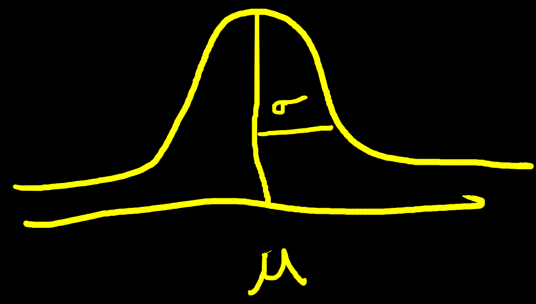
y	x
y_1	x_1
y_2	x_2
$\vdots$	$\vdots$
y_n	x_n

for i in $1 \ldots n$

$$y_i \sim N(\mu_i, \sigma^2)$$

$$\mu_i = \beta_0 + \beta_1 x_i$$

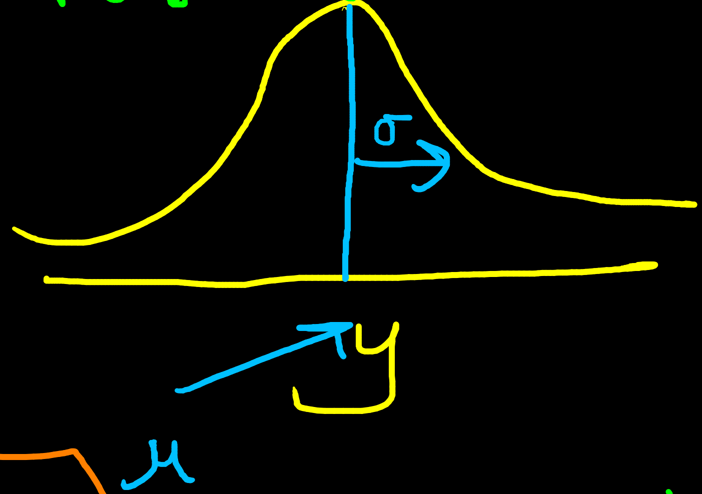


y	x
y_1	x_1
y_2	x_2
y_3	x_3
$\vdots$	$\vdots$
y_n	x_n

normal distribution

for i in 1 ... n

$$y_i \sim N(\mu, \sigma^2)$$



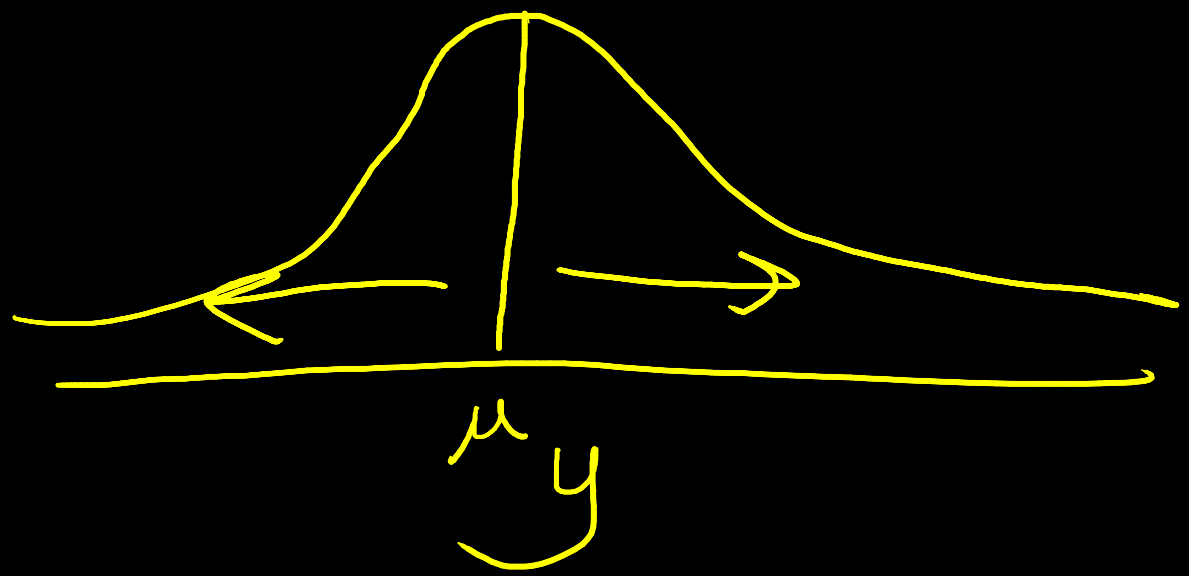
