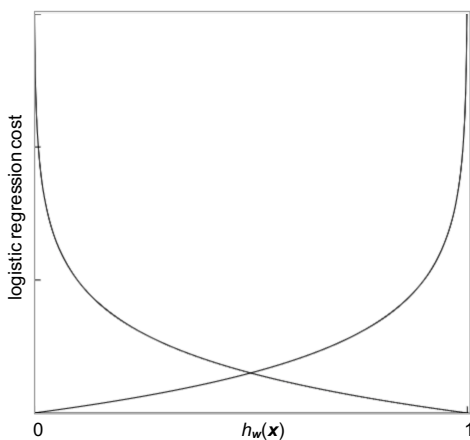


**Logistic Regression***(find and work with a partner)*

1. Say I train a binary logistic regression model (i.e. outcomes  $\in \{0, 1\}$ ) and end up with  $\hat{\mathbf{w}} = [\hat{w}_0, \hat{w}_1]^T = [-4, -5]^T$ . What is the decision boundary? Sketch a graph of this logistic model and label the decision boundary. How would you classify a new point  $x_{\text{test}} = -2$ ?

2. The graph below shows the cost for logistic regression as a function of the hypothesis  $h_{\mathbf{w}}(\mathbf{x})$ , for one example  $\mathbf{x}$ . Which curve corresponds to the true label  $y = 0$  and which corresponds to  $y = 1$ ?



3. A key step in our derivation of the SGD updates for logistic regression was the fact that  $g'(z) = g(z)(1 - g(z))$ , where  $g(z) = \frac{1}{1+e^{-z}}$ . This allowed us to cancel out the terms in the denominators. Compute the derivative of  $g(z)$  to demonstrate this fact. What does  $g'(z)$  tend to as  $z \rightarrow \infty$ ? As  $z \rightarrow -\infty$ ?