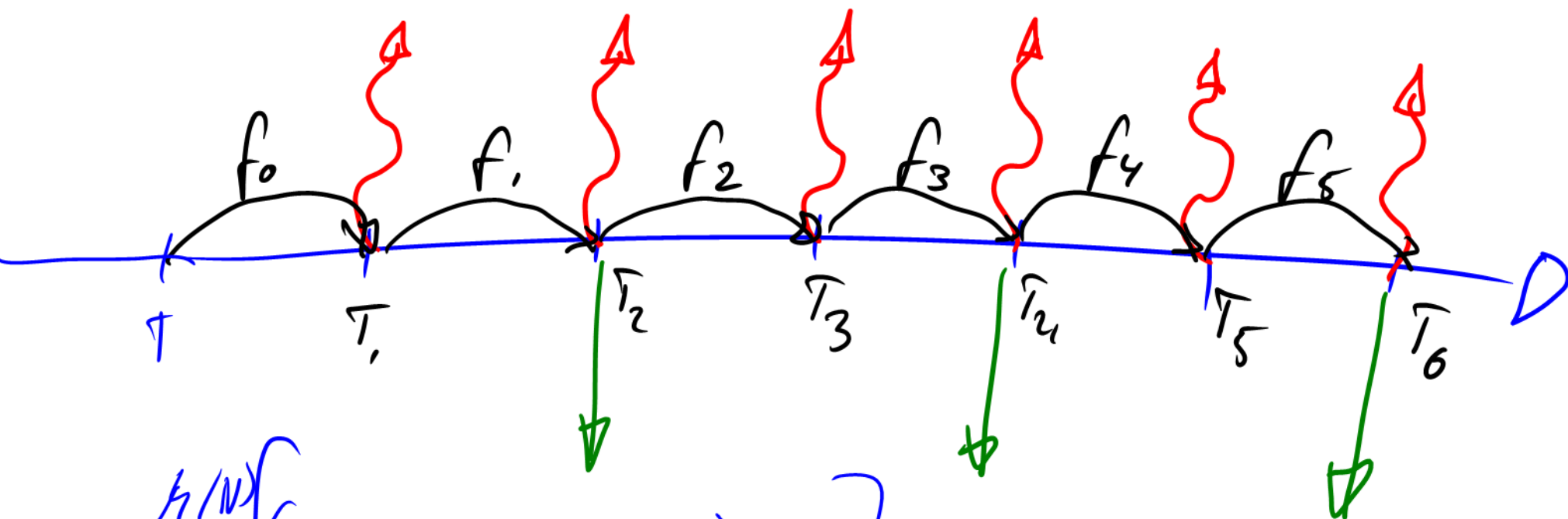
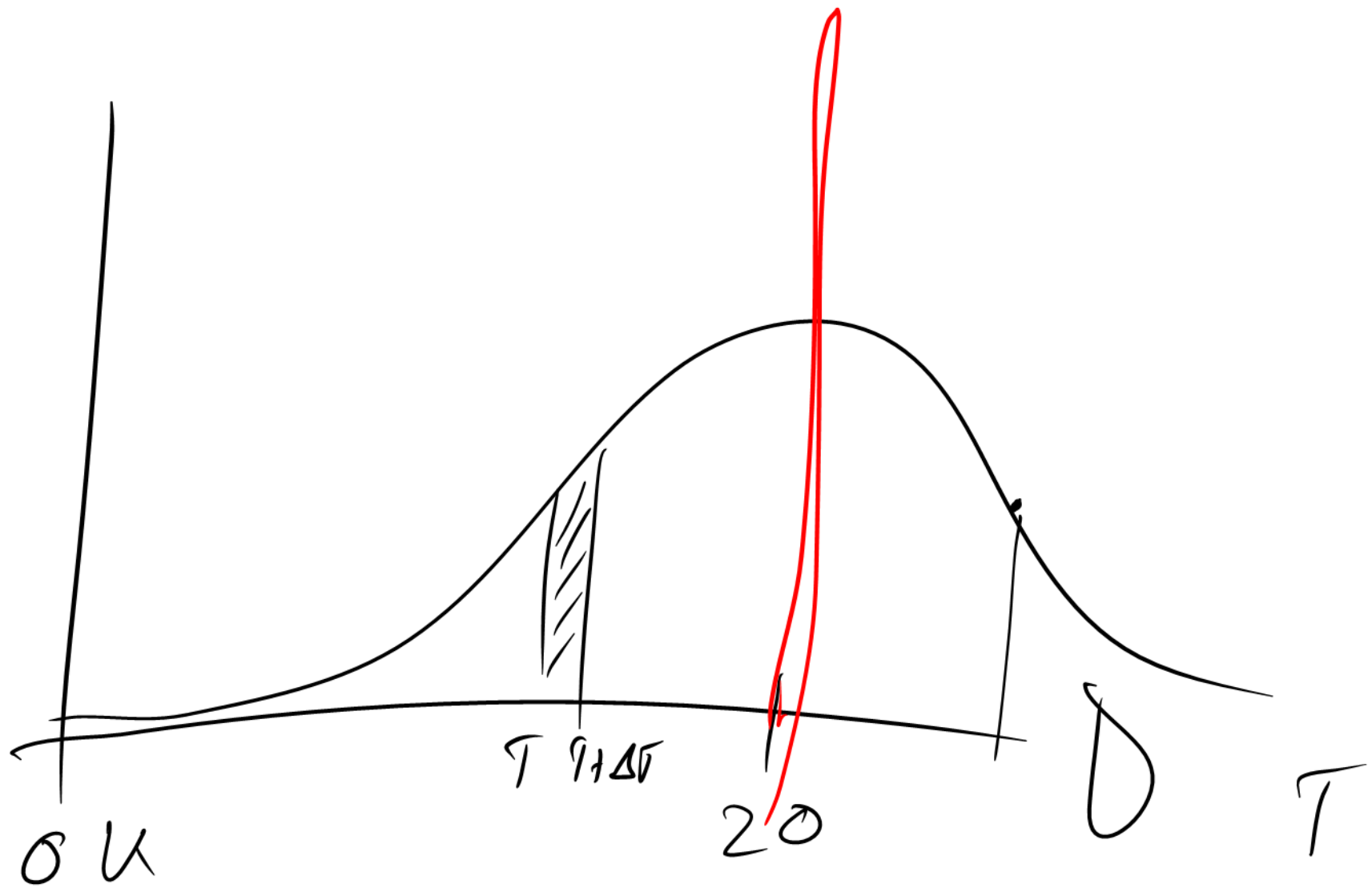


