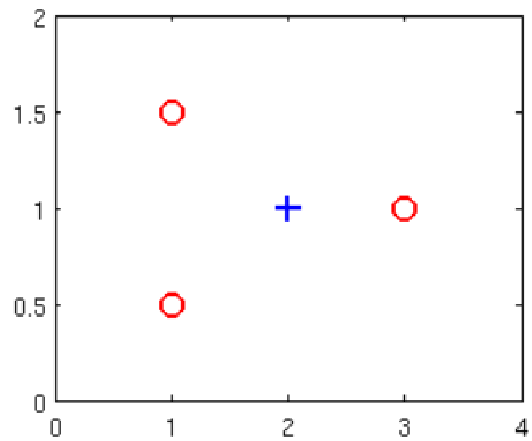
Week 3-1: Logistic Regression and Classification

1. Suppose that you have trained a logistic regression classifier, and it outputs on a new example x a prediction $h_\theta(x) = 0.4$. This means (check all that apply):

   (a) Our estimate for $P(y = 1|x; \theta)$ is 0.4.

   (b) Our estimate for $P(y = 0|x; \theta)$ is 0.6.

2. Suppose you have the following training set, and fit a logistic regression classifier $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$



x_1	x_2	y
1	0.5	0
1	1.5	0
2	1	1
3	1	0

Which of the following are true? Check all that apply.

   (a) Adding polynomial features (e.g., instead using $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_1^2 + \theta_4 x_1 x_2 + \theta_5 x_2^2))$ could increase how well we can fit the training data.

   (b) At the optimal value of θ (e.g. found by fminunc), we will have $J(\theta) \geq 0$.

3. For logistic regression, the gradient is given by $\frac{\partial}{\partial \theta_j} J(\theta) = \frac{1}{m} \sum_{i=1}^{m} \left(h_\theta\left(x^{(i)}\right) - y^{(i)}\right) x_j^{(i)}$. Which of these is a correct gradient descent update for logistic regression with a learning rate of α? Check all that apply.

   (a) $\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(h_\theta\left(x^{(i)}\right) - y^{(i)}\right) x_j^{(i)}$ (simultaneously update $\forall j$)

   (b) $\theta_j := \theta_j - \alpha \frac{1}{m} \sum_{i=1}^{m} \left(\frac{1}{1+e^{-\theta^T x^{(i)}}} - y^{(i)}\right) x_j^{(i)}$ (simultaneously update $\forall j$)

4. Which of the following are true? Check all that apply.

   (a) The cost function $J(\theta)$ for logistic regression trained with $m \geq 1$ examples is always greater than or equal to 0.

   (b) The sigmoid function $\frac{1}{1+e^{-z}}$ is never greater than one.

5. Suppose you train a logistic regression classifier $h_\theta(x) = g(\theta_0 + \theta_1 x_1 + \theta_2 x_2)$. Suppose $\theta_0 = -6, \theta_1 = 1, \theta_2 = 0$. Which of the following figures represents the decision boundary found by your classifier?