

EXAMPLES

WRITE $\text{LOG}_{27} 3 = \frac{1}{3}$ IN EXPONENTIAL FORM.

BASE IS 27 AND EXPONENT IS $\frac{1}{3}$

$$\text{SO... } \underline{\underline{27^{\frac{1}{3}} = 3}}$$

WRITE $2^{10} = 1024$ IN LOGARITHMIC FORM

BASE IS 2 AND EXPONENT IS 10

$$\text{SO... } \underline{\underline{\text{LOG}_2 1024 = 10}}$$

EVALUATE

$$\text{LOG}_3 27 = x$$

Δ TO EXPONENTIAL FORM

$$3^x = 27 \quad (\text{WHAT IS 27 AS PRIME FACTORS})$$

$$3^x = 3^3$$

$$\text{SO } \underline{\underline{x = 3}}$$

$$\text{LOG}_5 \frac{1}{625}$$

$$5^x = \frac{1}{625} \quad \text{OR} \quad 5^x = \frac{1}{5^4}$$

$$5^x = 5^{-4} \quad \text{SO} \quad \boxed{x = -4}$$

APPLICATIONS

HALF LIFE FORMULA

$$N = N_0 \left(\frac{1}{2}\right)^t$$

DOUBLING FORMULA

$$N = N_0 (2)^t$$

N_0 = INITIAL AMT

t = TIME PERIODS

N = FINAL AMT

EX. IF A BACTERIA COLONY DOUBLES EVERY 2 DAYS AND THERE ARE 500 BACTERIA ON APRIL 15. WHEN WILL THE POPULATION REACH 16000?

$$16000 = 500 (2)^t$$

$$\frac{16000}{500} = \frac{500}{500} (2)^t$$

$$32 = 2^t \quad \text{OR}$$

$$2^5 = 2^t$$

$t = 5$ PERIODS

\therefore 10 DAYS LATER

APRIL 25th

USE CALC



$$\log_2 32 = t$$



WE WILL

LOOK AT

SO PROPER

LATER

COMPOUND INTEREST FORMULA

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

t = TIME IN YEARS

A = FINAL AMT

P = PRINCIPLE

r = INTEREST RATE (ANNUAL)

n = COMPOUNDING PERIOD

HOW MANY YEARS WILL IT TAKE A \$700 INVESTMENT AT 6% ANNUAL INTEREST TO BE WORTH \$47,000 IF THE ACCOUNT IS COMPOUNDED QUARTERLY?

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

$$47000 = 700 \left(1 + \frac{.06}{4}\right)^{4t}$$

$$\frac{47000}{700} = \frac{700}{700} \left(1 + .015\right)^{4t}$$

$$67.14285714 = (1.015)^{4t}$$

$$\log_{1.015} 67.14285714 = 4t$$

$$282.5530282 = 4t$$

$$\boxed{70.63 \text{ yrs} = t}$$

PROPERTIES OF LOGS - THESE COULD BE DERIVED FROM PROPERTIES OF EXPONENTS SINCE THEY ARE INVERSES.

M AND N ARE POSITIVE #'S

D IS POSITIVE AND $\neq 1$, P IS ANY REAL #

PRODUCT PROPERTY

$$\log_b mn = \log_b m + \log_b n$$

QUOTIENT PROPERTY

$$\log_b \frac{m}{n} = \log_b m - \log_b n$$

POWER PROPERTY

$$\log_b m^p = p \cdot \log_b m$$

EQUALITY PROP

$$\text{IF } \log_b m = \log_b n, \text{ THEN } m = n$$

EXAMPLES

SOLVE EACH EQN USING THE PROPERTIES OF LOGS.

