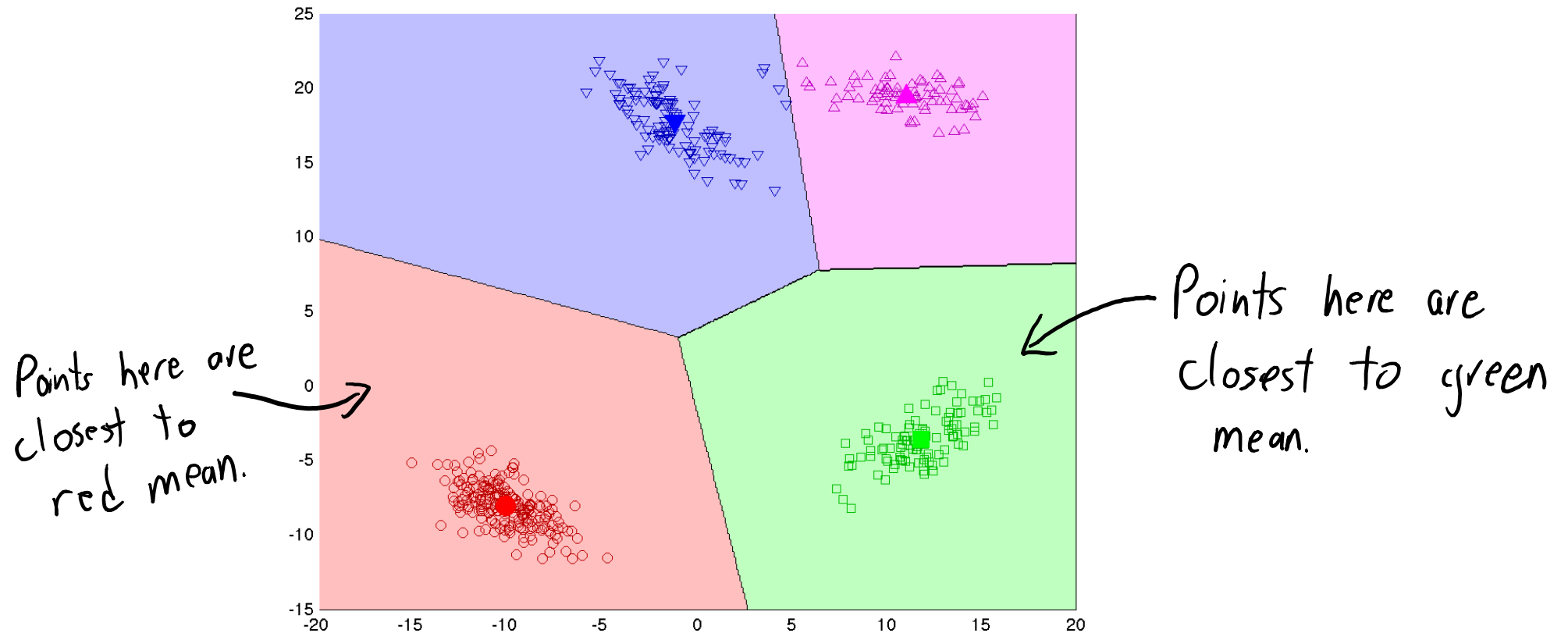


# Shape of K-Means Clusters

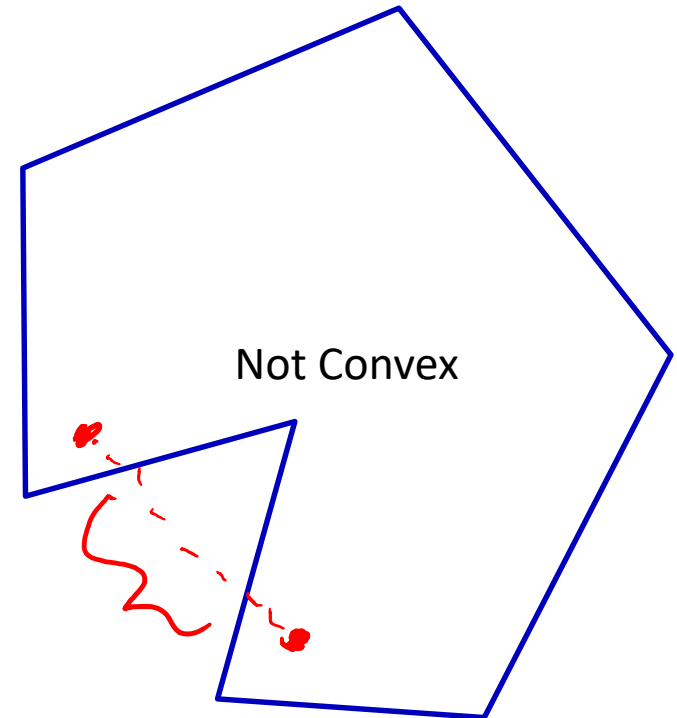
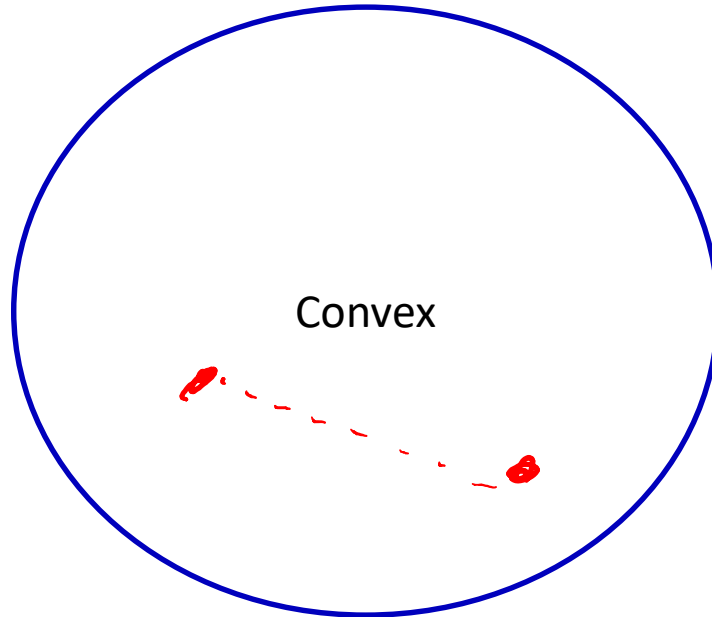
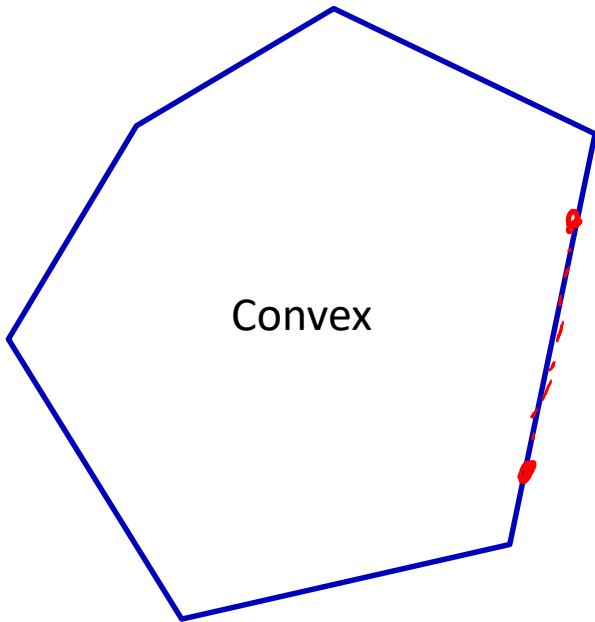
- K-means partitions the space based on the “closest mean”:



- Observe that the clusters are convex regions.

# Convex Sets

- A set is **convex** if **line between two points in the set stays in the set**.