for i in 1 ... n

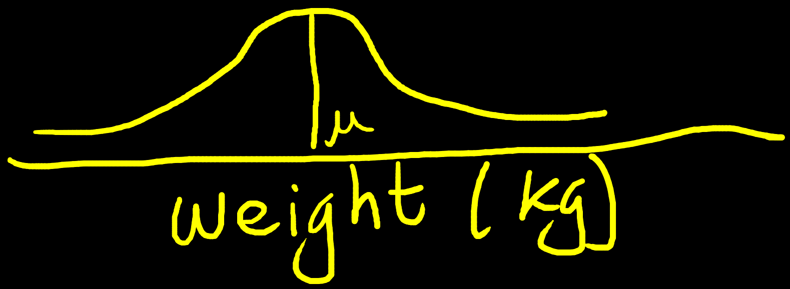
$$y_i \sim N(\mu_i, \sigma^2)$$

normality

$$\mu_i = \beta_0 + \beta_1 x_i$$

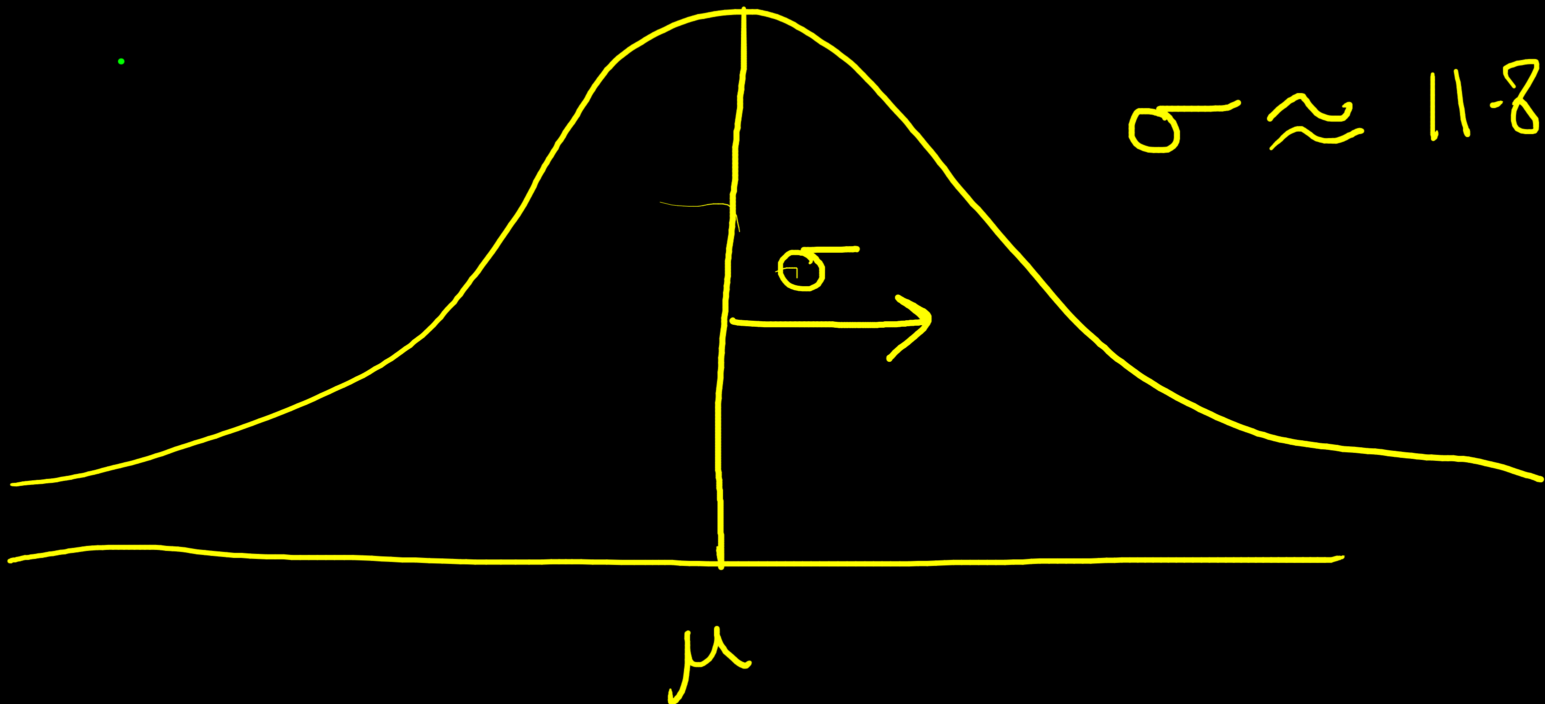
linear


μ
y



$$\boxed{\mu = \beta_0 + \beta_1 \times \text{height}}$$

β_0: -115 β_1: 1.14



$\sigma \approx 11.8$

$\underline{\underline{y}}$

y_1

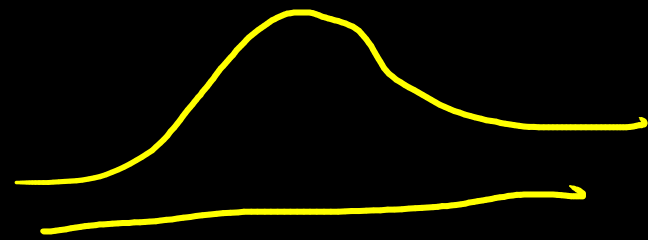
y_2

