-- Exponential and Logarithmic Functions --

Equations

$f(x) = ab^x$	$F = P(1 + r)^t$	$F = P(1 + \frac{r}{n})^{nt}$	$F = Pe^{rt}$
✱ use when there is exponential growth or decay ✱ ex. half-life / pop. growth ✱ a = initial # ✱ b = 1 + rate of growth/decay ✱ x = time ✱ 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 $x \to \infty$, $y \to$ _
as $x \to -\infty$, $y \to$ _

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

✱ $\log x = \log_{10} x$; means that the base is equal to 10
✱ $\ln x = \log_e x$; means that the base is equal to e

✱ $\log_b a = \frac{\log a}{\log b}$
✱ $\log_a b + \log_a c = \log_a (b \cdot c)$
✱ $\log_a b - \log_a c = \log_a (\frac{b}{c})$
✱ $c\log_a b = \log_a (b^c)$