01/05/2025

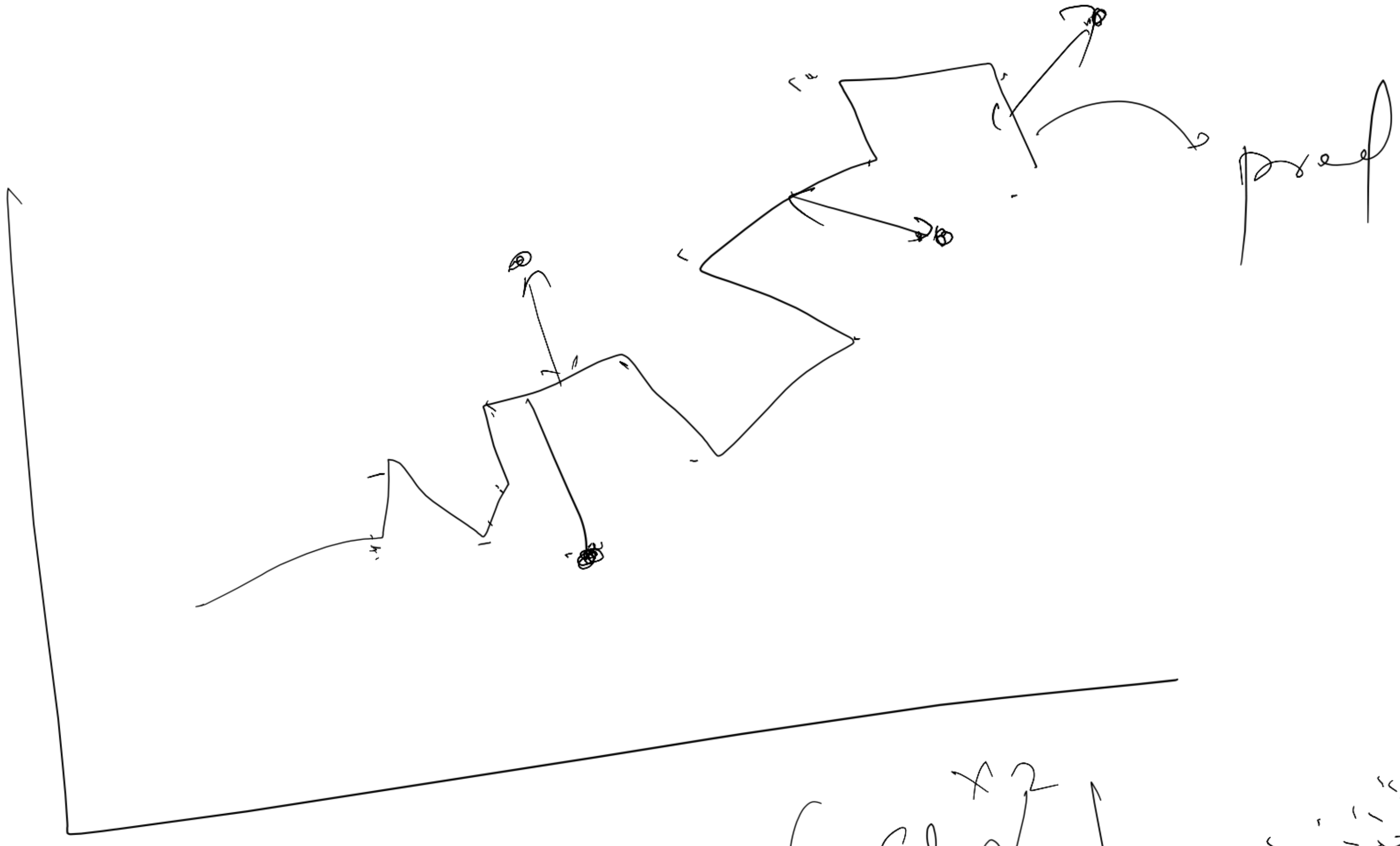
Regularization :-

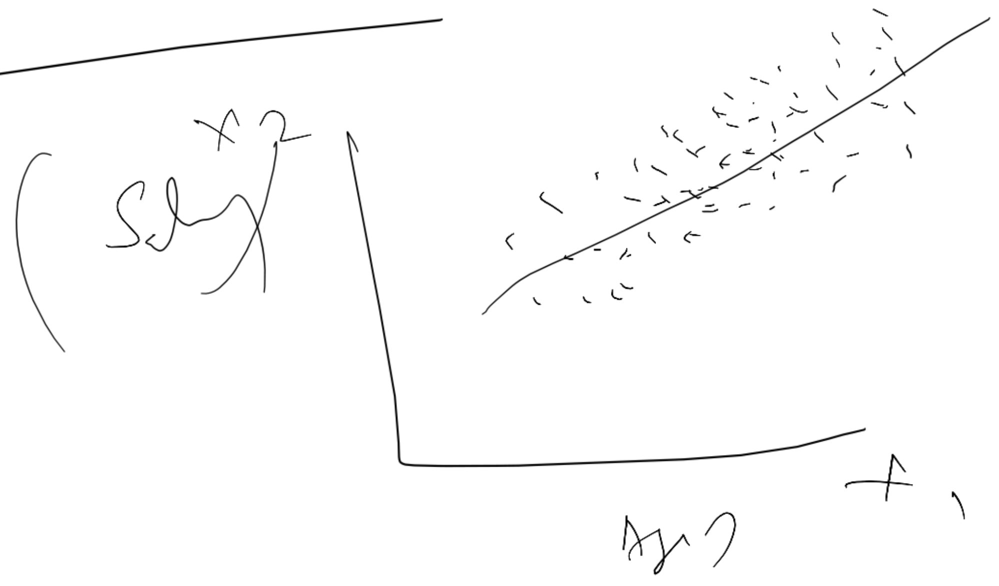
Overfitting :- Train error is less (eg 5% mape)

Test " " high (20% mape)