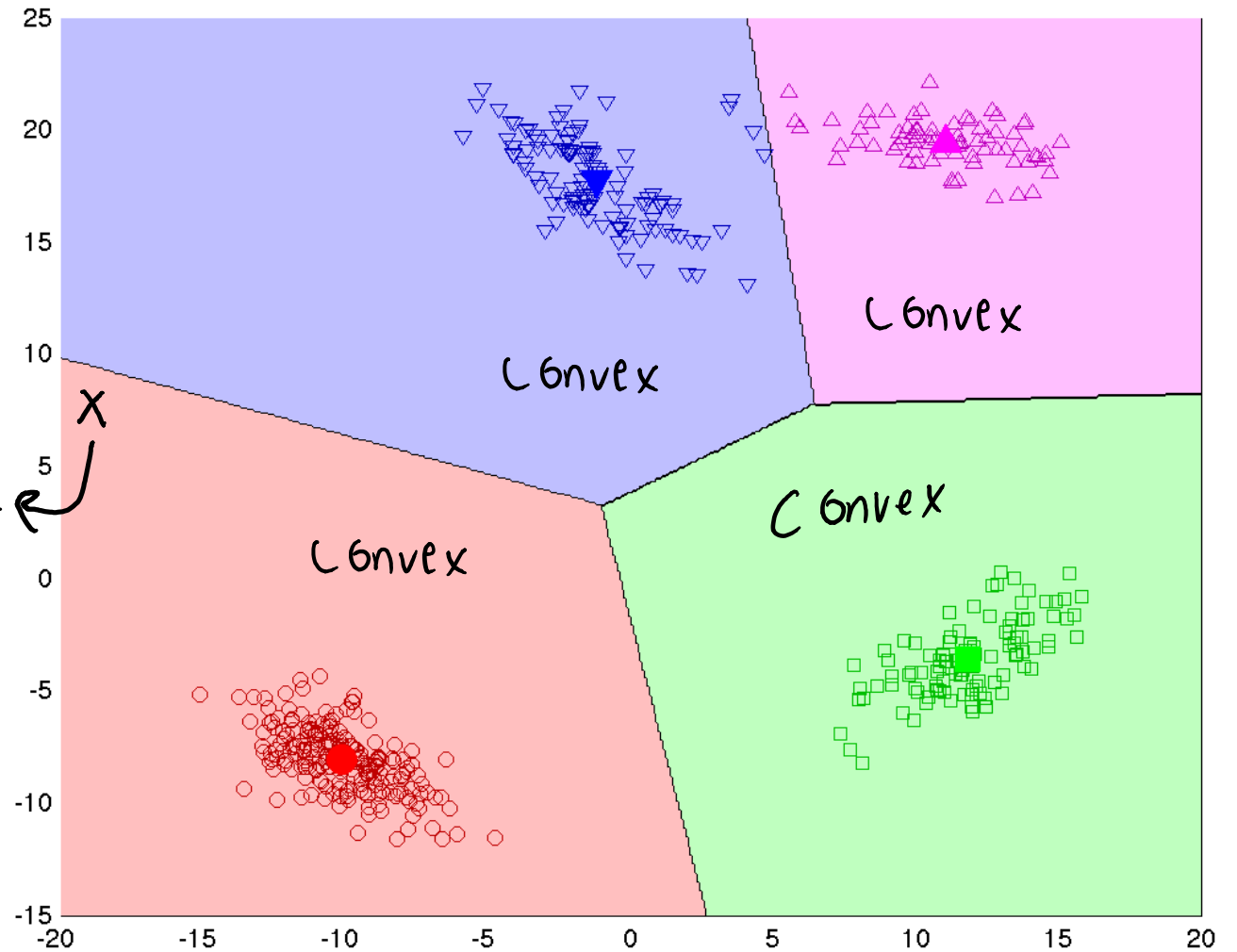


# Shape of K-Means Clusters

Issues with shape of K-means clusters:

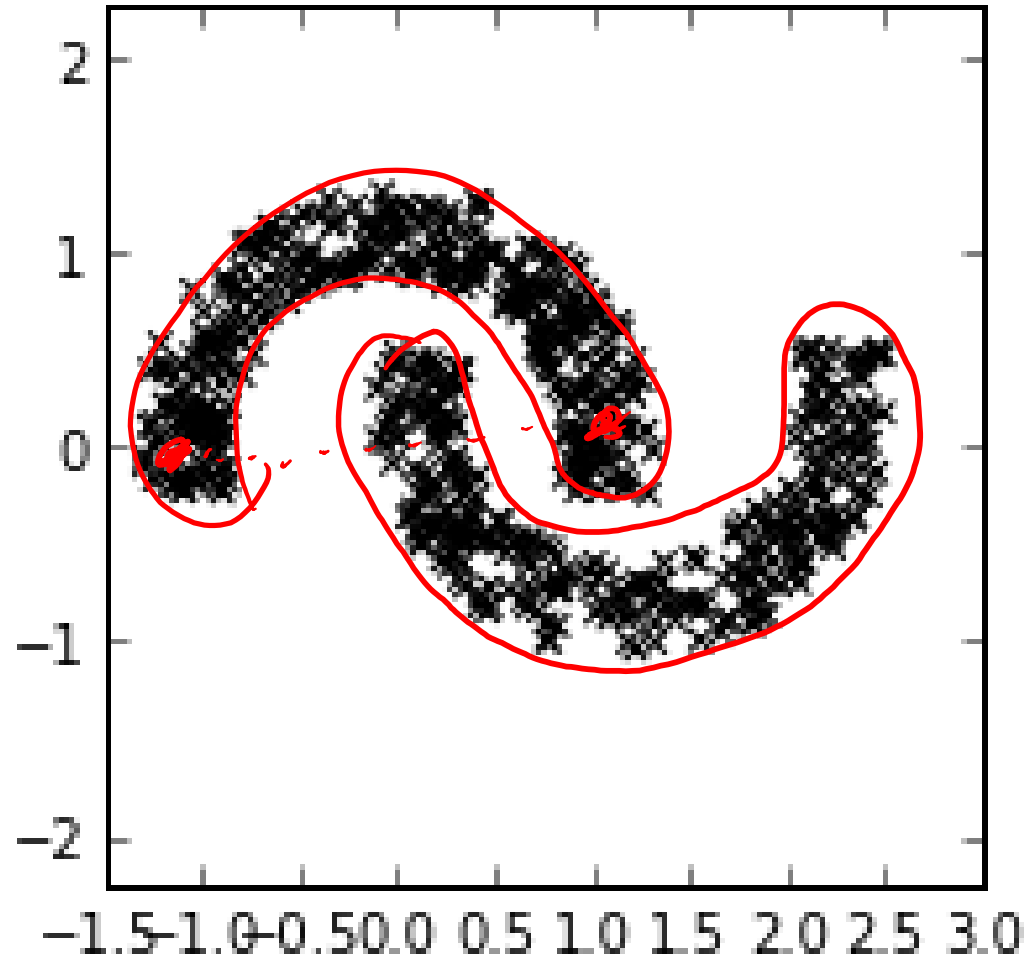
1. Clusters in the data might not be convex.

