Note: μ is the observed expectation value, and σ is the standard error of μ.
For $\mu > 0$ condition:

$$\begin{aligned}
P(x|\mu_{opt}, x \geq 0) = \quad & \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu_{opt})^2}{2\sigma^2}} = P(x|\mu_{opt} = x, x \geq 0) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-x)^2}{2\sigma^2}} && = \frac{1}{\sigma\sqrt{2\pi}} \\
P(x|\mu_{opt}, x < 0) = \quad & \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu_{opt})^2}{2\sigma^2}} = P(x|\mu_{opt} = 0, x < 0) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-0)^2}{2\sigma^2}} && = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}} \\
R(x|x \geq 0) = \quad & P(x|\mu, x \geq 0)/P(x|\mu_{opt}, x \geq 0) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} / \frac{1}{\sigma\sqrt{2\pi}} && = e^{-\frac{(x-\mu)^2}{2\sigma^2}} \\
R(x|x < 0) = \quad & P(x|\mu, x < 0)/P(x|\mu_{opt}, x < 0) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} / \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}} && = e^{\frac{2x\mu-\mu^2}{2\sigma^2}}
\end{aligned}$$

$$\begin{aligned}
-x_u^2 + 2x_u\mu - \mu^2 &= 2x_l\mu - \mu^2 \\
\Rightarrow -x_u^2 + 2x_u\mu &= 2x_l\mu \\
\Rightarrow x_l &= \frac{2\mu x_u - x_u^2}{2\mu}
\end{aligned}$$

For $\mu < b$ condition:

$$\begin{aligned}
P(x|\mu_{opt}, x \leq b) = \quad & P(x|\mu_{opt} = x, x \leq b) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-x)^2}{2\sigma^2}} && = \frac{1}{\sigma\sqrt{2\pi}} \\
P(x|\mu_{opt}, x > b) = \quad & P(x|\mu_{opt} = b, x > b) && = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-b)^2}{2\sigma^2}} \\
R(x|x \leq b) = \quad & P(x|\mu, x \leq b)/P(x|\mu_{opt}, x \leq b) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} / \frac{1}{\sigma\sqrt{2\pi}} && = e^{-\frac{(x-\mu)^2}{2\sigma^2}} \\
R(x|x > b) = \quad & P(x|\mu, x > b)/P(x|\mu_{opt}, x > b) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}} / \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-b)^2}{2\sigma^2}} && = e^{\frac{(2x-(\mu+b))(\mu-b)}{2\sigma^2}}
\end{aligned}$$

$$\begin{aligned}
-x_u^2 + 2x_u\mu - \mu^2 &= 2x_l(\mu - b) - \mu^2 + b^2 \\
\Rightarrow -x_u^2 + 2x_u\mu - b^2 &= 2x_l(\mu - b) \\
\Rightarrow x_l &= \frac{2\mu x_u - x_u^2 - b^2}{2(\mu - b)}
\end{aligned}$$