Undefitting : Train error is high

Test error is high


pred



L1 → LASSO $\boxed{\text{coeff} = 0}$ → 3 ~~x~~

$\boxed{\lambda = 1}$

L2 → RIDGE

Elastic Net $\boxed{\text{LASSO} + \text{RIDGE}}$

$$E = \sum(y - mx+b) + \lambda \sum \left|(m_1 + m_2 + m_3)\right|$$

Penalize the coeff that are high in magnitude

$$E = \sum y - mx + b + \lambda \sum (m_1^2 + m_2^2 + m_3^2)$$

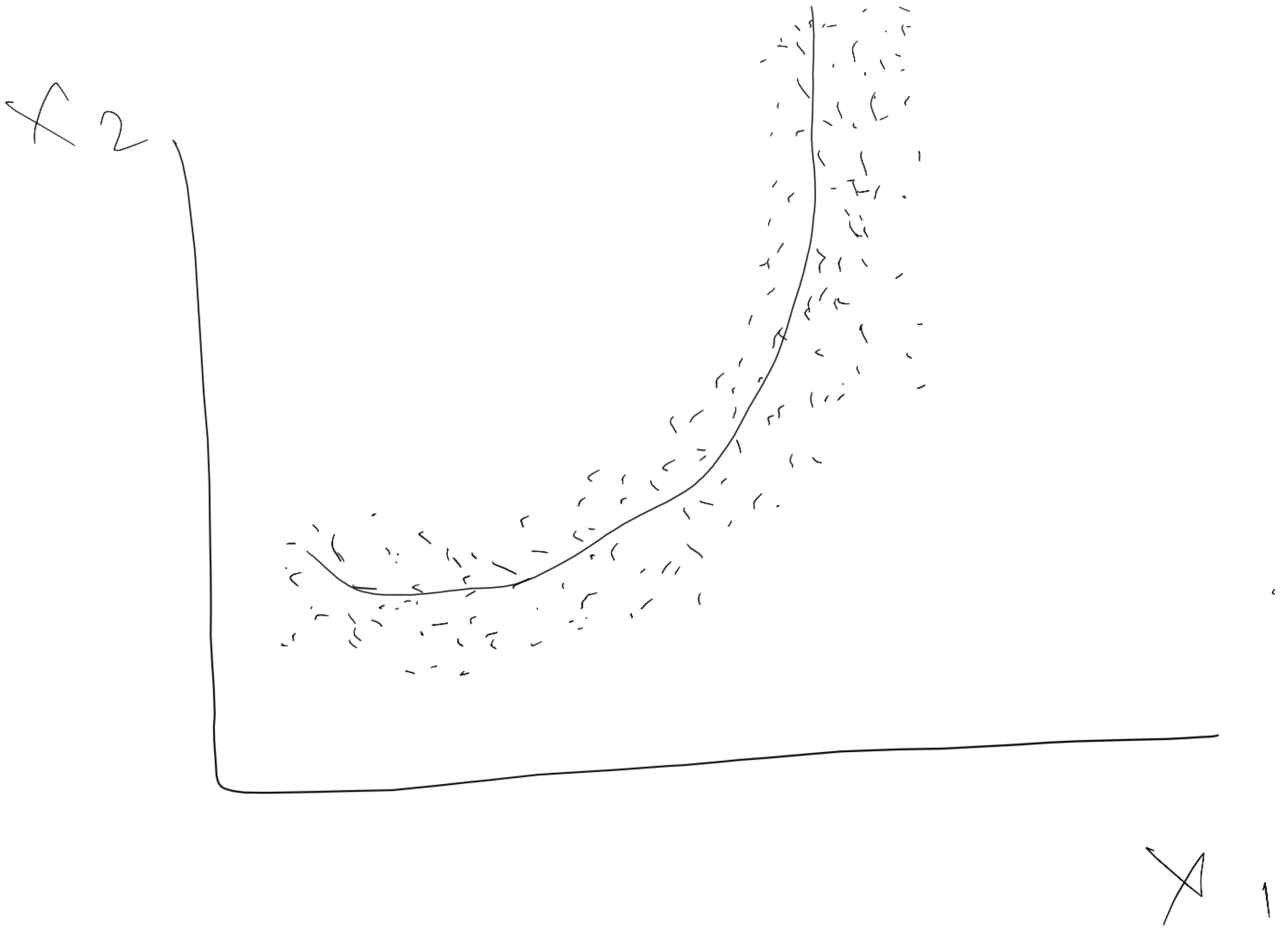
