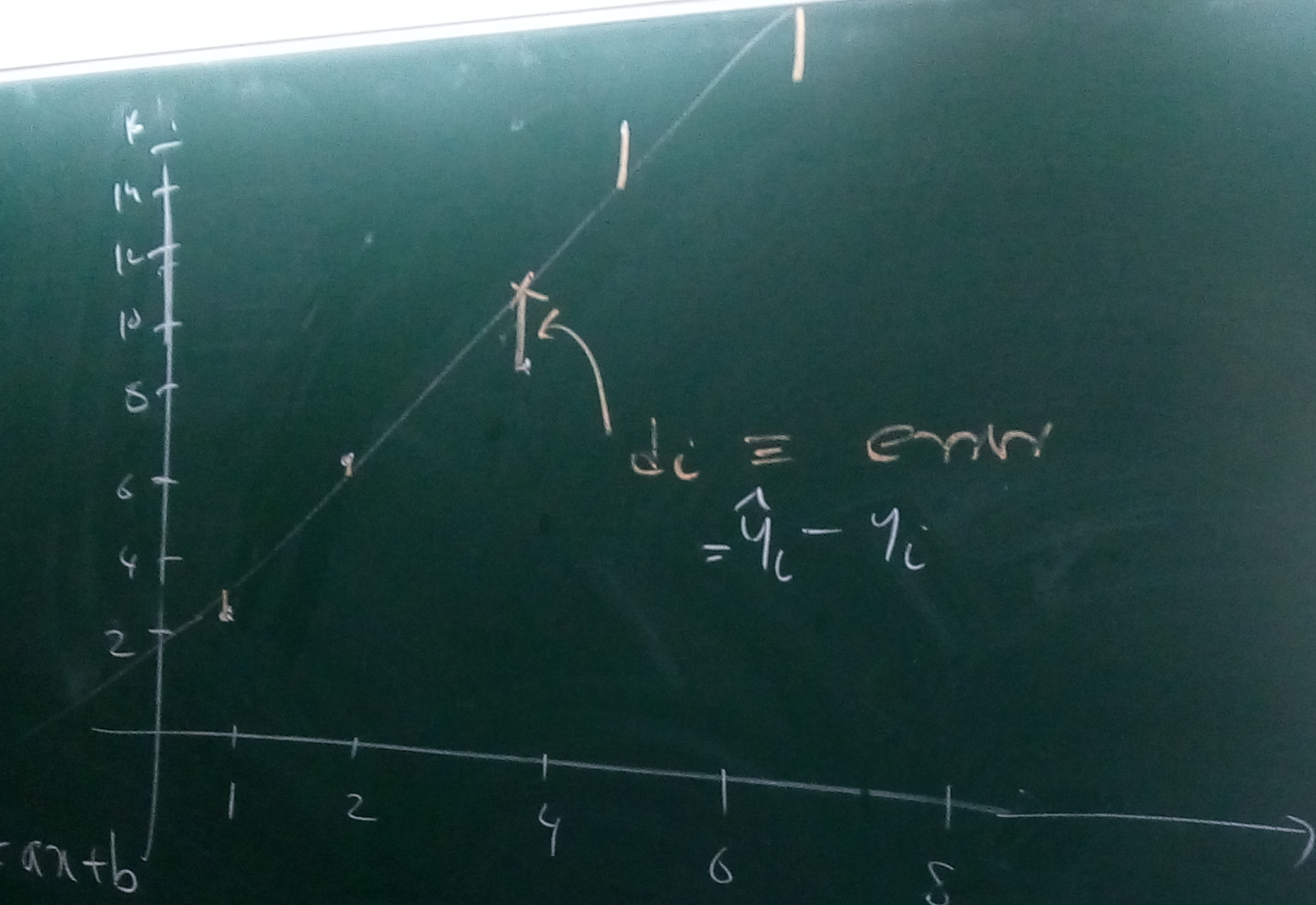


$y = ax + b$

$d_i \equiv \text{error}$

$= \hat{y}_i - y_i$

$d_i \quad 1 \le i \le n$

$d = \min\{d_i \mid 1 \le i \le n\}$

$\tilde{d} = \max\{d_i \mid 1 \le i \le n\}$

$\sum_{i=1}^{n} d_i = $ "0" in not
good indicator
because of cancellation

Simple . $\{w_i\}_{i=1}^{n} \in \mathbb{R}$

