Problem 1: Use the enumeration method to solve the following linear program

\[
\begin{align*}
\text{max} & \quad x_1 + 2x_2 \\
\text{s.t.} & \quad x_1 + 3x_2 \leq 12 \\
& \quad x_1 - x_2 \leq 3 \\
& \quad x_1 \geq 0, \quad x_2 \geq 0.
\end{align*}
\]

Problem 2: Transform the following general linear program to (1) standard form and (2) canonical form, with effort to reduce the size of the resulting problems:

\[
\begin{align*}
\text{max} & \quad 3x_1 - 4x_2 - x_3 + 6 \\
\text{s.t.} & \quad x_1 + x_2 + x_3 = 0 \\
& \quad x_1 - 2x_2 - x_3 \geq 4 \\
& \quad x_3 \geq -3 \\
& \quad x_1 + x_2 - x_3 = 5
\end{align*}
\]

Problem 3: (Problem 1.12 in Textbook) Consider a set $P$ described by linear inequality constraints, that is

\[
P = \{ x : a_i^T x \leq b_i, \ i = 1, \cdots, m \}.
\]

A ball with center $y$ and radius $r$ is the set of all points within Euclidean distance $r$ from $y$. Formulate a linear program which can find the largest ball entirely contained in the set $P$. Hint: Consider those points $y + r \frac{a_i}{\|a_i\|}$. 