Elastic Net:

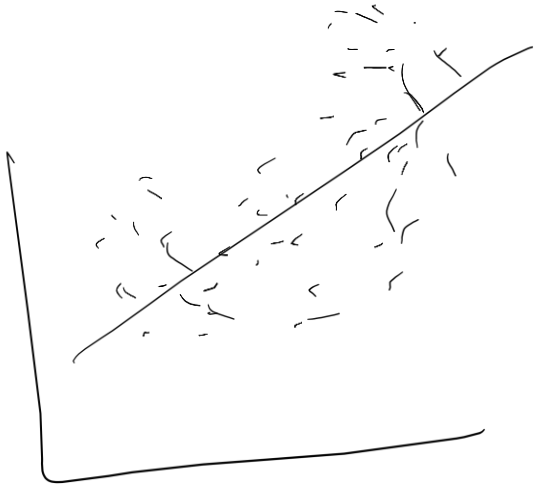
$$(y - mx + b) + \underbrace{\lambda \sum |m_1 + m_2|}_{\text{Lasso}} + \underbrace{\lambda \sum (m_1^2 + m_2^2)}_{\text{Ridge}}$$

$\boxed{70\%}$ $\boxed{30\%}$

2

coeff


X2
X1



$\boxed{y = mx + b}$ → simple line eqn

$x^2 + 2x + 4$ → Quadratic eqn

$x^3 + x^2 + 2x + 4$ → Cubic eqn

$x^4 + x^3 + x^2 + 2x + 4$ → Quatric eqn

Models → fit (X_train, y_train)

