Importance Sampling $\qquad E(X) = \int\limits_{-\infty}^{\infty} p(x) \cdot x \cdot dx$
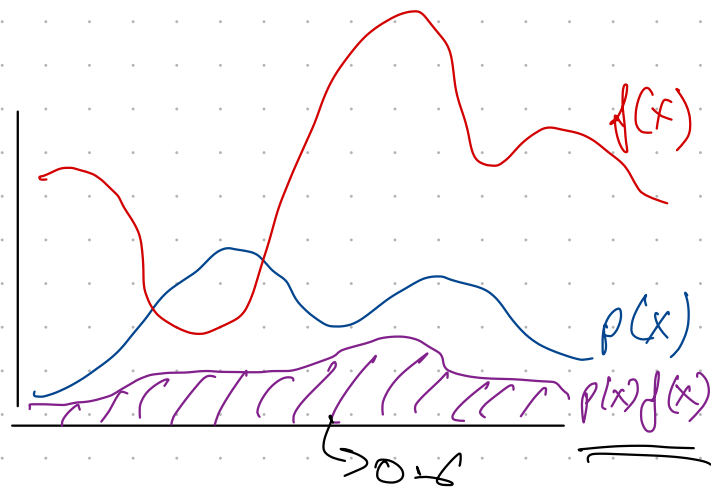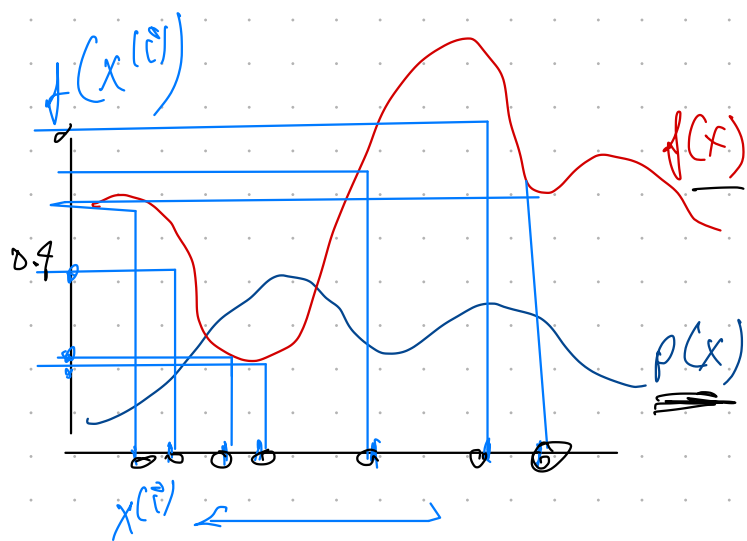
$$E[f(x)] = \int\limits_{-\infty}^{\infty} p(x) f(x) dx$$

$$E(f(x)) \approx \frac{1}{N} \sum^{2} f(x^{(i)}) \quad , \quad x^{(i)} \sim p(x)$$