$\sum_{i=1}^{n} |b - w_i| = f(b)$

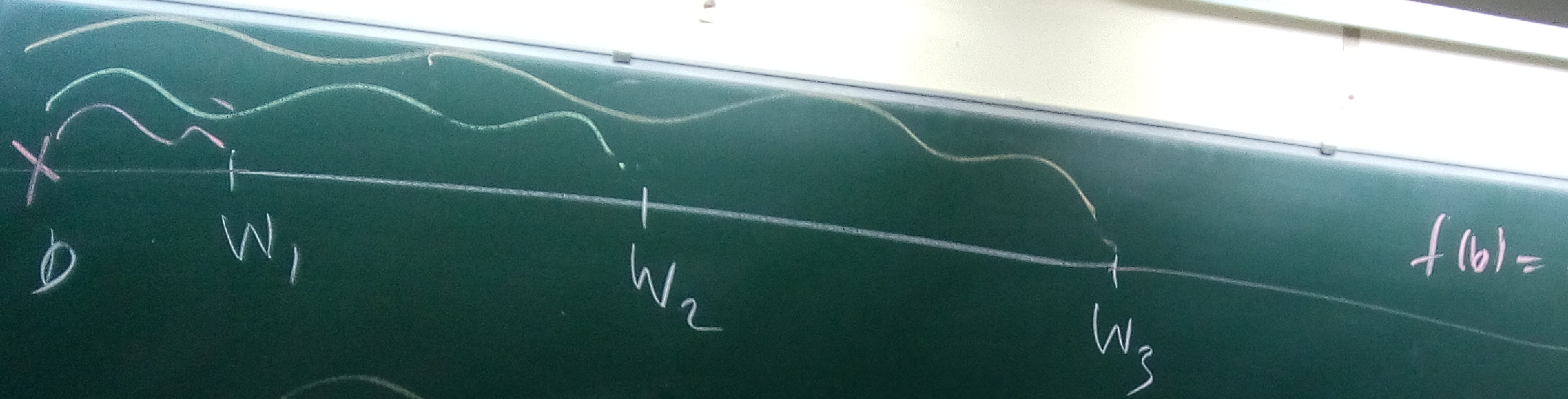
$\sum_{i=1}^{n} (b - w_i)^2 = f(b)$, $b = \frac{1}{n}\sum_{i=1}^{n} w_i$

$\bar{w}$

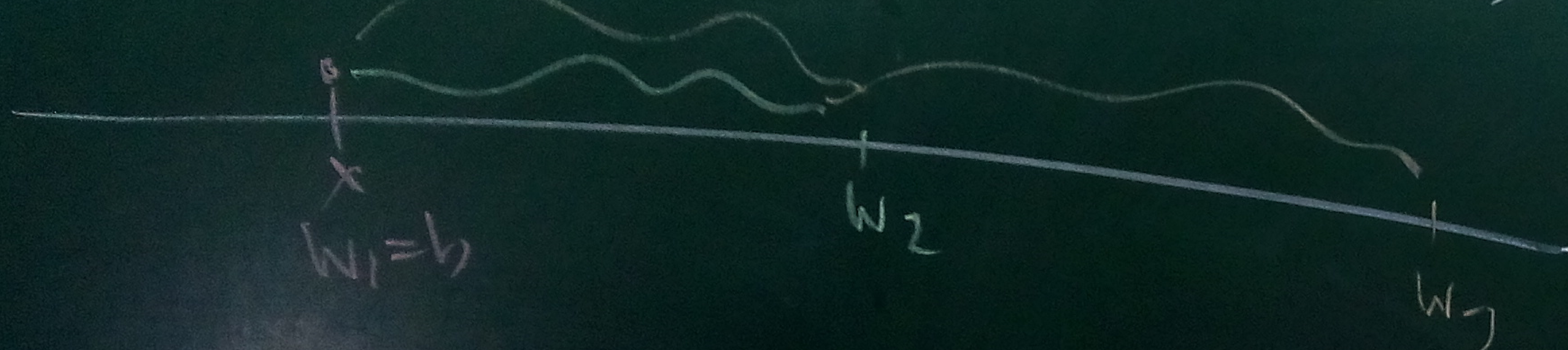
minimum of
f ?

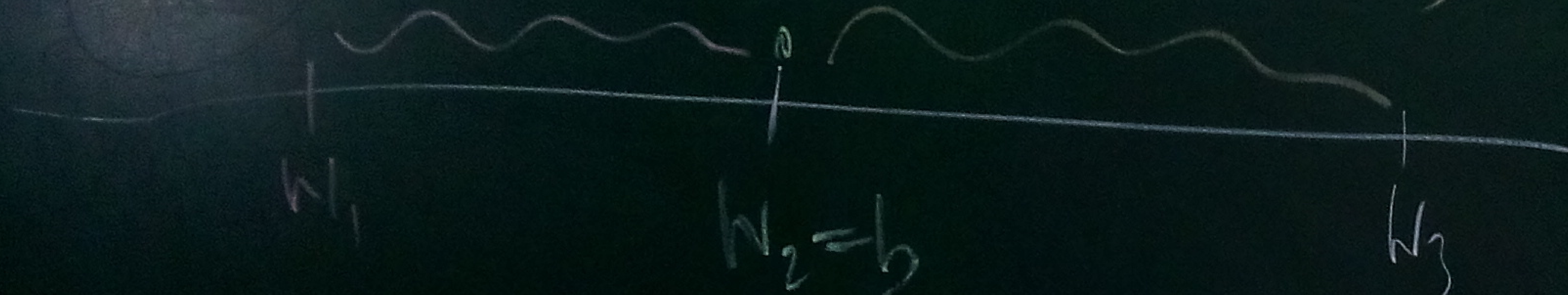
$- \sum_{i=1}^{n} |d_i| = \sum_{i=1}^{n} |\hat{y}_i - y_i| = \sum_{i=1}^{n} |a x_i + b - y_i| = f(a,b)$