Scaling: → 1 Std scalar

70% 70 → MinMax Scalar

i/p ⇒

X_train ⇒ fit_transform

1 → 5
2 → 6
3 → 4

$$\frac{X_i - M}{\sigma}$$

$M = 7 \quad \sigma = 1$

X_test 30% 30 transform

$y = mx + b \Rightarrow$ Model

$m_2 x_2^2 + m_1 x_1^1 + b$

+ inter

poly = 3

$m_3 x_1^3 + m_2 x_1^2 + m_3 x_1^1 + b$

$$\boxed{y = mx + b}$$

(n = 100)

2 → variable

(100, 2)

x_1 — 1V

x_2 → 2V

$$= m_1 x_1 + m_2 x_2 + b$$

polynomial degree = 3

$$m_1 x_1^1 + m_2 x_1^2 + m x_1^3 + m_1 x_2^1 + m_1 x_2^2 + m_1 x_2^3 + b$$

m1 ⇒ 0.02 m_2 ⇒ 0.1 (100, 6)

Regression: (Target → Continuous)

- Linear Regression
- L1
- L2
- ElasticNet

Logistic Regression :-

Target - Discrete

CLASSIFICATION

0

1

Binary (0, 1)

Multi-class (0, 1, 2, ,)

On top of linear Regression → Continuous

Classification model Application:

1) Weath prediction ⟶ Rain / Not

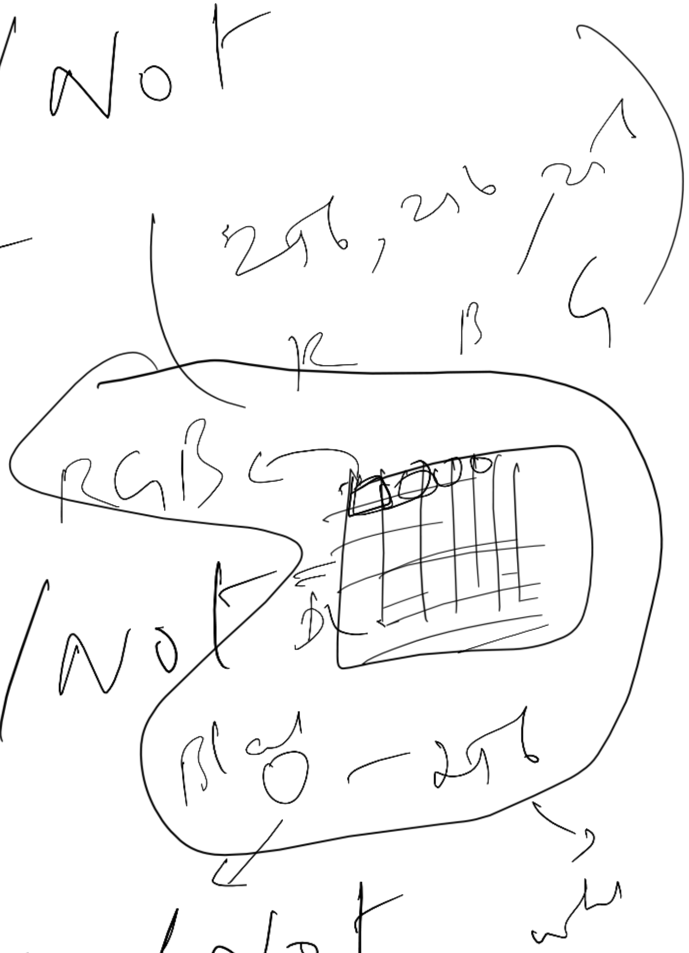
2) Email ⟶ Spam / Not

3) Exam ⟶ pass / Fail

4) Online Fraud ⟶ fraudulent / Not

5) Election - predict ⟶ Win / Not

6) Credit / Loan ⟶ Give / Approve / Not



Output of Linear Regression:

