Regular Acquisition Functions

- Aim to find the maximum in a single step
- Do not capture the value of the information gained from sampling a solution
- **Where is the maximum of our function?**

Knowledge Gradient

- Sampling at a point provides some information to later time steps
- Simulates a one step lookahead from our sampling point
- **If I sample next at point x what's the expected increase in my best predicted value after updating the GP?**

Formal Definition

$$\mathrm{KG}(x) = \mathbb{E}\left[\max_{x'' \in \mathcal{X}} \{\mu_y^{n+1}(x'')\} - \max_{x' \in \mathcal{X}} \{\mu_y^{n}(x')\} \;\middle|\; x^{n+1} = x\right].$$