \cdot M \cdot M \cdots M}_{p \text{ times}})$$

$$= \underbrace{\log_a M + \log_a M + \cdots + \log_a M}_{p \text{ times}}$$

$$\log_a M^p = p \log_a M$$

Quotient Rule

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

common **errors**

$$\log_a MN \neq (\log_a M)(\log_a N)$$

$$\log_a (M+N) \neq \log_a M + \log_a N$$

$$\log_a \frac{M}{N} \neq \frac{\log_a M}{\log_a N} \Big\} = \log_N M$$

$$(\log_a M)^p \neq p \log_a M = \log_a (M^p)$$

$$\log_b M = \frac{\log_a M}{\log_a b}$$

Inverse Properties

$\log_a a^x = x$; $a^{\log_a x} = x$

$4^x = 5$

$\log_4 4^x = \log_4 5$

$x = \log_4 5$

$\log_2 x = 3$

$2^{\log_2 x} = 2^3$

$x = 2^3$

Examples

2. $\log_2(8 \cdot 64) = \log_2 8 + \log_2 64$

$= 3 + 6 = \boxed{9}$

10. $\log_a x^4 = 4 \log_a x$

16. $\ln\sqrt{a} = \ln a^{1/2} = \frac{1}{2}\ln a$

22. $\log_b \frac{3}{w} = \log_b 3 - \log_b w$

32. $\log_c \sqrt[3]{\frac{y^3 z^2}{x^4}} = \log_c \left(\frac{y^3 z^2}{x^4}\right)^{1/3}$

$= \log_c \left(\frac{y z^{2/3}}{x^{4/3}}\right) = \log_c (y z^{2/3}) - \log_c (x^{4/3})$

$= \log_c y + \log_c z^{2/3} - \log_c x^{4/3}$

$= \log_c y + \frac{2}{3}\log_c z - \frac{4}{3}\log_c x$

36. $\log 0.01 + \log 1000$

$= \log(0.01 \cdot 1000)$

$= \log 10 = \boxed{1}$

44. $\ln 2x + 3(\ln x - \ln y)$

$= \ln 2x + 3\ln\frac{x}{y}$

$= \ln 2x + \ln\left(\frac{x}{y}\right)^3$

$= \ln\left(2x\left(\frac{x}{y}\right)^3\right) = \boxed{\ln\frac{2x^4}{y^3}}$

50. $\frac{2}{3}\left[\ln(x^2-9)-\ln(x+3)\right]+\ln(x+y)$

rewrite as a single logarithm

$= \frac{2}{3}\ln\frac{x^2-9}{x+3} + \ln(x+y)$

$= \frac{2}{3}\ln\frac{(x-3)(x+3)}{x+3} + \ln(x+y)$

$= \frac{2}{3}\ln(x-3) + \ln(x+y)$

$= \ln(x-3)^{2/3} + \ln(x+y)$

$= \ln\left[(x-3)^{2/3}(x+y)\right]$

$\log_a 2 \approx 0.301, \log_a 7 \approx 0.845, \log_a 11 \approx 1.041$

54. $\log_a 14 = \log_a(2\cdot 7)$

$= \log_a 2 + \log_a 7$

$= 0.301 + 0.845 =$ 1.146

56. $\log_a \frac{1}{7} = \log_a 1 - \log_a 7 = 0 - 0.845 =$ -0.845

$\log_a 7^{-1} = -\log_a 7$

58. $\log_a 9 = \log_a(11-2) = \log_a(7+2)$