$\langle -\infty , +\infty \rangle$

$y - 5$

range $(0 \quad +\infty)$ $\boxed{\exp^{-5}}$

-2	-1	0	1	2
0.13	0.36	1	2.71	7.38

Step :-> 1

exp

random = 7000

4Sn

$(-\infty \text{ to } \infty)$

$x = 7000$

$(0 \leftrightarrow 1)$

$(0 \text{ to } \infty)$

Step 2 ->

$$\frac{x}{x+1} = \frac{7000}{7000+1}$$

$(0, 1)$

$(0, 1)$

0

1

$$\boxed{y = mx + b} \longrightarrow \text{Linear Regression}$$

$$y = (-\infty, \infty) \Longrightarrow (0, 1) \Longrightarrow \text{Logistic Reg}$$

$$\boxed{\frac{e^{(mx+b)}}{e^{(mx+b)}+1}} = P_y \quad (0, 1)$$

$$\boxed{P = \frac{e}{e^{y}+1}}$$

$$\cancel{\frac{e^y}{e^y}}\, P = \frac{e^y}{e^y+1} = \frac{\cancel{e^y/e^y}}{\frac{e^y+1}{e^y}}$$

Both numerator & Denominator, $\times$ by e^y

$$P = \frac{1}{\cancel{\frac{e^y}{e^y}} + \frac{1}{e^y}} = \frac{1}{1+\frac{1}{e^y}} = \frac{1}{1+e^{-y}}$$

$$P(1+e^{-y}) = 1 \implies P = \frac{1}{1+e^{-y}}$$

$$\boxed{P = \frac{1}{1+e^{-(mx+b)}}}$$

$\left.\begin{array}{l}\text{Numb}\\ \text{Num}\end{array}\right\rangle f \longrightarrow (0, 1)$

$\boxed{\text{Sigmoid fn}} \longrightarrow$ D.L

$\boxed{(0, 1)}$

$$P = e^y / e^y + 1$$

$$P(e^y + 1) = e^y$$

$$Pe^y + P = e^y \implies P = e^y - Pe^y$$

$$P = e^y(1 - P)$$

$$\boxed{e^y = \frac{P}{1-P}}$$

Applying log on both sides

$$\cancel{\log}\left(\cancel{e}^{y}\right) = \log\left(\frac{p}{1-p}\right)$$

$$y = \log\left(\frac{p}{1-p}\right)$$

$$mx + b = \log\left(\frac{p}{1-p}\right)$$

$\boxed{p}$ = prob of success (0.7)

$\boxed{1-p}$ = " " "

