LINEAR FUNCTION AND REGRESSION MODEL

$$Y = a + bX$$

MATHEMATICAL MODEL

PARAMETERS

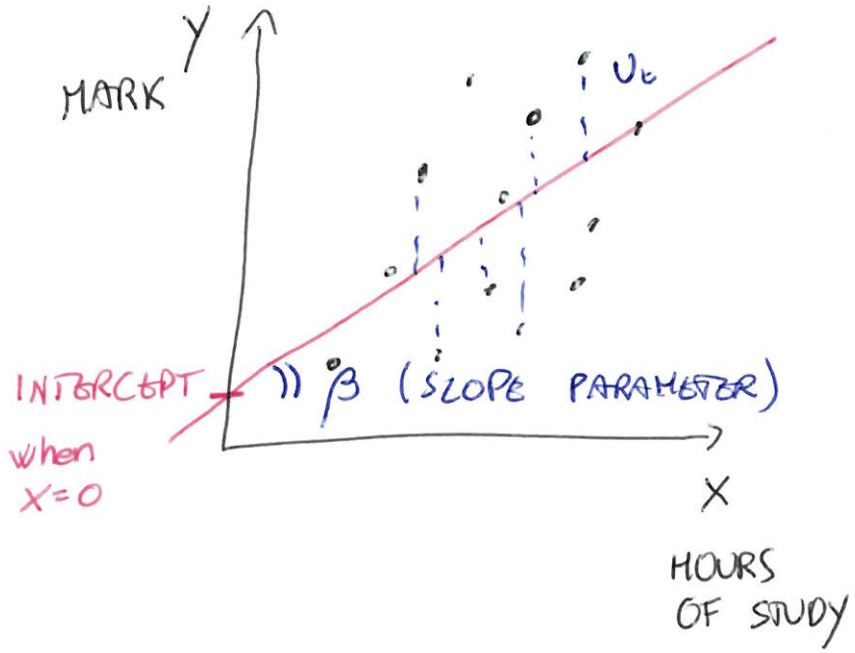
or

$$Y = ax + b$$

$$Y_t = \alpha + \beta X_t + U_t$$

ECONOMETRIC MODEL

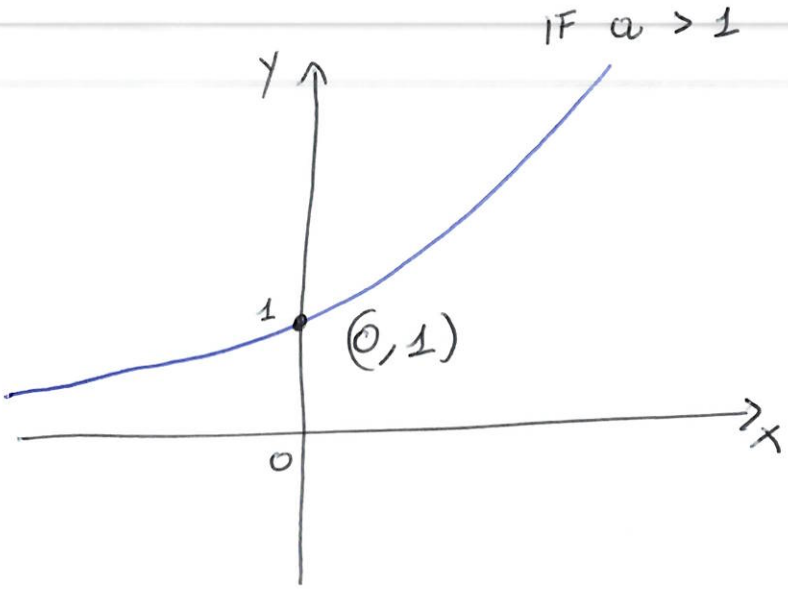
ERROR TERM



EXPONENTIAL FUNCTION:

$y = a^x$

$y = \underbrace{e}_{\approx 2.71}^x$



IF $x \to \infty \Rightarrow y \to +\infty$

IF $x \to -\infty \Rightarrow y \to 0$

LOGARITHM FUNCTION

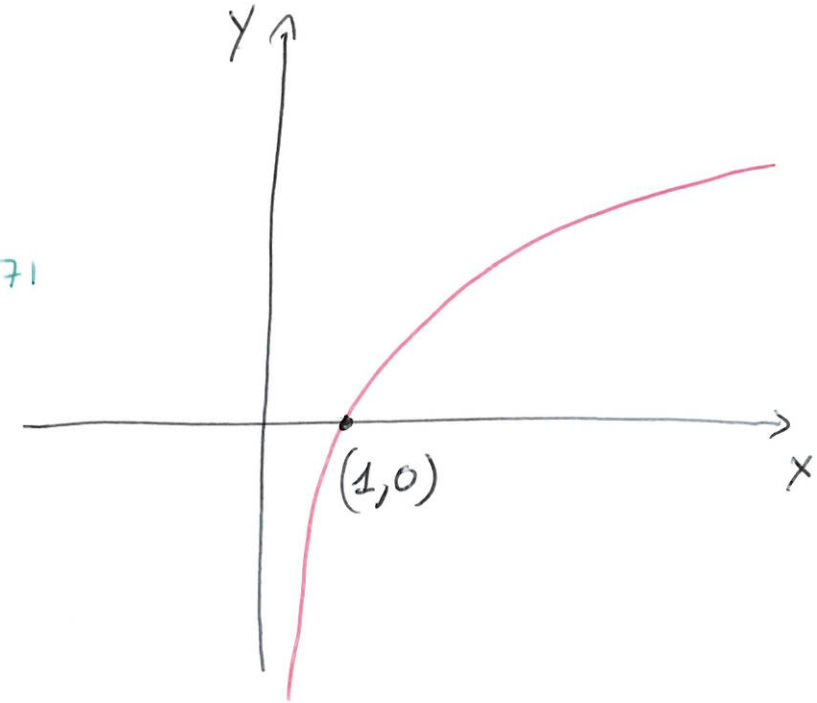
$y = \log_a x$

$\downarrow$

$y = \lg x \qquad a = 10$

$y = \ln x \qquad a = e = 2.71$

(NATURAL LOG)



- CONCAVE

- IF $X > \infty \rightarrow y \rightarrow \infty$

- X CAN ONLY BE POSITIVE

  - IF $X > 1$ then $\lg(x) > 0$

    IF $X = 1$ then $\lg(x) = 0$

    IF $0 < X < 1$ then $\lg(x) < 0$

IF $X \rightarrow 0$, then $\lg(x) \rightarrow -\infty$

How to calculate returns

Stock prices P_t

Returns

- Simple returns $r_t = \frac{P_t - P_{t-1}}{P_{t-1}}$

Log returns $r_t = \ln(P_t) - \ln(P_{t-1})$

$= \ln\left(\frac{P_t}{P_{t-1}}\right)$

a) $f(x) = 7x^2 + 122x + 54$

$f'(x) = 2 \cdot 7 x^{2-1} + 122 \cdot 1 + 0$

$= 14x + 122$

RULES.

- $f(x) = g(x) + h(x) + i(x)$

  $f'(x) = g'(x) + h'(x) + i'(x)$

- $f(x) = ax^n \rightarrow f'(x)\ n a x^{n-1}$
- $f(x) = ax \rightarrow f'(x) = a$
- $f(x) = a \longrightarrow f'(x) = 0$

$$f(x) = \underbrace{4x^3}_{g(x)}\ \underbrace{(2x-1)}_{h(x)}$$

$$f'(x) = \underbrace{12x^2}_{g'(x)}(2x-1) + 4x^3 \underbrace{(2)}_{h'(x)}$$

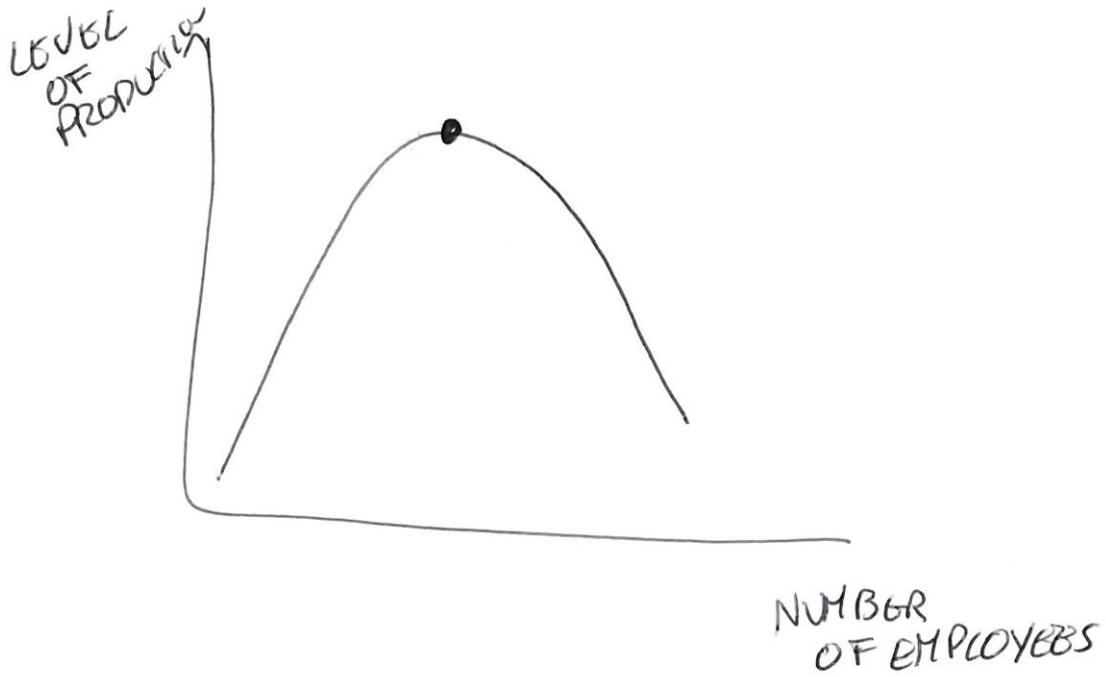
$$= 24x^3 - 12x^2 + 8x^3$$

RULE:

$$f(x) = g(x)\,h(x)$$

$$f'(x) = g'(x)\,h(x) + g(x)\cdot h'(x)$$

$$= 32x^3 - 12x^2$$



$f(x)$ → MODEL

FOC : $f'(x)$

$f'(x) = 0$ → STATIONARY POINT

SOC $f''(x) > 0$ → MIN

$f''(x) < 0$ → MAX