(1) (10 Points) Consider the following labeled training dataset:

\[ ((0, 0), 1), ((2, 2), 0), ((-1, -2), 0) \]

Draw the decision boundary of the 1-nearest neighbor classifier on this training data. Assume that the distance used to determine neighbors is the usual Euclidean distance. Clearly label the regions that the classifier marks as 0 and 1, and write down the equations corresponding to each section of the decision boundary.

We first solve the boundary for \((0, 0), 1\) and \((2, 2), 0\):

\[
\sqrt{(x-0)^2+(y-0)^2} = \sqrt{(x-2)^2+(y-2)^2} \Rightarrow x+y = 2. \quad (1)
\]

We then solve the boundary for \((0, 0), 1\) and \((-1, -2), 0\):

\[
\sqrt{(x-0)^2+(y-0)^2} = \sqrt{(x+1)^2+(y+2)^2} \Rightarrow 2x + 4y + 5 = 0. \quad (2)
\]

We also solve the intersection of (1) and (2):

\[
\begin{cases}
    x+y=2 \\
    2x+4y+5=0
\end{cases} \Rightarrow (x, y) = \left( \frac{13}{2}, -\frac{9}{2} \right)
\]

The region that has label 1 is shaded, the rest of the area has label 0.