Unit 4: Exponential & Logarithmic Functions

Exponential & Logarithmic Forms

when rewriting exponential functions read it as log base of what gives you exponent

Ex: i) $2^{5x} = 18$ $\qquad 5x = \log_2(18)$

ii) $(x+1)^y = 8$ $\qquad y = \log_{x+1}(8)$

NOTE: Expressions cannot be rewritten, ONLY equations!!!

Exponential and Logarithmic graph

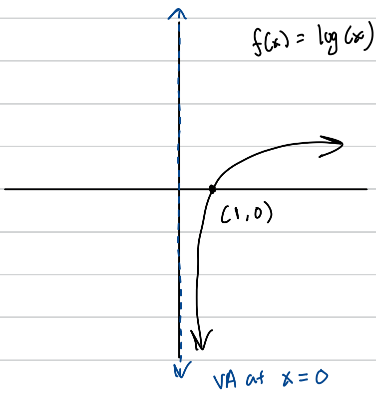
exponential functions always have the point $(0,1)$ except when it shifted horizontally or vertically

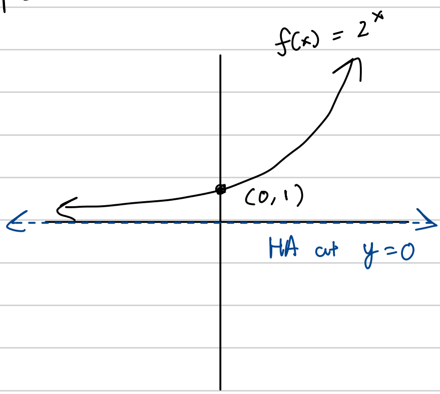
It is important to know the domain and range of exponential and log functions

$\log(x)$ Domain: $(0, \infty)$ Range: $(-\infty, \infty)$

10^x Domain: $(-\infty, \infty)$ Range: $(0, \infty)$

Shapes of both graphs





Exponential and Logarithmic Rules

There are four main rules of for logs / exponents

product rule

$$\log_b(xy) = \log_b x + \log_b y$$

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

power rule

$$\log_b x^n = n \log_b x$$

$$(a^p)^q = a^{pq}$$

quotient rule

$$\log\left(\frac{x}{y}\right) = \log_b x - \log_b y$$

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

Change of base rule

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

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

Exponential and Logarithmic Equations

Since logarithmic functions are one - to - one, inputs can be set equal

Ex: $\log_2 x = \log_2 y \rightarrow x = y$

when solving equations, find ways to rewrite so that all x are in one term

Watch out for an u - sub Ex: $e^{2x} + e^x - 1 = 0$ let $u = e^x$

$$u^2 + u - 1 = 0$$

Look out for extraneous solutions for logarithmic functions

Domain of $\log(x)$ is $(0, \infty)$

Logarithmic Scales

These are used to compress data

Rather than increasing by a certain amount on the y-axis, it increases by a factor instead

The Logarithmic Scale linearizes exponential data