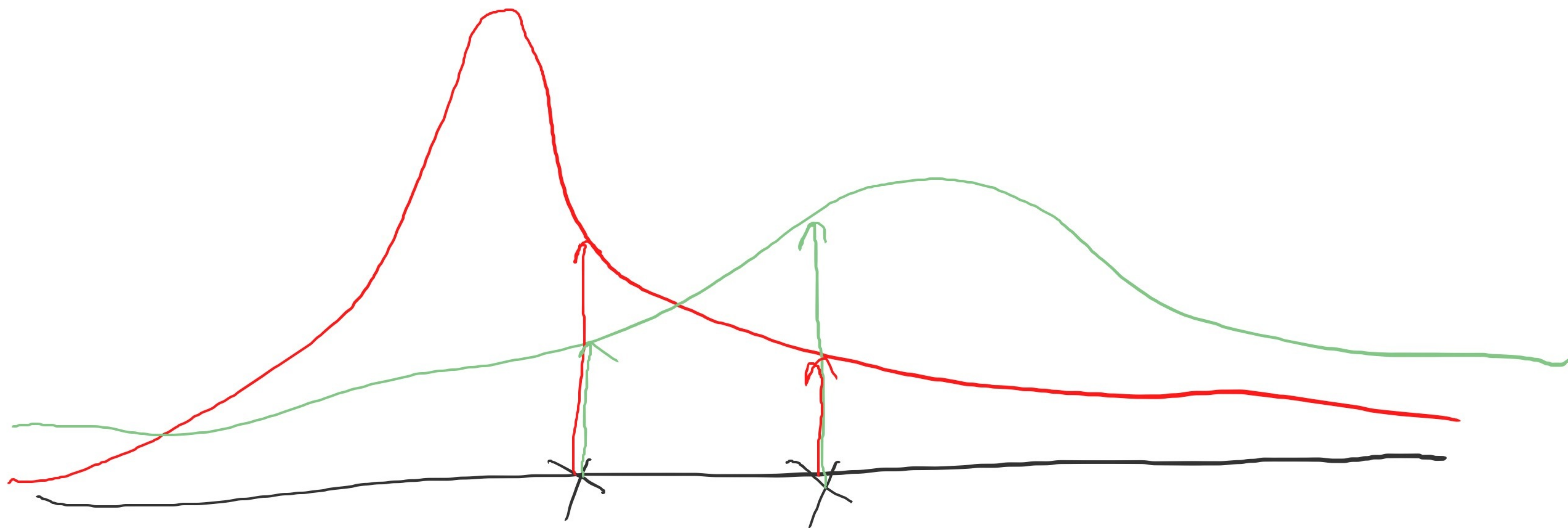




$$\frac{2}{3} +$$

