N2.
$$\frac{\partial \log p(t|\theta)}{\partial \log \theta_j} = \frac{\partial \log p(t|\theta)}{\partial \theta_j} \cdot \frac{\partial \theta_j}{\partial \log \theta_j} = \frac{\partial \log p(t|\theta)}{\partial \theta_j} \theta_j$$

N3

$$N(x|0,1) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{1}{2}x^2\right)$$

$$\Rightarrow \frac{\partial N(x|0,1)}{\partial x} = -\frac{x}{\sqrt{2\pi}} \exp\left(-\frac{x^2}{2}\right)$$

$$EI(x) = \mathbb{E}_{y(x)} \max(0, t_{min} - y(x)) = \int_{-\infty}^{+\infty} \max(0, t_{min} - y(x)) \, p(y(x)) \, dy(x)$$

$$= \int_{-\infty}^{t_{min}} (t_{min} - y(x)) \, p(y(x)) \, dy(x) =$$

$$= \int_{-\infty}^{t_{min}} (t_{min} - y(x)) \frac{1}{\sqrt{2\pi\sigma^2(x)}} \exp\left(-\frac{1}{2\sigma^2(x)}(y(x) - \mu(x))^2\right) dy(x) =$$

$$= \left\{ s(x) = \frac{y(x) - \mu(x)}{\sigma(x)}, \quad t_{new} = \frac{t_{min} - \mu(x)}{\sigma(x)} \right\}$$

$$= \int_{-\infty}^{t_{new}} (t_{min} - \sigma(x)s(x) - \mu(x)) \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{s^2(x)}{2}\right) d\, s(x) =$$

$$= \int_{-\infty}^{t_{new}} (t_{min} - \mu(x)) \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{s^2(x)}{2}\right) d\, s(x) -$$

$$- \int_{-\infty}^{t_{new}} \frac{\sigma(x)s(x)}{\sqrt{2\pi}} \exp\left(-\frac{s^2(x)}{2}\right) d\, s(x) =$$

$$= (t_{min} - \mu(x)) \, \Phi\left(\frac{t_{min} - \mu(x)}{\sigma(x)}\right) + \sigma(x) N\left(\frac{t_{min} - \mu(x)}{\sigma(x)} \bigg| 0,1\right)$$