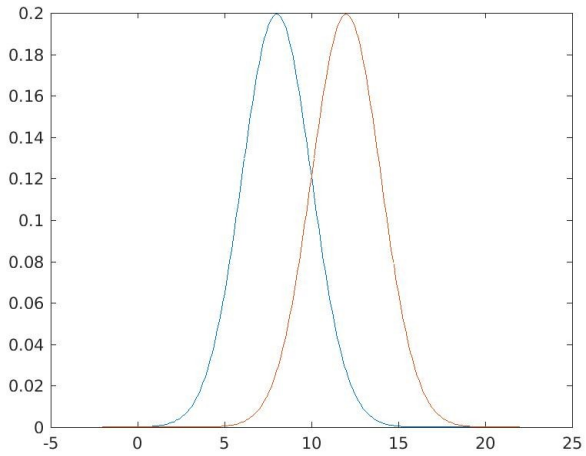
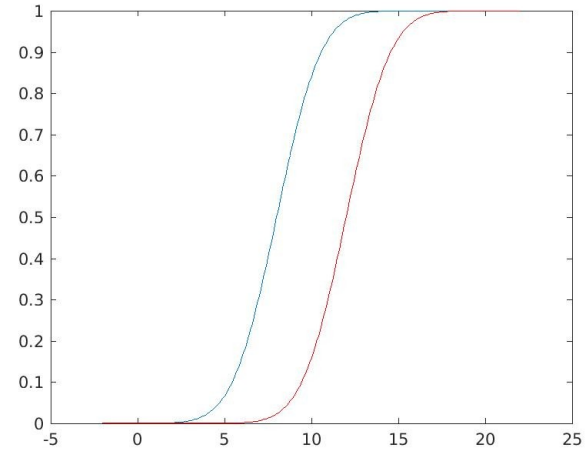
Matlab exercise 2: ROC curves

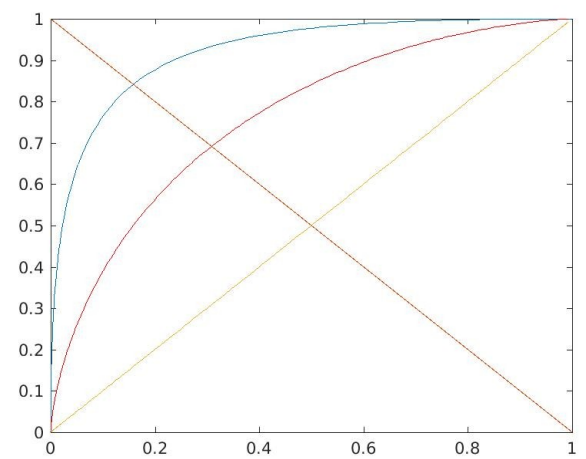
The exercise begins by drawing probability density functions of two distributions. (Calculating ROC for more than two classes in possible but practically never used due to the complexity).



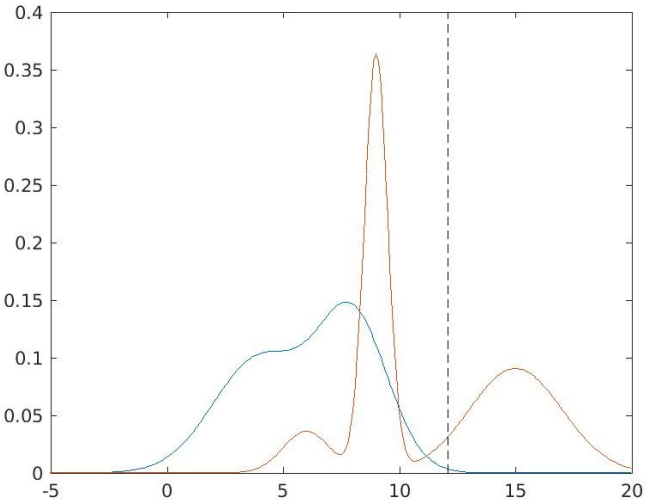
The respective cumulative density functions are determined with normcdf function and look like in the following figure



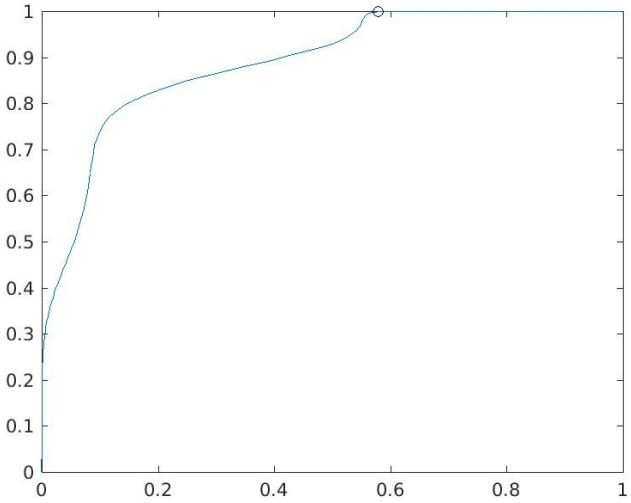
By using the cumulative functions, we can build the ROC curve (blue). The line from upper left corner to lower right corner shows the decision points if the costs are equal. With standard deviation of 4 (twice the original) we get a different ROC curve (red). The pdfs are less separable and thus the ROC curve does not go as near the upper left corner. If the distributions are equal, they cannot be separated and thus the ROC curve is line from lower left to upper right corner. Only way to do any classification in this case is to guess. (or invent a better classifier, better features etc.)



In the second exercise we look at two varying distributions. The distributions seem to be overlapping and it might even be better to use multiple decision thresholds. However, now we must select one.



The distributions are not simple and therefore the ROC curve is likewise not simple.



Let's determine a decision boundary as the costs are given. The cost function is shown in the next figure and a line is drawn on the minimum point. We have also drawn the point to the two previous figures.