(i) If a problem has a solution, no solution, or an unbounded objective function, you must clearly state so and justify your claim, for the original given problem.

(ii) Solve each problem using as few pivots as possible. The whole exam can be solved by a total of 4 pivots only.

(ii) Place the final complete answer to each problem after you have solved it on lines immediately below the question.

Last Name (Print):_______________
First Name: ________________

Grades

1. Question 1:_______
2. Question 2:_______
3. Question 3:_______
4. Question 4:_______
5. Total:_________
1. Solve:

\[ \begin{align*}
  x_1 - x_2 - x_3 &= -1 \\
  -x_1 + 2x_2 &= 2 \\
  x_1 + x_2 - 3x_3 &= -1
\end{align*} \]

Answer: ________________________________
2. Solve without changing the number of variables or constraints:

\[
\begin{align*}
\text{minimize} & \quad -x_1 - x_2 + 2x_3 \\
x_1 & \quad + \quad 3x_2 - 2x_3 \quad \geq \quad 1 \\
x_1 & \quad + \quad x_2 - x_3 \quad = \quad 1 \\
\text{subject to} & \quad 2x_2 - x_3 \quad \geq \quad -1 \\
x_1, \quad x_2 & \quad \geq \quad 0 \\
x_3 & \quad : \quad \text{free}
\end{align*}
\]

Answer: ____________________________________________
Scratch Sheet
3.

minimize \(-3x_1 - x_2 + x_3\)

subject to

\(-13x_1 + x_2 - 2x_3 \geq -1\)

\(x_1 + x_3 \geq -2\)

\(2x_1 + x_2 + 3x_3 \geq -1\)

\(x_1, x_2, x_3 \geq 0\)

Answer:  

-
Scratch Sheet
4.

minimize \[ x_1 + 2x_2 + x_3 \]
subject to
\[ x_1 - 2x_2 - x_3 \geq 3 \]
\[ -x_1 + x_2 + x_3 \geq -1 \]
\[ -x_1 + 4x_2 + 2x_3 \geq -8 \]
\[ x_1, x_2, x_3 \geq 0 \]

Answer:
Scratch Sheet