10a(4). Minimize $w = 2x + 3y + z$ subject to:

a: $x + y + z \leq 12$

b: $x + 3y + 3z \leq 24$

$x \geq 0$, $y \geq 0$, $z \geq 0$

10b(4). Same problem but find the maximum.

Label each constraint boundary plane with the constraint label.

You must draw all 9 edges of the polyhedron. List all extremes and circle the minimum.
The problems below are not from the text.

0(2). 1: \( y \leq 1, \quad x, y \geq 0 \)
\[ f(x,y) = x, \quad g(x,y) = x + y, \quad h(x,y) = y, \quad k(x,y) = -x + y, \]
\[ l(x,y) = -x, \quad m(x,y) = -x - y. \]

(a) Which functions have no maximum?
(b) Which functions have one maximum?
(c) Which functions have infinitely many maxima?

1(6). Convert to standard form and to canonical form.

\[ \text{minimize} \quad w = 3x - 2y \]
subject to
\[ s: \quad 2x - y \geq 1 \]
\[ t: \quad x - 2y \leq 10 \]
\[ x \geq 0, \quad y \text{ unrestricted} \]

**Standard form.** Replace the unrestricted variable \( y \) with a difference of two positive variables \( u \) and \( v \). Make the inequality \( \leq \) and replace the minimizing objective with a maximizing objective.

**Canonical form.** Convert the problem to canonical form by adding slack variables. Warning: you may not use the same slack variable for two different inequalities. Please observe the convention of using the label on the standard constraint as the slack in the canonical equation.

**Canonical form with positive constants.** Do one more step rewrite the above canonical form so that the constants on the right-hand side are all positive (multiply any equations with negative constants by -1).

2(3). Give the general solution, the basic solution and find a feasible solution for the following canonical problem.
\[ x - y + 2x = 9 \]
\[ -x + 2y - 3z = -13 \]
\[ x, y, z \geq 0 \]

<table>
<thead>
<tr>
<th>General Solution:</th>
<th>Basic Solution:</th>
<th>Feasible Solution:</th>
</tr>
</thead>
</table>

3(8). Convert the standard form problem to a canonical form problem.

On the horizontal \( x-y \) plane, graph the feasible solutions for the standard problem and circle the point of maximum value.

Using the same coordinate system, also graph the feasible solutions for the canonical problem, give the coordinates of the extreme points and circle the point of maximum value.
The \( x-y \) coordinates have been rotated from their usual position in order to view the sloping canonical plane edge-on.

**Standard form.**

\[ \text{maximize} \quad w = 2x + y \]
subject to
\[ s: \quad x + 2y \leq 4 \]
\[ x, y \geq 0 \]

**Canonical form.**

\[ \text{maximize} \quad w = 2x + y \]
subject to
\[ s: \quad x + 2y \leq 4 \]
\[ x, y \geq 0 \]

**Standard table.**

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
<th>( w )</th>
</tr>
</thead>
</table>

**Canonical table.**

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
<th>( s )</th>
<th>( w )</th>
</tr>
</thead>
</table>

List the extreme solutions in the tables above. Indicate the maximal row.

Except for the slack variable \( s \), the tables should be the same. Hint: entries in the canonical table total to 20.

*Read Using LinSolve.*