$$E_p(f(x)) = \int p(x) f(x) dx$$

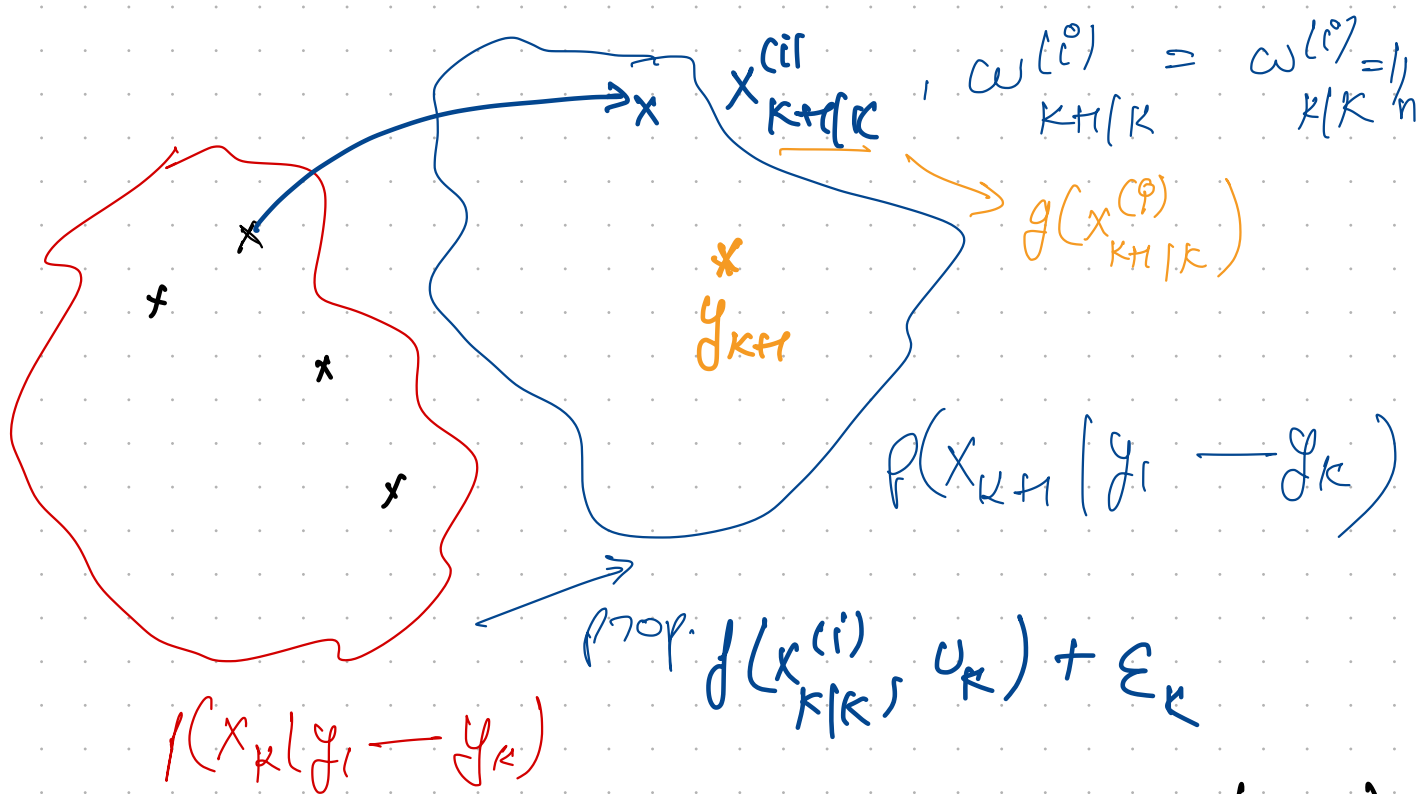$$= \int p(x) f(x) \left(\frac{q(x)}{q(x)} \right) dx$$

$$= \int q(x) \left[\frac{p(x)}{q(x)} \cdot f(x) \right] dx$$

$$E_p\left(f(x)\right) = E_q\left[\frac{p(x)}{q(x)} \cdot f(x)\right]$$

$$\approx \frac{1}{N}\sum_{i}^{N} \frac{p(x^{(i)})}{q(x^{(i)})} \cdot f(x^{(i)}) \qquad x^{(i)} \sim q(x)$$

$$\approx \frac{1}{N}\sum_{i=1}^{N} \underbrace{\omega^{(i)}}_{=} \cdot f(x^{(i)}) \qquad \underline{\underline{x^{(i)} \sim q(x)}}$$

$$\omega^{(i)}_{k+1|k} = \frac{\omega^{(i)}_{k|k} = 1}{n}$$

$$g\left(x^{(i)}_{k+1|k}\right)$$

$$p\left(x_{k+1} \mid y_1 \longrightarrow y_k\right)$$

$$\text{prop. } f\left(x^{(i)}_{k|k}, u_k\right) + \varepsilon_k$$

$$f\left(x_k \mid y_1 \longrightarrow y_k\right)$$

$$\longrightarrow \sim N(0, Q)$$

$$y_{k+1} = g\left(x^{(i)}_{k+1|k}\right) + V_k$$