$1 - 0.7 = 0.3$

$(0, 1)$

$\boxed{\dfrac{p}{1-p}}$ => Odds

Continu

$\boxed{\log(\text{odds}) = mx + b}$

$\longleftrightarrow$ $(0 \, \ldots\ldots\ldots \, 1)$

$$\log\left(\frac{p}{1-p}\right) = \boxed{mx + b} \Rightarrow \text{Continua}$$

$$\log\left(\frac{p}{1-p}\right) = \boxed{-0.066 \times 0} + 1.8185$$

$$= 1.8185$$

$$m \Rightarrow -0.066$$

$$x_1 \Rightarrow 0$$

$$b \Rightarrow 1.8185$$

$$\frac{p}{1-p} = \exp(1.8185) = 6.16$$

$$\frac{p}{1-p} = 6.16$$

$$p = 6.16 - 6.16p$$

$$p + p\,6.16 = 6.16$$

$$p(1 + 6.16) = 6.16$$

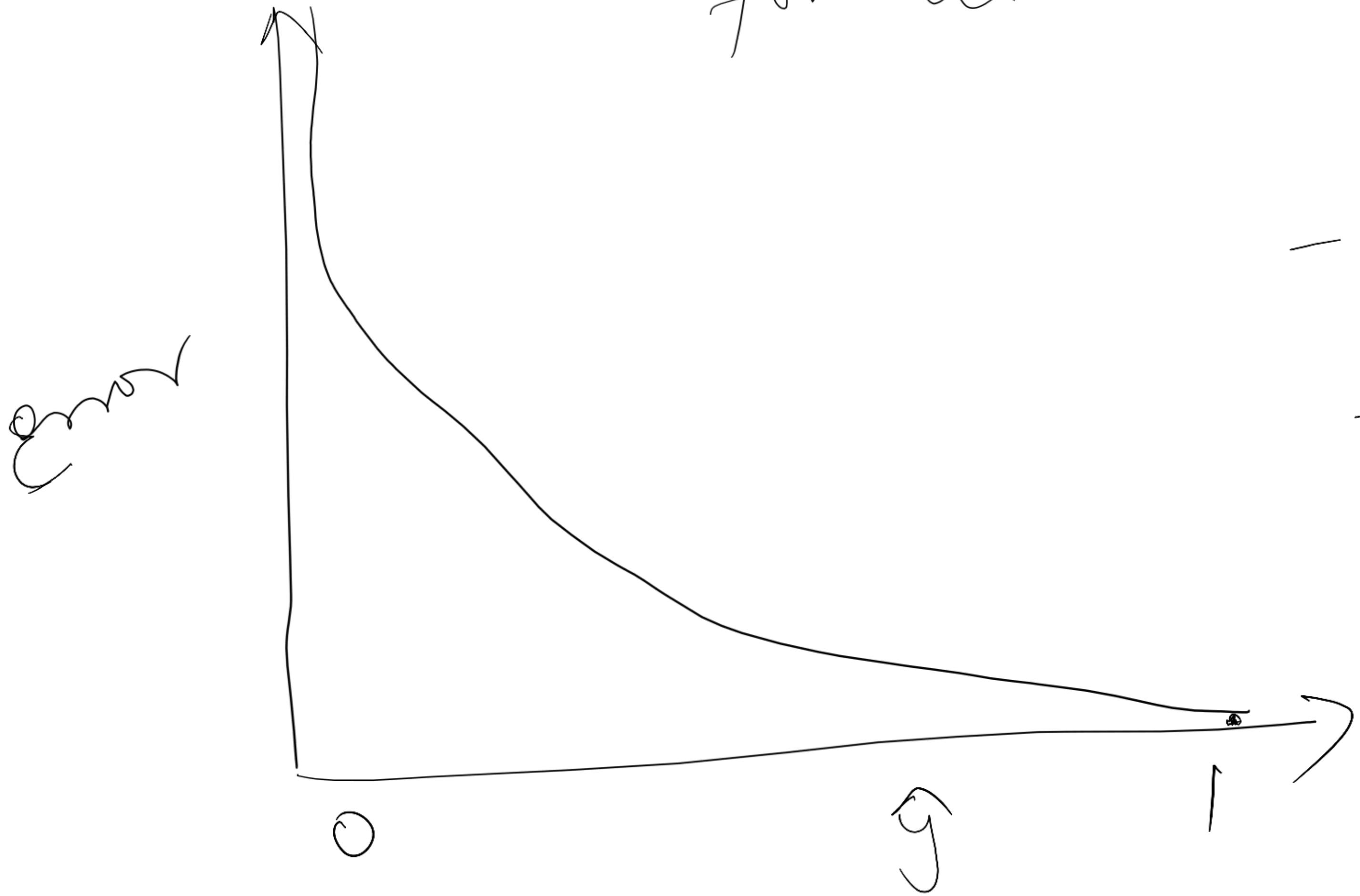
$$p = \frac{6.16}{7.16} = 0.86$$

Error:

		Error
0 $\longrightarrow$	0 $\longrightarrow$	0
0 $\longrightarrow$	1 $\longrightarrow$	∞
1 $\longrightarrow$	1 $\longrightarrow$	0
1 $\longrightarrow$	0 $\longrightarrow$	∞
(Act)	(pred)	

