Exercise: Derivation of the EP updates for trueskill

Derive the followijng update equation for EP applied to the trueskill model:

$$\mu_g^t = \mu_{h_g \to d_g}^t + y_g \sigma_{h_g \to d_g}^t \Psi\left(\frac{y_g \mu_{h_g \to d_g}^t}{\sigma_{h_g \to d_g}^t}\right) \tag{1}$$

Hint: if we define the rectified truncated Gaussian as follows

$$\mathbb{R}(x; \mu, \sigma^2, l, u) = \mathbb{I}_{x \in (l,u)} \frac{\mathcal{N}(x; \mu, \sigma^2)}{\Phi(u; \mu, \sigma^2) - \Phi(l; \mu, \sigma^2)} \tag{2}$$

then one can show (see Equations 4.2 and 4.4 of (**?**)) that its mean is given by

$$\mu_{\mathbb{R}} = \mu + \sigma \frac{\mathcal{N}(\frac{l}{\sigma} - \frac{\mu}{\sigma}) - \mathcal{N}(\frac{u}{\sigma} - \frac{\mu}{\sigma})}{\Phi(\frac{u}{\sigma} - \frac{\mu}{\sigma}) - \Phi(\frac{l}{\sigma} - \frac{\mu}{\sigma})} \tag{3}$$