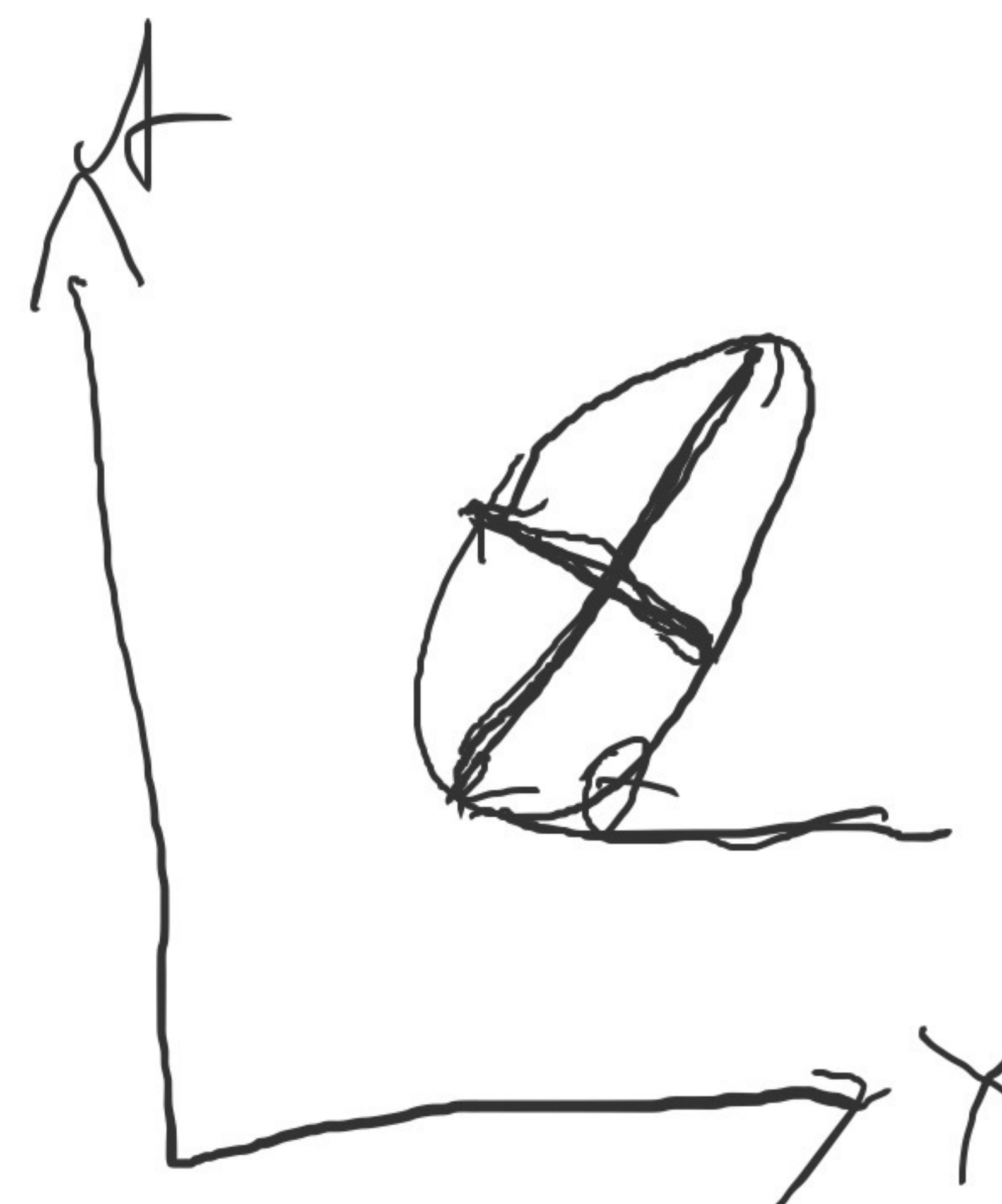
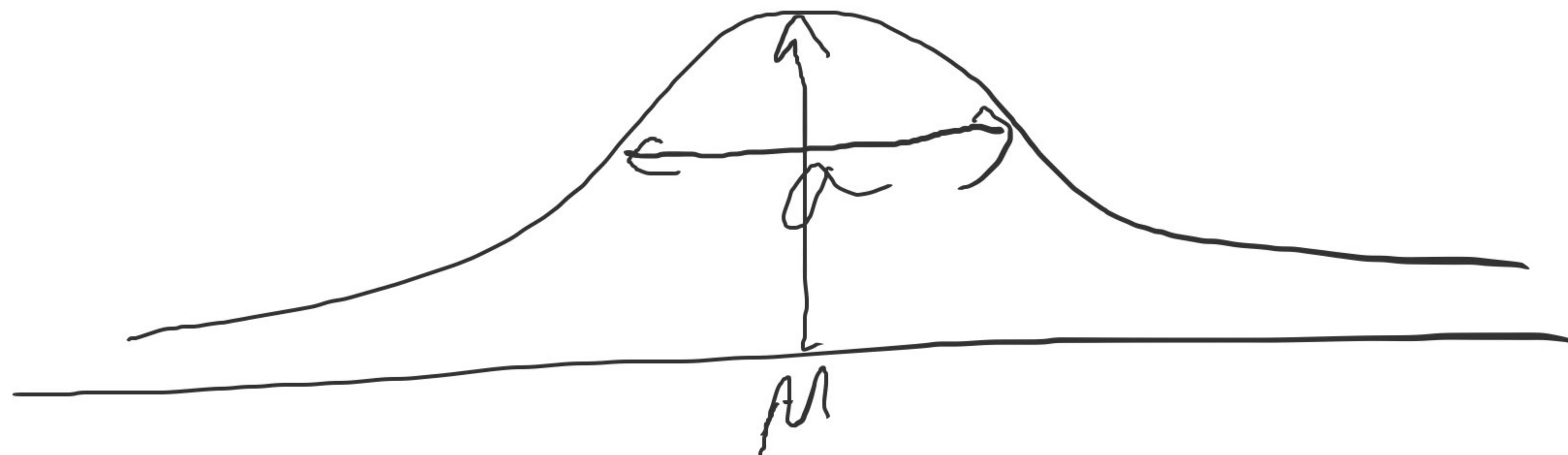
$$\frac{1}{2} 0$$