y_3

$\vdots$

y_n

$y_i \in \{0, 1\}$



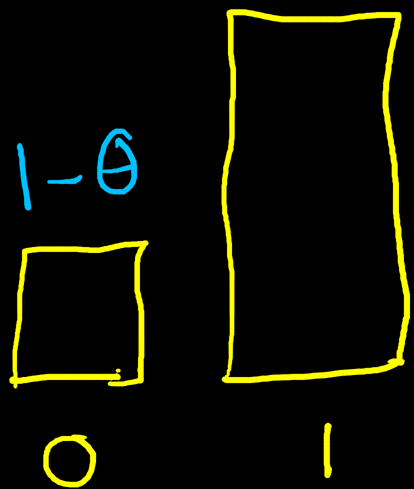
θ

75%

Bernoulli

25%

$1-\theta$



Normal linear model

for i in 1 ... n

$$y_i \sim N(\mu_i, \sigma^2)$$

$$\boxed{\mu_i = \beta_0 + \beta_1 x_i}$$

Binary logistic

for i in 1..n

$$y_i \sim \text{Bernoulli}(\theta_i)$$

✗

$$\cancel{\theta_i = \beta_0 + \beta_1 x_i}$$

link

link

✓

$$\phi_i = \beta_0 + \beta_1 x_i$$

link: logit or log odds

for i in 1 ... n

$$y_i \sim \text{Bernoulli}(\theta_i)$$

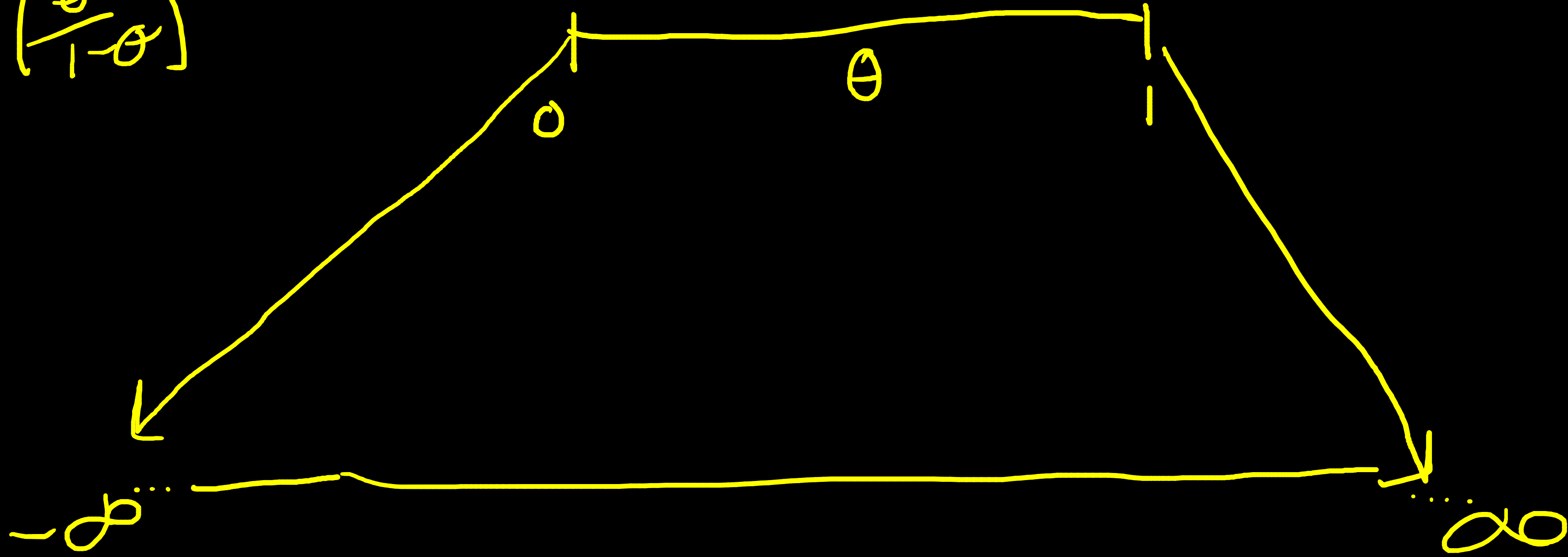
$$\log\left(\frac{\theta_i}{1-\theta_i}\right) = \underset{\substack{\uparrow \\ -1.6}}{\beta_0} + \underset{\substack{\uparrow \\ 0.05}}{\beta_1} x_i$$

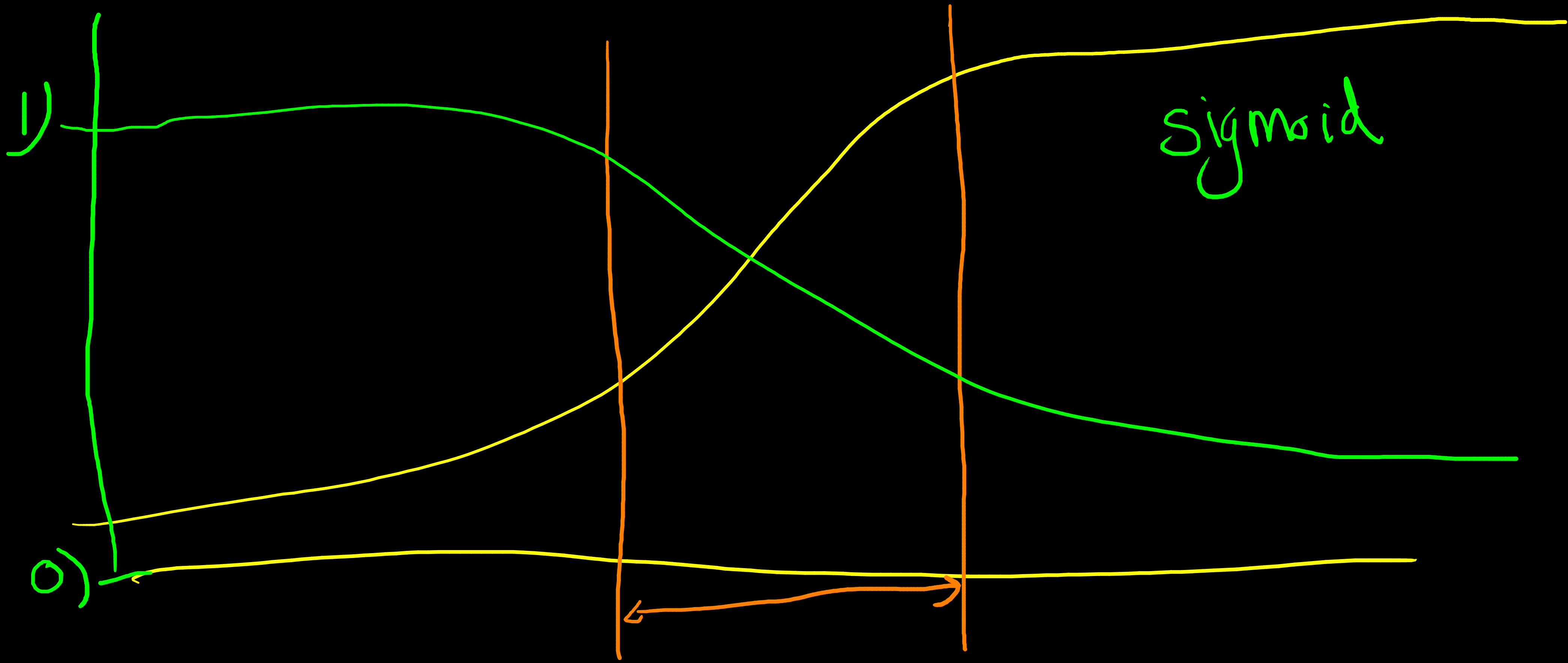
logit link: $\theta \longrightarrow \phi$

