-- Logs & Exponents --

Equations

$f(x) = ab^{x-h} + k$	$F = P(1 + r)^t$	$F = P(1 + \frac{r}{n})^{nt}$	$F = Pe^{rt}$
Exponential Growth or Decay Growth: $b > 1$ /Decay: $b < 1$ ✱ ex. half-life / pop. growth ✱ a = initial # ✱ b = 1 + rate of growth/decay ✱ x = time ✱ k is an asy. At y = k ✱ always convert percents→decimals when creating equations	✱ another form of ab^x ✱ use when there is compounded interest ✱ P = initial $ ✱ r = rate of interest ✱ t = time ✱ always convert percents→decimals when creating equations	✱ use this formula when making your own compound interest function ✱ compounded daily: n = 365 compounded weekly: n = 52 compounded quarterly: n = 4 basically n = how many times its compounded in one year	✱ use when something is continuously compounded ✱ P = initial $ ✱ r = rate of interest ✱ t = time ✱ e = euler's number = 2.718 ✱ use this only when the problem specifically says continuously compounded

Graphing

$y = (\frac{1}{3})^x$

x	y
-2	9
-1	3
0	1
1	1/3
2	1/9

1. create an input-output table with the following x-values: -2, -1, 0, 1, 2

2. plot the points and draw the line. remember that 0 < b < 1 is decay and b > 1 is growth

Transformations

(x − a): shift right (x + a): shift left

f(x) + a: shift up f(x) − a: shift down

af(x): −1 < a <1→wider a<−1 or a>1 →skinnier

if a < 0, gets flipped upside down

Intercepts

✱ x-intercept: plug in 0 for y
✱ y-intercept: plug in 0 for x

Intervals

✱ increasing + decreasing: focus on "slope"
✱ positive + negative: focus on the y-value

End Behavior

as x → ∞, y → _
as x → − ∞, y → _

Logarithms

Explanation

$base^{exponent} = answer$ $\log_{base} answer = exponent$

$4^2 = 16$ $\log_4 16 = 2$
$5^3 = 125$ $\log_5 125 = 3$

✱ the base is at the "bottom" of both equations
✱ the purpose of the log is always to solve for the exponent

Properties

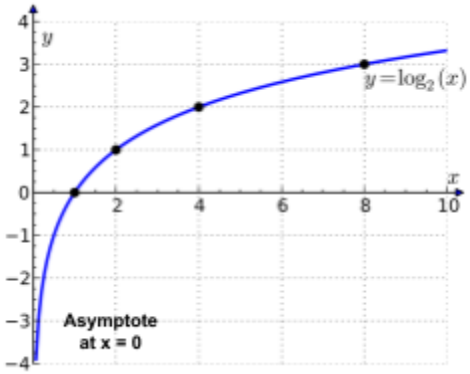
Logs

✱ $\log x = \log_{10} x$; base is equal to 10
✱ $\ln x = \log_e x$;base is equal to e
✱ $\log_b a = \frac{\log a}{\log b}$
✱ $\log_a b + \log_a c = \log_a (b \cdot c)$
✱ $\log_a b - \log_a c = \log_a (\frac{b}{c})$
✱ $c \cdot \log_a b = \log_a (b^c)$

Exponents

✱ $x^m \cdot x^n = x^{m+n}$
✱ $\frac{x^m}{x^n} = x^{m-n}$
✱ $(x^m)^n = x^{m \cdot n}$

Logarithmic Graphs



$f(x) = \log_a x$; $x = a^y$

$a > 1$; *increasing* $a < 1$; *decreasing*

✱Domain: (0, ∞) ✱ Range: (−∞, ∞)

✱VA: x = 0 ✱x-int: (1, 0) ✱ y-int: none

Expand

$\log_6 \frac{3x^5}{y^2 x} = \log_6 3 + \log_6 x^5 - \log_6 y^2 - \log_6 z$

$\log_6 3 + 5\log_6 x - 2\log_6 y - \log_6 z$

Condense

$\ln 1 + 2\ln 4 - 3\ln 2 = 0 + \ln 4^2 - \ln 2^3$

$\ln 16 - \ln 8 = \ln \frac{16}{8} = \ln 2$

Evaluate on a Calculator:
Alpha ⇒ Window ⇒ 5

$9^x = \frac{1}{3}^{x+4} = (3^2)^x = (3^{-1})^{x+4}$

$3^{2x} = 3^{-x-4} = 2x = -x - 4$

$3x = -4$; $x = -4/3$

$64 \cdot 16^{-3x} = 16^{3x-2}$

$(4^3)(4^2)^{-3x} = (4^2)^{3x-2}$

$4^{3+(-6x)} = 4^{6x-4}$

$6x + 3 = 6x - 4$

$7 = 12x$

x=7/12