$$z_{ij} \propto p(x_i | c_j)$$

$$\forall_i \sum_j z_{ij} = 1$$

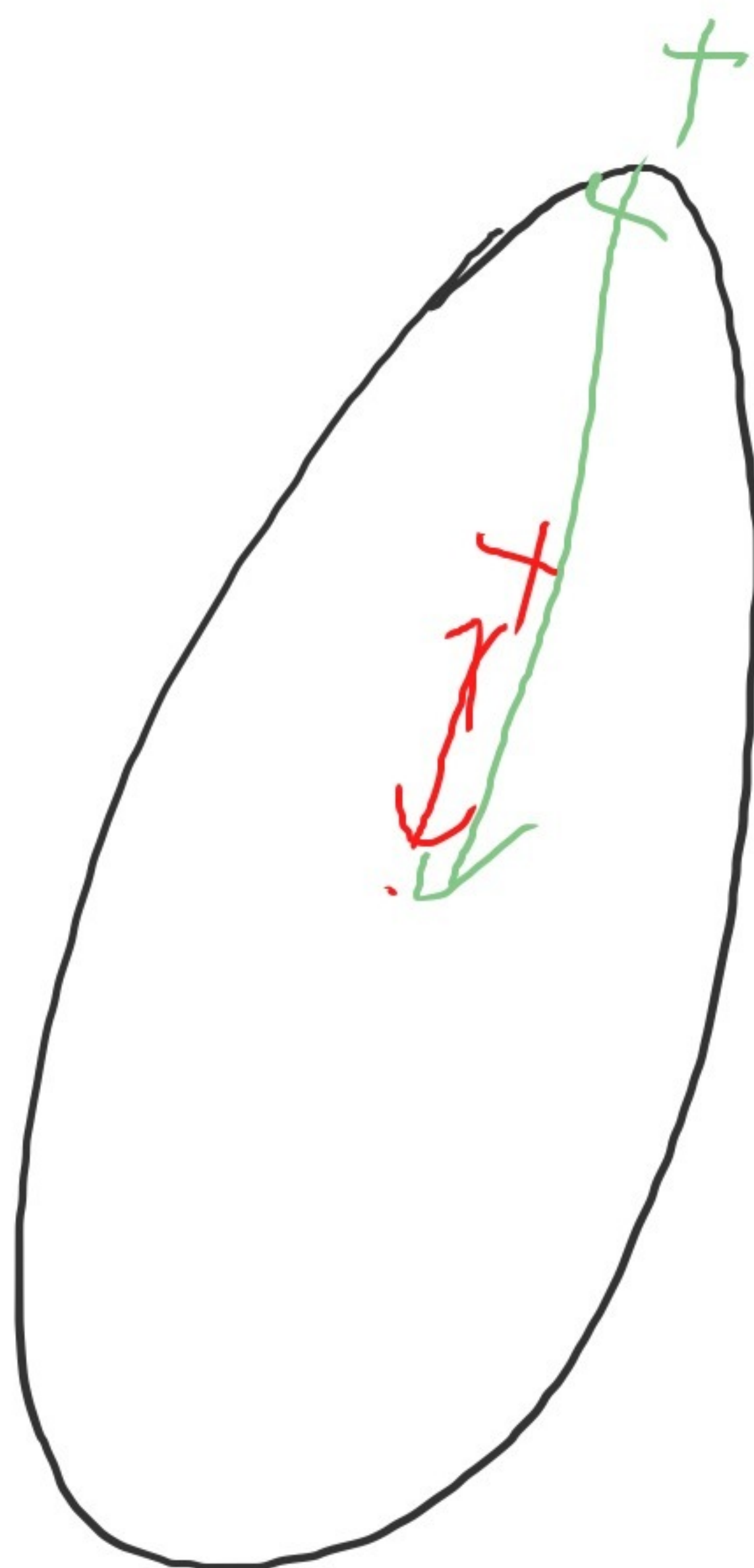
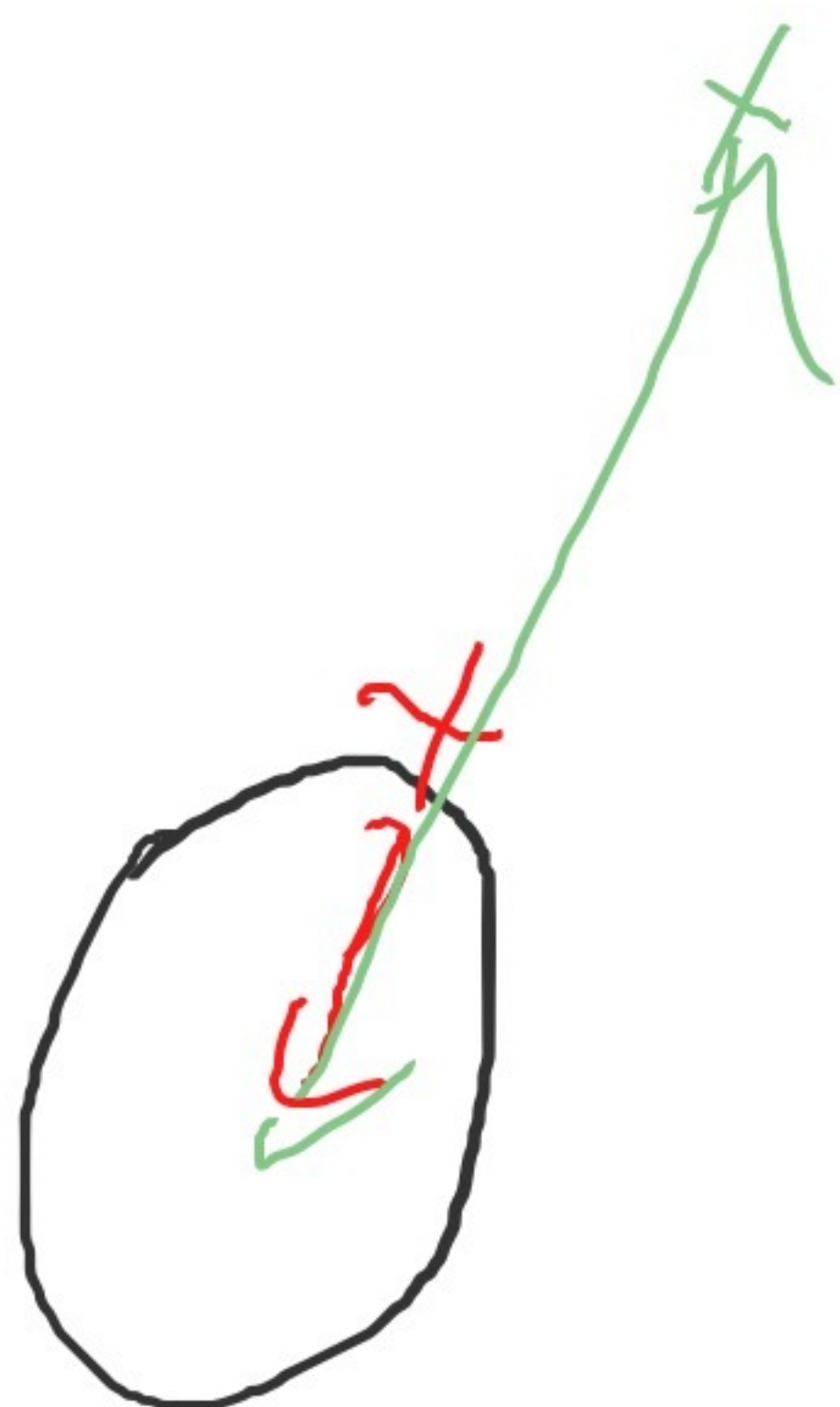
$$z_i$$



$$\|x\|^2 = \sqrt{x^T \cdot x} = \sqrt{x^2}$$

$$\|x - \mu\|^2 = \sqrt{(x - \mu)^T (x - \mu)}$$





$$\|x\|_{\mu, \Sigma}^2 = (x - \mu)^T \Sigma^{-1} (x - \mu) \quad \text{Mahalanobis Distance/Norm}$$