$$\underbrace{\log\left(\underbrace{\frac{\theta}{1-\theta}}_{\text{odds}}\right)}_{\substack{\text{log odds}\\ \text{aka}\\ \text{logit}}} \longrightarrow \phi$$

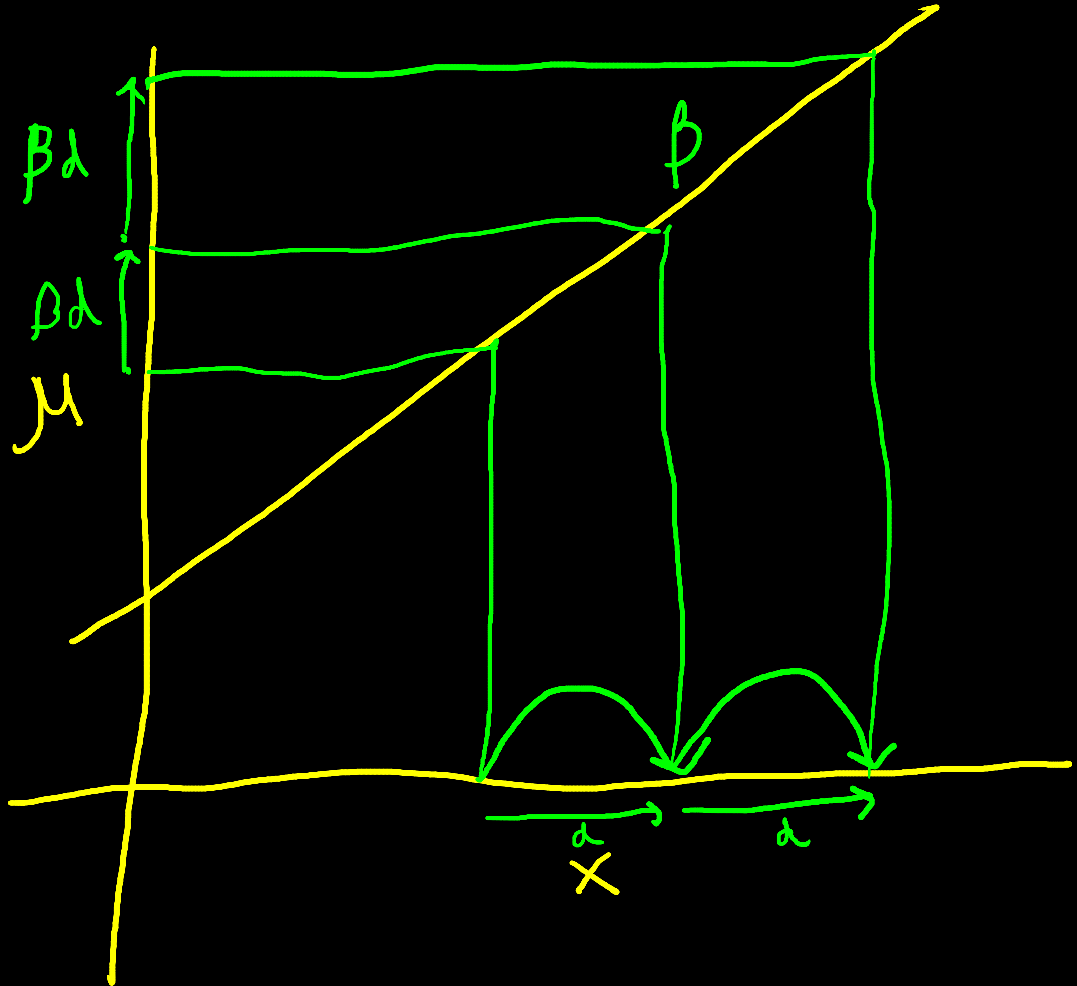
θ

$$\phi = \log\left(\frac{\theta}{1-\theta}\right)$$

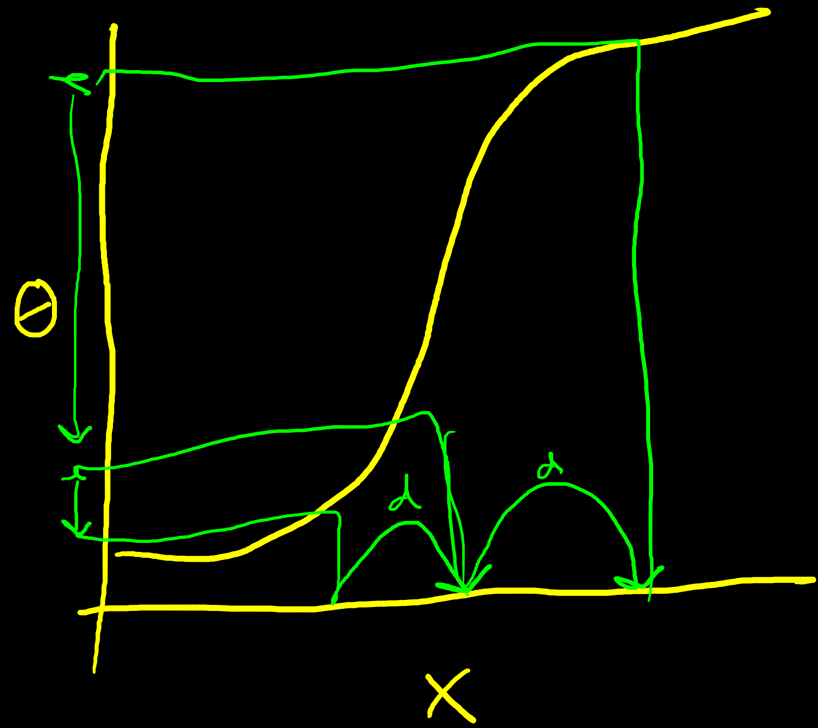




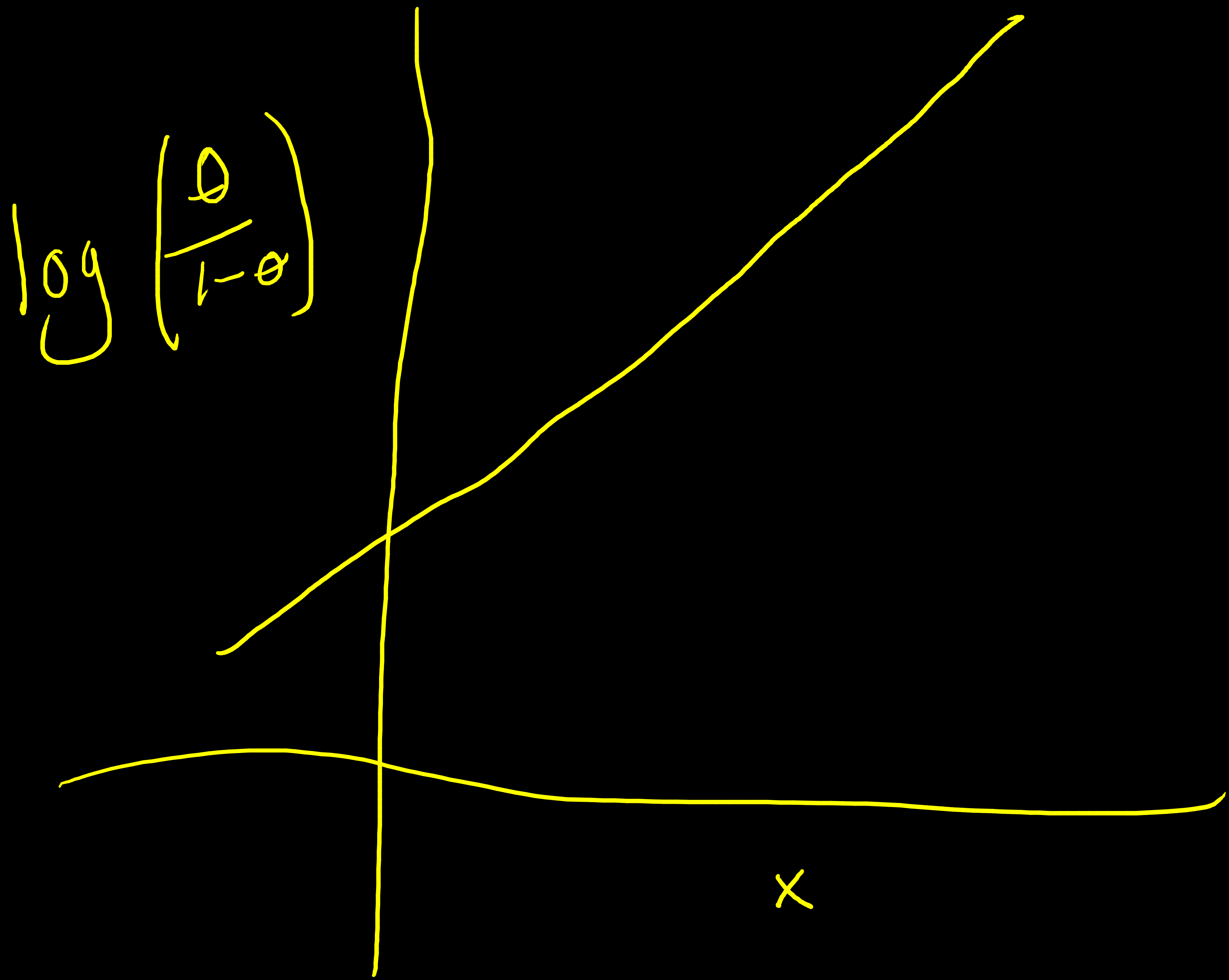
1
0
sigmoid



βd
βd
μ
β
d
d
X



θ
d
d
X


$\log\left(\frac{\theta}{1-\theta}\right)$
x

p : prob job MBA

q : prob job do not MBA

odds if MBA $\dfrac{p}{1-p}$

odds if not MBA $\dfrac{q}{1-q}$

odds ratio :

$$\frac{p/1-p}{q/1-q} \quad \text{e.g.} = 10$$

$e^{\beta} = 1.06$

The factor by which the odds changes for a unit change in the predictor

Deviance

$$= -2 \times \text{Log Likelihood}$$

$$\text{Likelihood} = P(\text{outcome} \mid \text{predictors}, \hat{\beta})$$

$$-2 \times \log \text{likelihood} = \text{deviance}$$

$$LL_0 - LL_1$$

$$= \log L_0 - \log L_1 = \log\left(\frac{L_0}{L_1}\right)$$

$$\underline{\underline{D_0 - D_1}}$$

$$= -2 \log L_0 - -2 \log L_1$$

$$= -2\left[\log L_0 - \log L_1\right] = -2 \log\left(\frac{L_0}{L_1}\right)$$

Deviance = $-2 \log$ Likelihood

AIC = Deviance + 2K