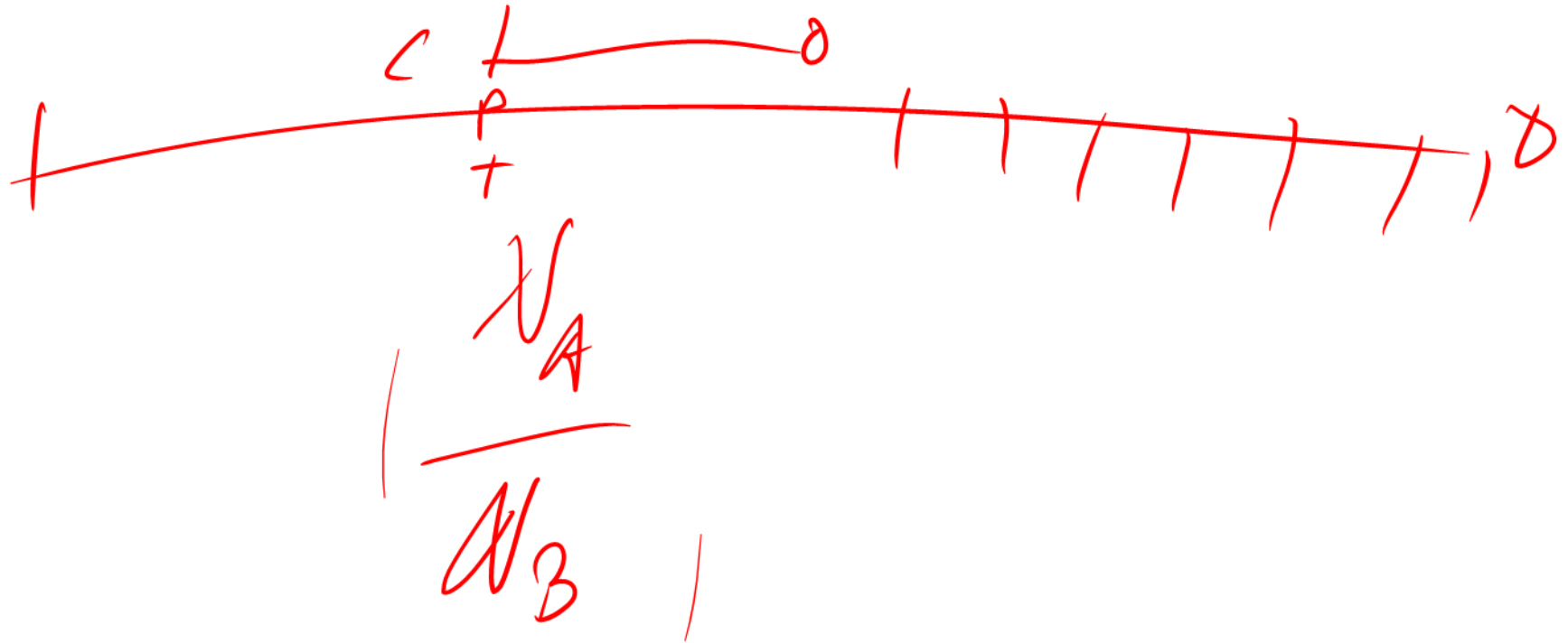
A swap



$$E \left[\frac{K/N \cdot (B - A)_+}{N} \right] \cdot N(0)$$



$$E^{M(N)} \left[\frac{CCT}{NCT} \right] \cdot W(0)$$



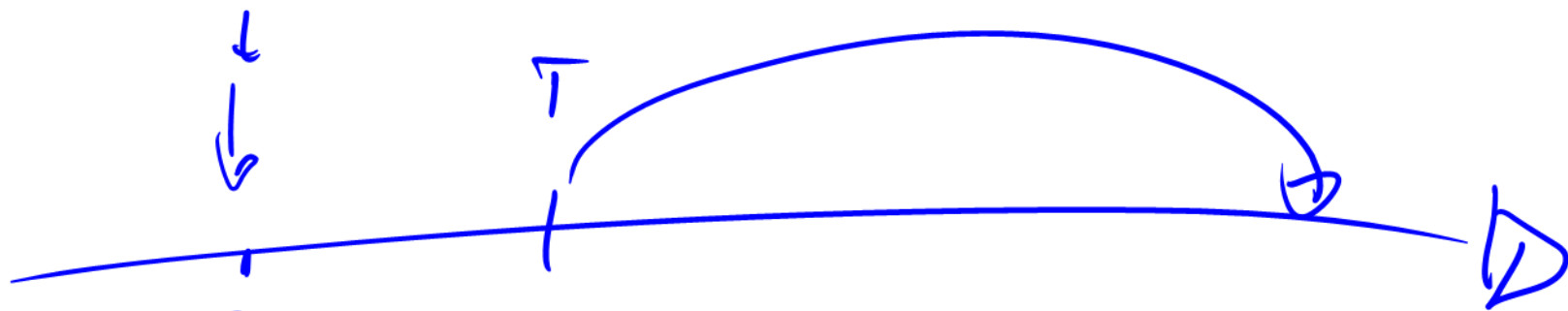
$$SR \cdot B - A = 0$$

$$SR = \frac{A}{B}$$

$$A = SR \cdot B$$

$$(u \cdot B - A)_+ = (u \cdot B - SR \cdot B)_+ = (u - SR)_+ \cdot B$$

$$\text{npv}_{\text{swaption}} = \frac{B(0, T)}{A} E^{Q(B)} \left[\frac{(u - SR)_+ \cdot B}{B} \right]$$



$$SR(t) = \frac{A(t)}{B(t)}$$

$SR(0)$



$$= B(0) \cdot E \left[\frac{(1 - SR(t)) \cdot B(t)}{B(t)} \right]$$

$$0 = \underline{B(0)} \cdot \left[1 - E^{SR(0)} [SR(t)] \right]$$

$$SR(0) = E[SR(t)]$$

W

$$dW^2 = df$$

$$f(x) = x^2 + \sinh(x)$$

$$f(W, t)$$

$$df = \frac{\partial f}{\partial t} dt + \frac{\partial f(W, t)}{\partial W} dW + \frac{1}{2} \frac{\partial^2 f}{\partial W^2} dW^2$$

$$\int df$$

$$\frac{1}{dt} \left[\frac{dt_i}{f_i} \cdot \frac{d(1 + f_n r_n)}{1 + f_n r_n} \right] = \frac{1}{dt} \left[\frac{\sigma_i d\tilde{w}_i f_n \sigma_n r_n}{1 + f_n r_n} \right]$$