2. Does this point really belong in red cluster?

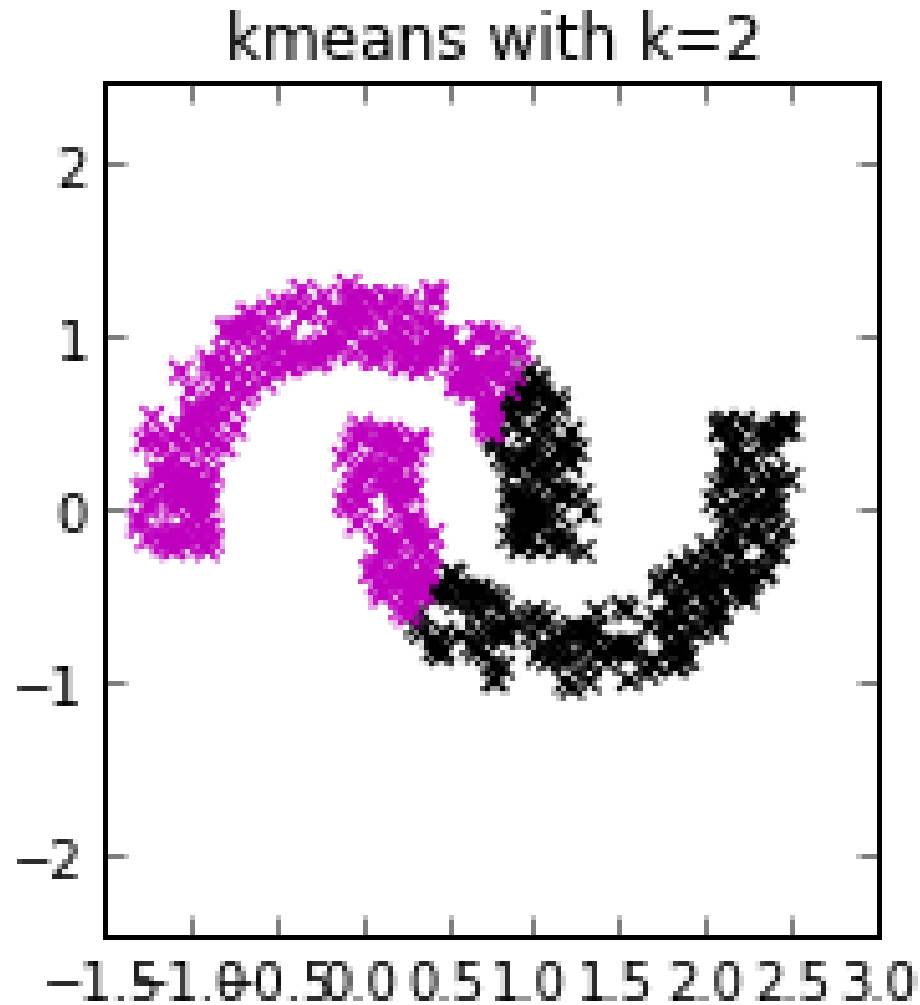


# K-Means with Non-Convex Clusters

Non-convex banana-shaped data points

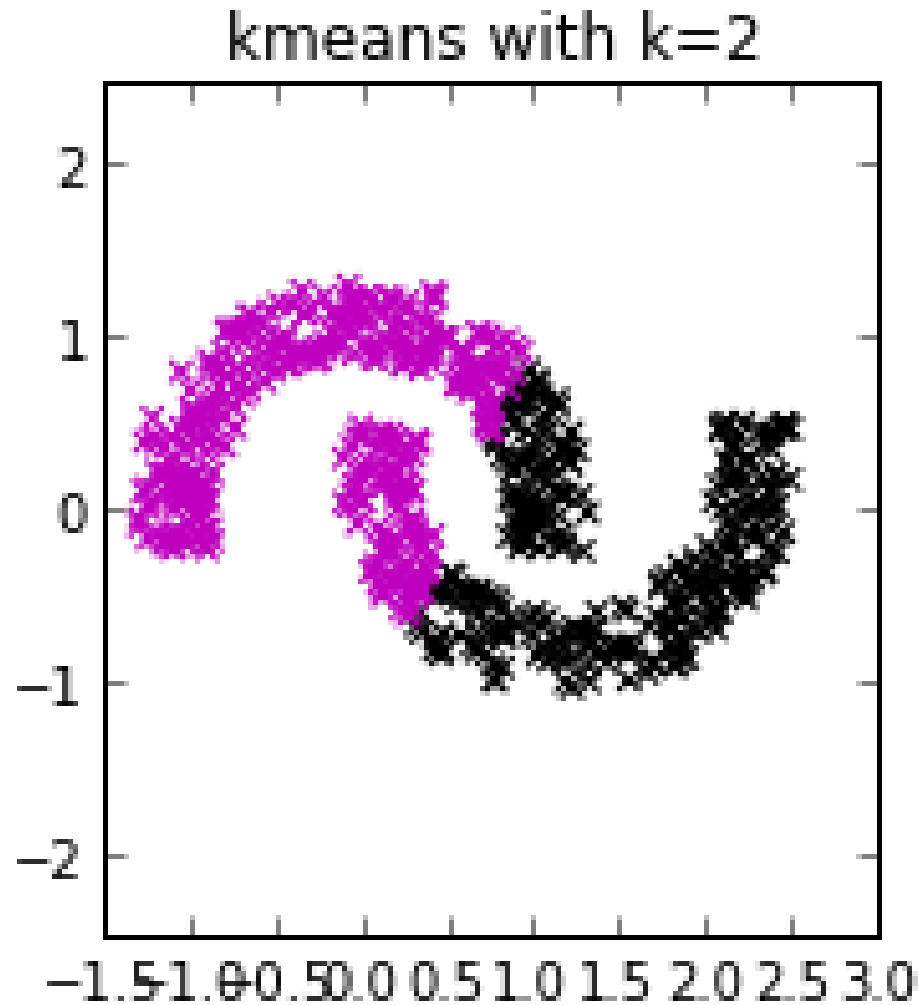


# K-Means with Non-Convex Clusters



K-means **cannot separate**  
non-convex clusters

# K-Means with Non-Convex Clusters



K-means **cannot separate**  
non-convex clusters

Though over-clustering can help  
(next class)

