3c $h^*(x) = \underset{y \in \{-1,1\}}{\operatorname{argmin}} \; P(Y=y \mid X=x)$

$\Rightarrow$ " $\underset{y}{\operatorname{argmin}} \; \dfrac{P(X=x \mid Y=y)\, P(Y=y)}{P(X=x)}$

$\Rightarrow$ " $\underset{y}{\operatorname{argmin}} \; P(X=x \mid Y=y)\, P(Y=y)$ ($\because$ denominator does not impact outcome)

$\Rightarrow$ " $\underset{y}{\operatorname{argmin}} \; \dfrac{P(X=x \mid Y=y)}{2}$ (We can take away the $\frac{1}{2} = P(Y=y)$ as well since it's a constant)

$\Rightarrow \underset{y}{\operatorname{argmin}} \; \dfrac{1}{\sqrt{2\pi}} e^{\frac{-(x-s_y)^2}{2}}$

This results in the classifier

$$h^*(x) = \begin{cases} -1 & \text{if } x < 0 \\ 1 & \text{if } x \geq 0 \end{cases}$$

$\because$ $P(X=x \mid Y=-1) >$ $P(X=x \mid Y=1)$ when $x < 0$ & vice versa