1) (18 points) Find the points in the plane which satisfy the two inequalities (i.e., the feasible set)

\[ x - y \leq 1 \quad 4x + y \leq -3 \]

Make a large sketch with the feasible set \textit{unshaded}.

Find all vertices and label clearly with their coordinates on your sketch. Show your work in finding the coordinates.

The two inequalities become \( y \geq x - 1 \) and \( y \leq -4x - 3 \).
So the feasible set is “above” the line \( y = x - 1 \) and “below” (and to the left of) the line \( y = -4x - 3 \).
The intersection point of the two lines is the only vertex. To find it we can solve \( x - 1 = -4x - 3 \) to get \( x = -2/5 \) and then \( y = -2/5 - 1 = -7/5 \), so the vertex is \((-2/5, -7/5)\).

2) You have the data points \((-2, 3), (-1, 1), \) and \((0, -2)\).

a) (5 points) Find the least squares distance of the line \( y = -5x - 5 \) from the given points.

b) (7 points) Find the least squares best fit line for the given points.

a) The following table summarizes the calculation:

<table>
<thead>
<tr>
<th>( x )</th>
<th>data ( y )</th>
<th>line ( y )</th>
<th>((\text{data } y - \text{line } y)^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>3</td>
<td>5</td>
<td>((3 - 5)^2 = 4)</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
<td>0</td>
<td>((1 - 0)^2 = 1)</td>
</tr>
<tr>
<td>0</td>
<td>-2</td>
<td>-5</td>
<td>((-2 - (-5))^2 = 9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(E = 14)</td>
</tr>
</tbody>
</table>

b) There are \( N = 3 \) data points. We get

\[ \sum x = -3, \sum y = 2, \sum xy = -7, \text{ and } \sum x^2 = 5. \]

So \( m = \frac{3(-7) - (-3)^2}{3(5) - (-3)^2} = -15/6 = -5/2, \)

and \( b = \frac{2 - (-5/2)(-3)}{3} = -11/6. \)

The best fit line is \( y = -\frac{5}{2}x - \frac{11}{6}. \)