$$\boxed{y = 1}$$

Formula $= -\log(\hat{y})$



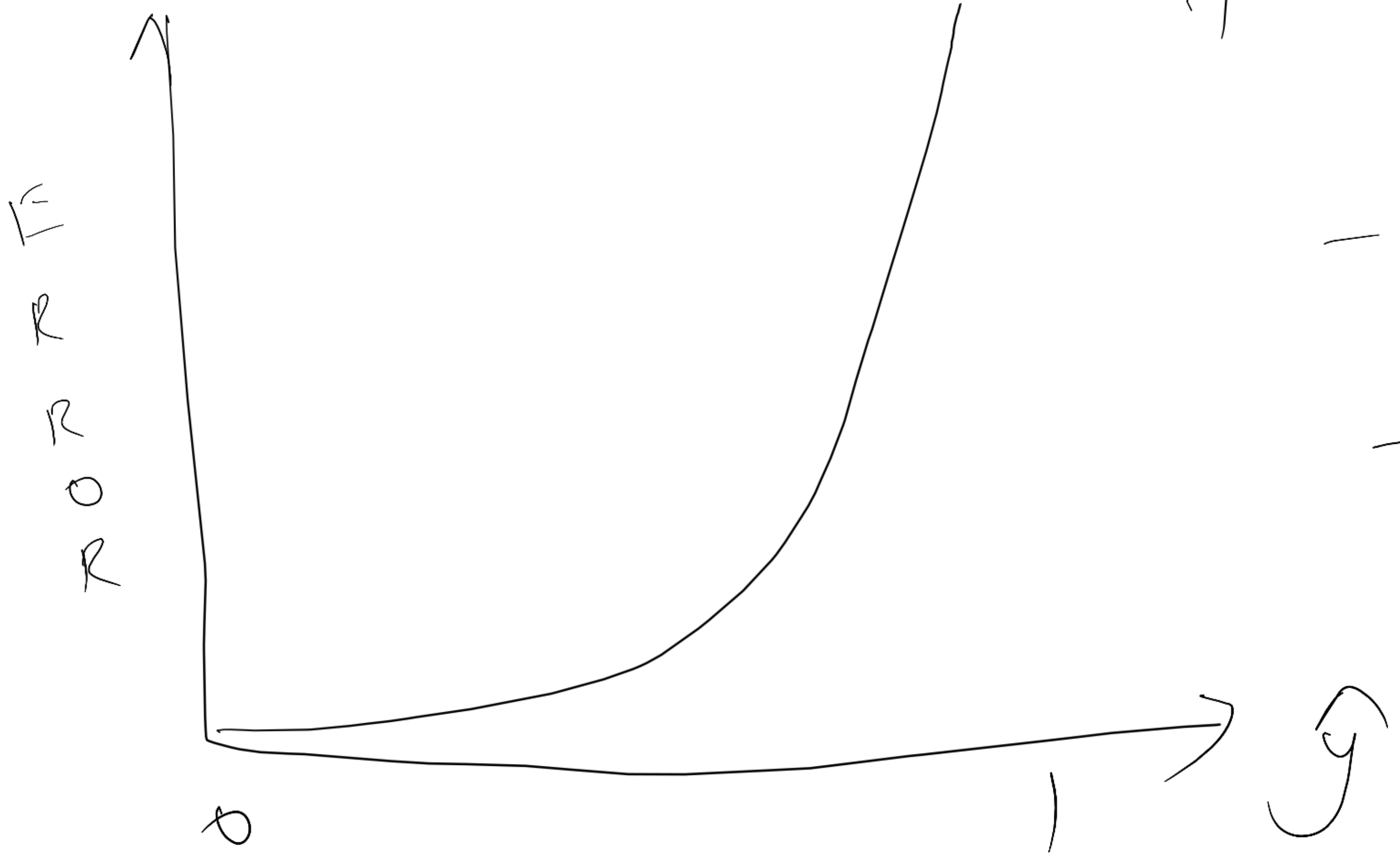
$-\log(1) = 0$

$-\log(0) = \infty$

$-\log(0.7) = 0.154$

$-\log(0.1) = 1$

$$\boxed{y = 0}$$



$$\text{Formula} = -\log(1-\hat{y})$$

$$-\log(1-1) = \infty$$

$$-\log(1-0) = 0$$

Cost function:

$y = 1 \longrightarrow -\log(\hat{y})$

$y = 0 \longrightarrow -\log(1-\hat{y})$

$$= \left[\underbrace{-y \log(\hat{y})}_{y=1} - \underbrace{(1-y)\log(1-\hat{y})}_{y=0} \right]$$

Log Loss $\Rightarrow -y \log(mx+b) - (1-y)\log(1-(mx+b))$