$$\|x\|_{\mu}^2 = (x - \mu)^T (x - \mu) \quad \text{Euclidean Distance/Norm}$$

$$\Sigma^{-1} = I$$

$$\mathcal{N}(x | \mu, \Sigma) = \frac{1}{\sqrt{2\pi} |\Sigma|}} e^{-\frac{1}{2} \|x\|_{\mu, \Sigma}^2}$$

$$Z_{ij} = \pi_j \mathcal{N}(x_i | \mu_j, \Sigma_j)$$

Diagram illustrating the mixture model equation $Z_{ij} = \pi_j \mathcal{N}(x_i | \mu_j, \Sigma_j)$. The parameters π_j , μ_j , and Σ_j are circled in red, and the entire expression is enclosed in a green box. Blue arrows point to the π_j , μ_j , and Σ_j terms. A green arrow points from the x_i term in the equation to the x_i term in the mixture model diagram below.

x_i

mixture
model



x_i

sample

E-step
Expectation-step

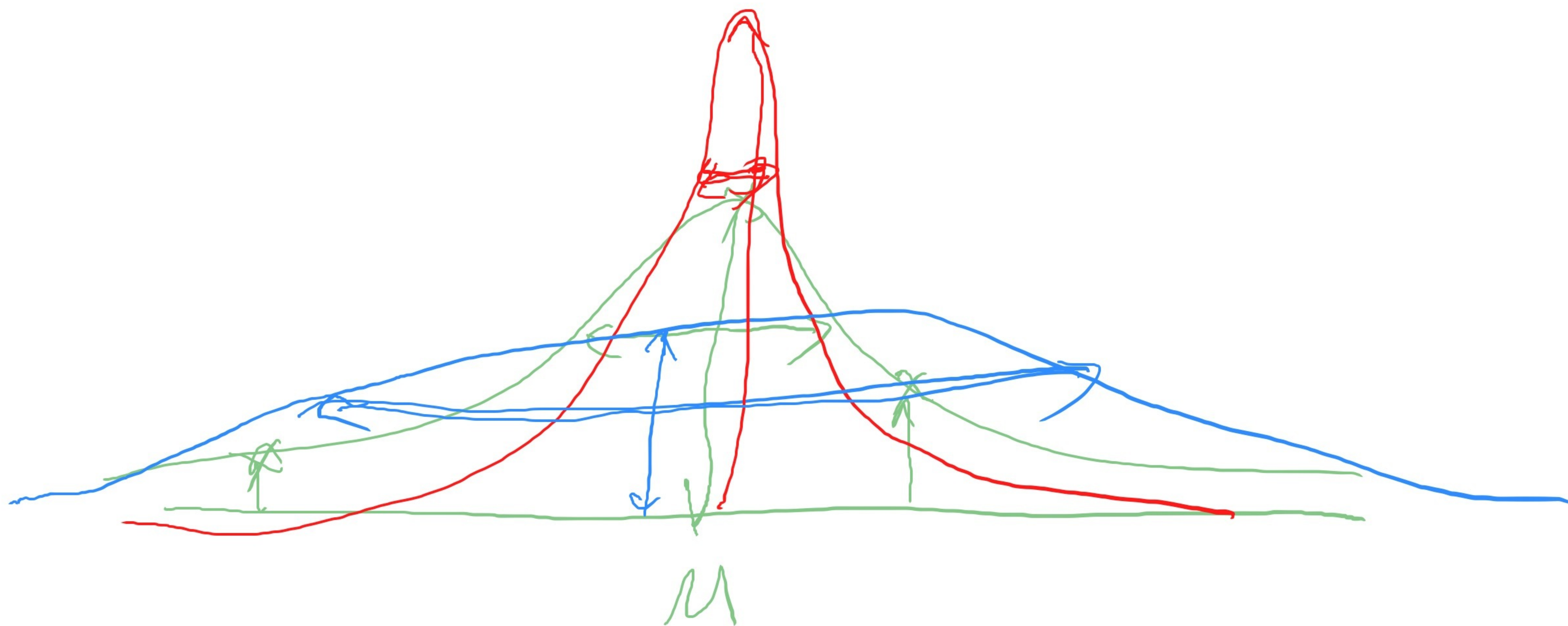
- 1 - discrete distribution over class
- 2 - distribution for each class