$- \sum_{i=1}^{n} d_i^2 = \sum_{i=1}^{n} (y_i - a x_i - b)^2 = f(a,b)$



$f(b) = w_1 - b + w_2 - b + w_3 - b$





minima at w_2

"median"

$$f(b) = \sum_{i=1}^{n} (b - w_i)^2 = \sum_{i=1}^{n} (b - \bar{w} + \bar{w} - w_i)^2 = \sum_{i=1}^{n} (b - \bar{w})^2 + \sum_{i=1}^{n} (w_i - \bar{w})^2 + 2 \sum_{i=1}^{n} (b - \bar{w})(\bar{w} - w_i)$$

$$0 = 2(b - \bar{w}) \sum_{i=1}^{n} (w_i - \bar{w})$$

$$= n(b - \bar{w})^2 + \sum_{i=1}^{n} (w_i - \bar{w})^2$$

(6)

$$f(a,b) = \sum_{i=1}^{n} \left(a x_i + b - y_i - \bar{y} + \bar{y} - a\bar{x} + a\bar{x} \right)^2$$

$$(\mathcal{E}x) = \sum_{i=1}^{n} (y_i - \bar{y})^2 + a^2 \sum_{i=1}^{n} (x_i - \bar{x})^2 + n(-\bar{y} + a\bar{x} + b)^2 - 2a \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})$$

- $b = \bar{y} - a\bar{x}$ (at the minimum value)

- To find a: $\sum_{i=1}^{n} (y_i - \bar{y})^2 + a^2 \sum_{i=1}^{n} (x_i - \bar{x})^2 - 2a \sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})$

$a =$

$b =$

at
∴ minimum value

$$a = \frac{2\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{2\sum_{i=1}^{n}(x_i-\bar{x})^2}$$

$$\boxed{a = \frac{\sum_{i=1}^{n}(x_i-\bar{x})(y_i-\bar{y})}{\sum_{i=1}^{n}(x_i-\bar{x})^2} = \frac{\sigma_{xy}^2}{\sigma_x^2}}$$

$$\boxed{b = \bar{y} - \frac{\sigma_{xy}^2}{\sigma_x^2}\bar{x}}$$

Simple: $\{w_i\}_{i=1}^{n} \in \mathbb{R}$

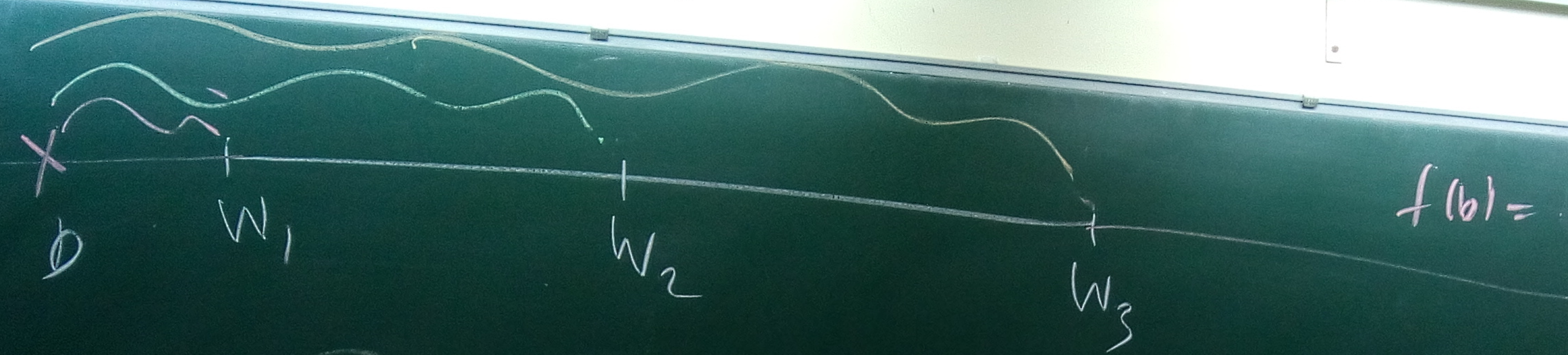
$$\sum_{i=1}^{n} |b - w_i| = f(b)$$

$$\sum_{i=1}^{n} (b - w_i)^2 = f(b), \quad b = \frac{1}{n}\sum_{i=1}^{n} w_i = \bar{w}$$