$$= \frac{1}{dt} \frac{\sigma_i \sigma_n \sin dt \cdot f_n}{1 + f_n r_n}$$

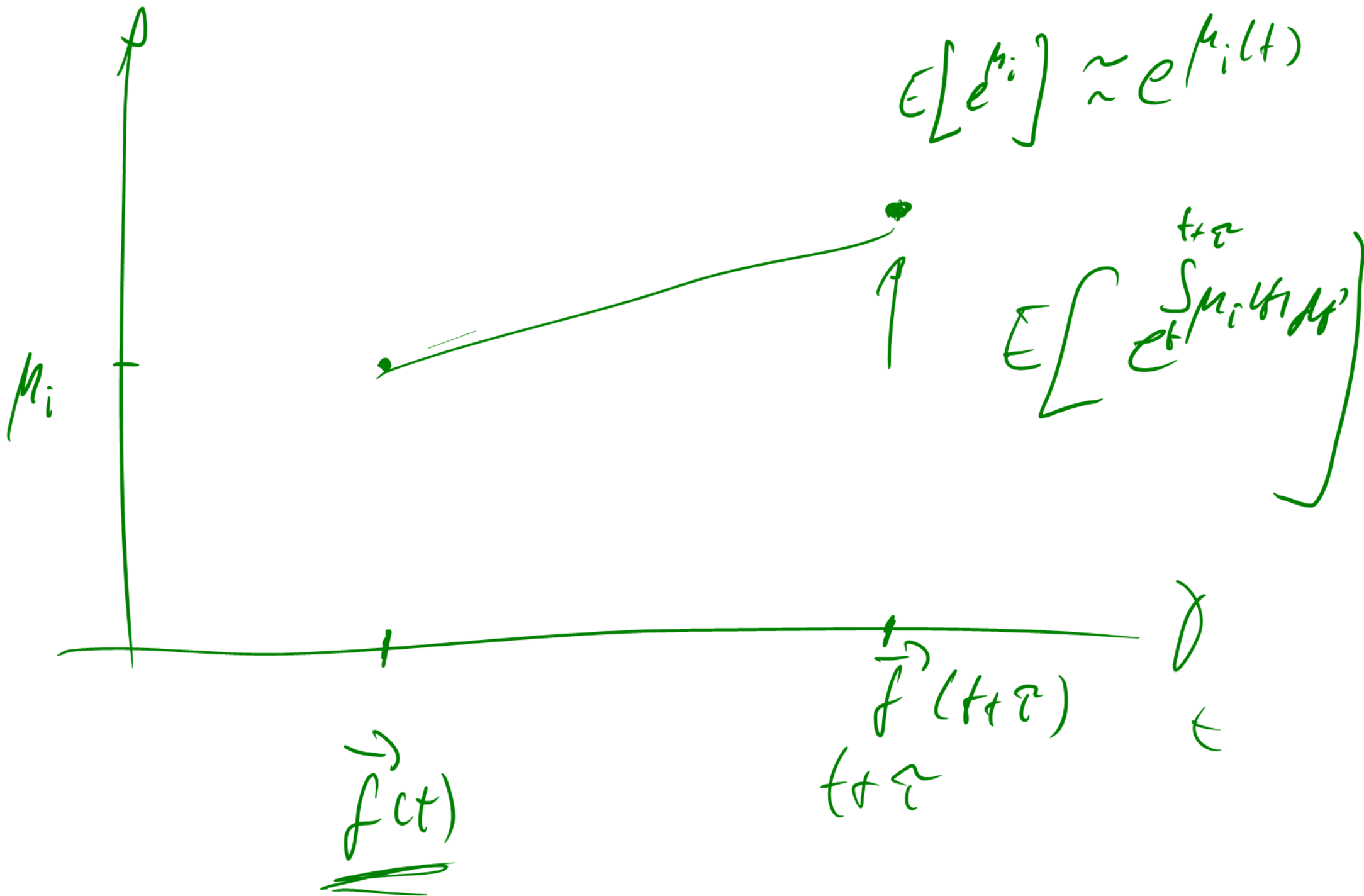
$$= \frac{c_{in} \cdot f_n}{1 + f_n r_n}$$

$$E^{n(P_N)} \left[\underline{x_i(t) \mu_i(t) f_i(t)} \mid \mathcal{F}_t \right] dt$$

$$+ E^{n(P_N)} \left[\underline{dx_i(t) \cdot df_i(t)} \mid \mathcal{F}_t \right]$$

$$x_i(t) \mu_i(t) f_i(t) dt = - E^{n(P_N)} \left[dx_i(t) \cdot df_i(t) \mid \mathcal{F}_t \right]$$

$$\mu_i = - E^{n(P_N)} \left[\overline{\frac{dx_i}{x_i} \frac{df_i}{f_i}} \right]$$



$$E \left[\int_{t+\tau}^{t+\tau} \mu_i(u) du \right] \approx \tau$$

$$\left(\frac{\mu_i(t) + \mu_i(t+\tau)}{2} \right) \tau$$

$$\frac{\mu_i(t+\tau)}{\uparrow} \approx$$

$$O(\tau)$$