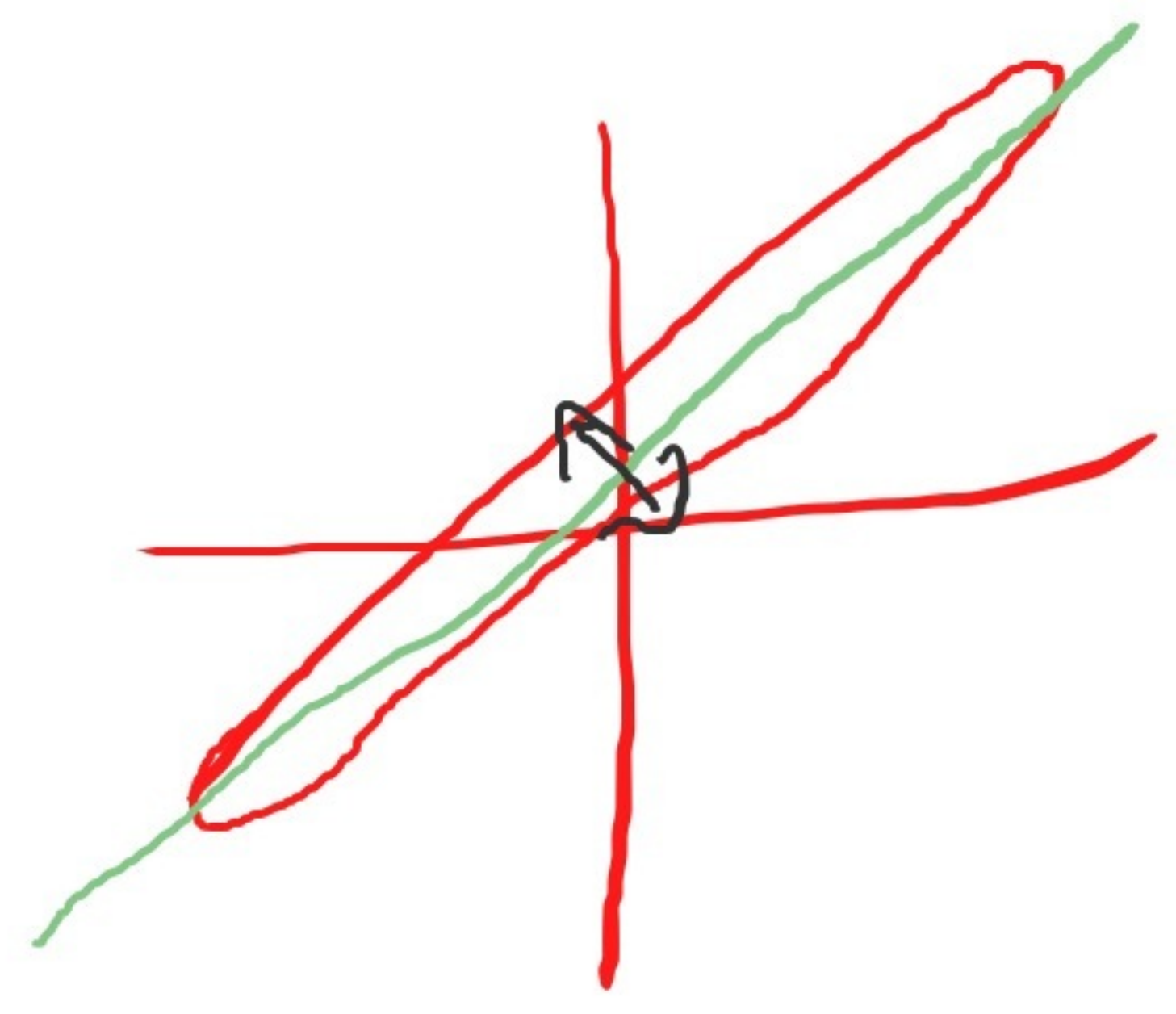
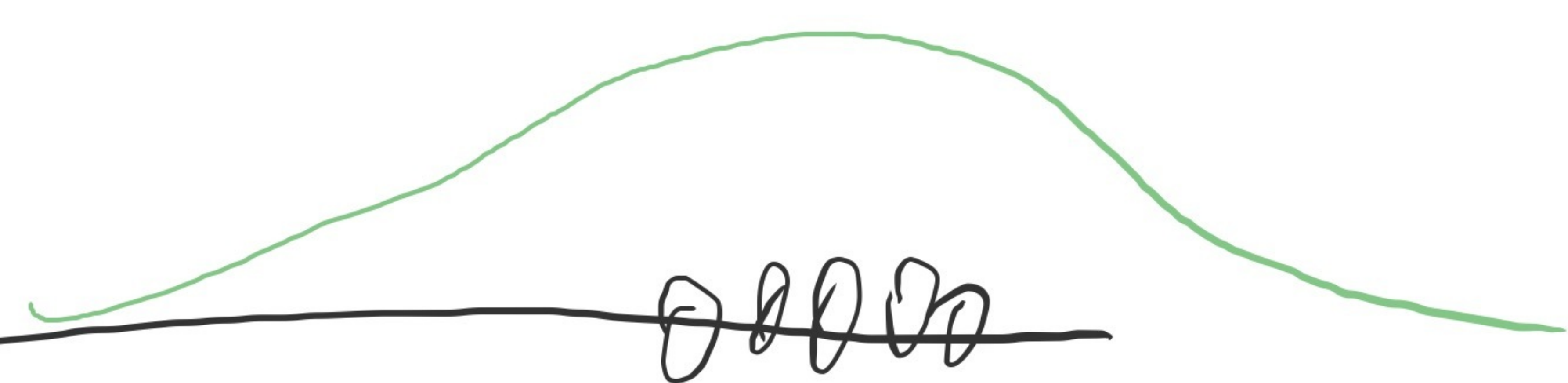
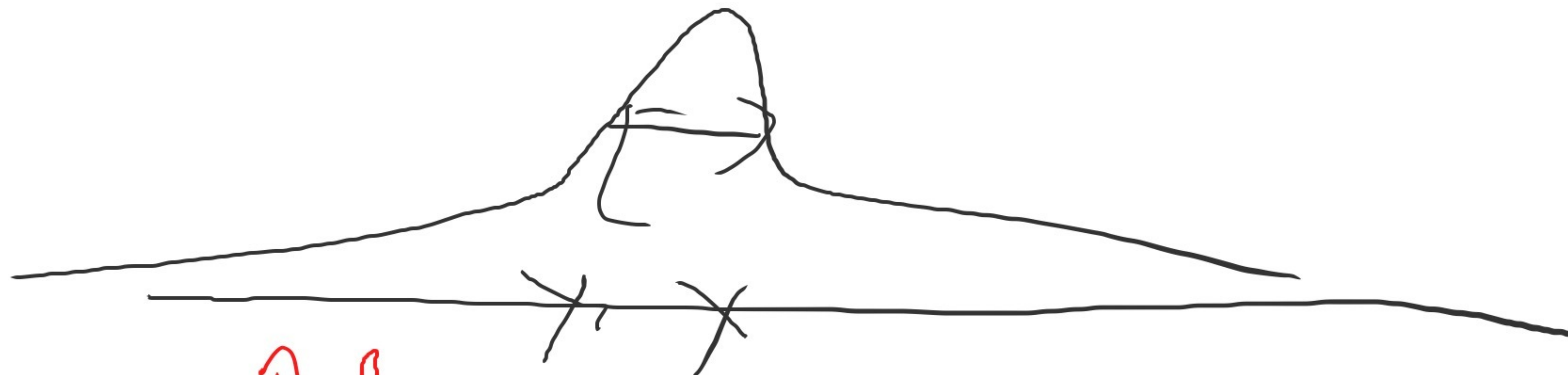
$$\rightarrow \pi_j \propto \sum_i z_{ij} \quad \sum_j \pi_j = 1$$

$$\rightarrow \mu_j = \frac{1}{\pi_j} \sum_i z_{ij} x_i \quad \frac{1}{I} \sum_i x_i$$

$$\rightarrow \Sigma_j = \frac{1}{\pi_j} \sum_i z_{ij} (x_i - \mu_j) (x_i - \mu_j)^T$$

M-step
Maximization step





$$z_{i1} = \frac{1}{\sum_j z_{ij}} P(x_i | \mu_j, \Sigma_j) = \frac{1}{\sum_j P(x_i | \mu_j, \Sigma_j)} P(x_i | \mu_j, \Sigma_j)$$

$$z_{ij} \propto P(x_i | \mu_j, \Sigma_j)$$

$$(\forall i) \sum_j z_{ij} = 1$$