$$\log_{10}(2x+5) = \log_{10}(5x-4)$$

EQUALITY PROP

SO. $2x+5 = 5x-4$ AND SOLVE

$$\begin{array}{r} -2x \quad -2x \\ 5 = 5x - 4 \end{array}$$

$$\begin{array}{r} 5 = 5x - 4 \\ +4 \quad +4 \end{array}$$

$$9 = 5x$$

$$9 = 3x$$

$$\boxed{x=3}$$

$$\log_3(4x+5) - \log_3(3-2x) = 2$$

QUOTIENT PROP

REWRITE AS $\log_3 \frac{4x+5}{3-2x} = 2$

TO EXPONENTIAL FORM $3^2 = \frac{4x+5}{3-2x}$

CROSS MULTIPLY

$$9 = \frac{4x+5}{3-2x}$$

$$9(3-2x) = 4x+5$$

$$27 - 18x = 4x + 5$$

$$22 = 22x$$

$$\boxed{x=1}$$

$$\log_b(15,625)^{1/6} = -\frac{1}{3}$$

POWER PROP.

$$\frac{1}{6} \cdot \log_b 15625 = -\frac{1}{3}$$

OR

$$\text{CALCULATE } 15625^{1/6} = \sqrt[6]{15625} = 5$$

$$\text{SO } \log_b 5 = -\frac{1}{3}$$

CHANGE TO EXPONENTIAL $b^{-1/3} = 5$

RAISE BOTH SIDES TO -3 POWER

$$(b^{-1/3})^{-3} = 5^{-3}$$

$$b = \frac{1}{125}$$

GRAPHING LOGS

$$y = \log_2(x-1)$$

$2^y = x-1$

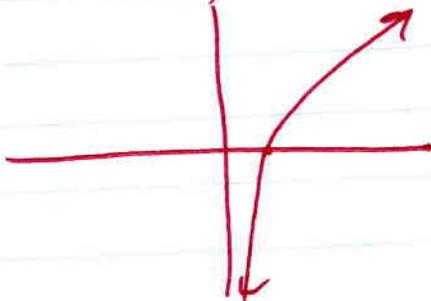
SUBSTITUTE VALUES FOR

y . THIS GIVES YOU

WHAT $x-1$ IS EQUAL TO.

FIND x BY SOLVING.

PLOT (x,y) COORDINATES



y	$x-1$	x	(x,y)
-3	$\frac{1}{8}$	1.125	(1.125, -3)
-2	$\frac{1}{4}$	1.25	(1.25, -2)
-1	$\frac{1}{2}$	1.5	(1.5, -1)
0	1	2	(2, 0)
1	2	3	(3, 1)
2	4	5	(5, 2)
3	8	9	(9, 3)

GRAPH $y \leq \log_3(x+1)$

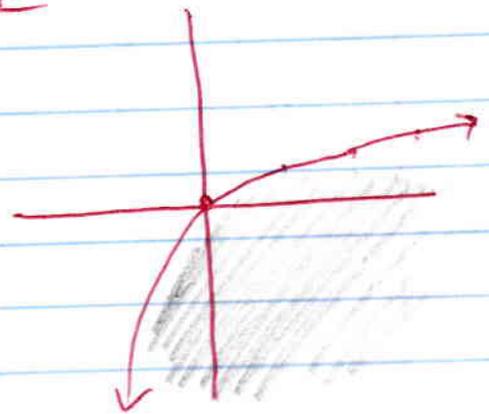
BOUNDARY LINE

$$y = \log_3(x+1)$$

$$3^y = (x+1)$$

USE
SOLID
LINE

y	x+1	x	
-2			
-1	$\frac{1}{3}$	$-\frac{2}{3}$	$(-\frac{2}{3}, -1)$
0	1	0	$(0, 0)$
1	3	2	$(2, 1)$
2	9	8	$(8, 2)$



REMEMBER TO
SHADE AND USE
APPROPRIATE BOUNDARY
LINE

SHADE BELOW

TEST A POINT

$$(3, 0)$$

$$0 \leq \log_3(4)$$

$$3^0 \leq 4 \quad \text{TRUE}$$

P.

P. 723-725 #20-58 EVEN, 59, 62, 66