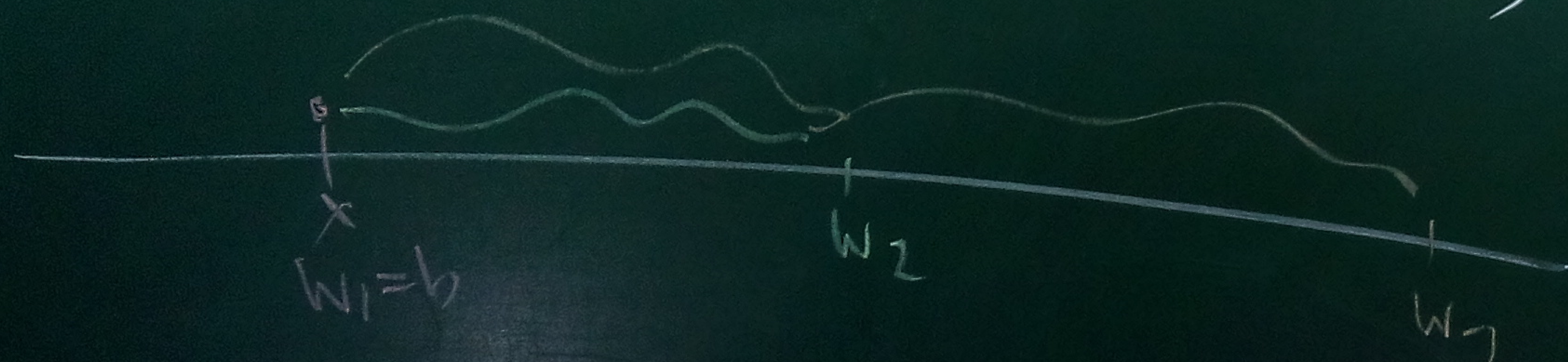
$$y = \frac{\sigma_{xy}^2}{\sigma_x^2}x + \left(\bar{y} - \frac{\sigma_{xy}^2}{\sigma_x^2}\bar{x}\right)$$

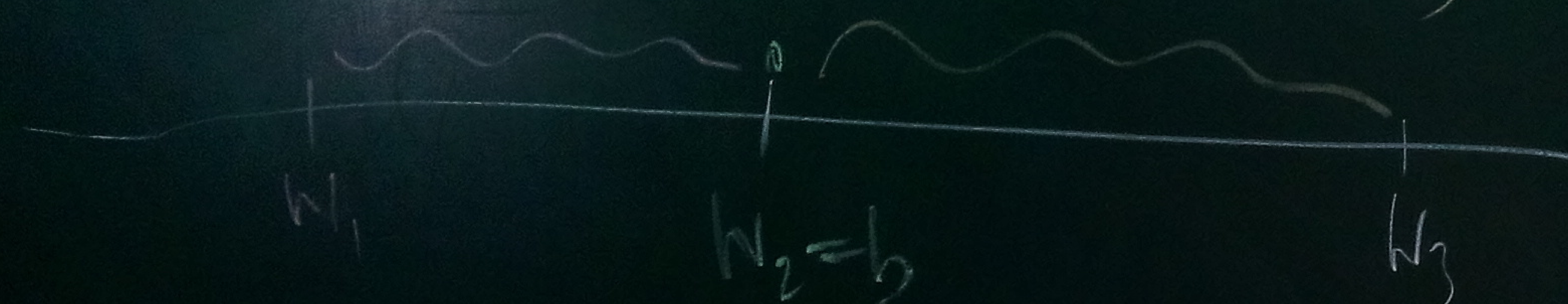
$$(y-\bar{y}) = (x-\bar{x})\frac{\sigma_{xy}^2}{\sigma_x^2}$$

$f(b) =$



$f(b) = w_1 - b + w_2 - b + w_3 - b$





minima at w_2

"median"

$$f(b) = \sum_{i=1}^{n} (b - w_i)^2 = \sum_{i=1}^{n} (b - \bar{w} + \bar{w} - w_i)^2 = \sum_{i=1}^{n} (b - \bar{w})^2 + \sum_{i=1}^{n} (w_i - \bar{w})^2 + 2\sum_{i=1}^{n} (b - \bar{w})(\bar{w} - w_i)$$

$$0 = 2(b - \bar{w}) \sum_{i=1}^{n} (w_i - \bar{w})$$

$$= n(b - \bar{w})^2 + \sum_{i=1}^{n} (w_i - \bar{w})^2$$