Name: _____

MATH 108
Spring 2022
Written HW 5: Due 03/07

"Does it disturb anyone else that 'the Los Angeles Angels' baseball team translates directly to 'the the angels angels'?"
–Neil DeGrasse Tyson

Problem 1. (10pt) Consider the region given by the following inequalities:

$$\begin{cases} x + 2y \leq 16 \\ -3x + y \geq -6 \\ x, y \geq 0 \end{cases}$$

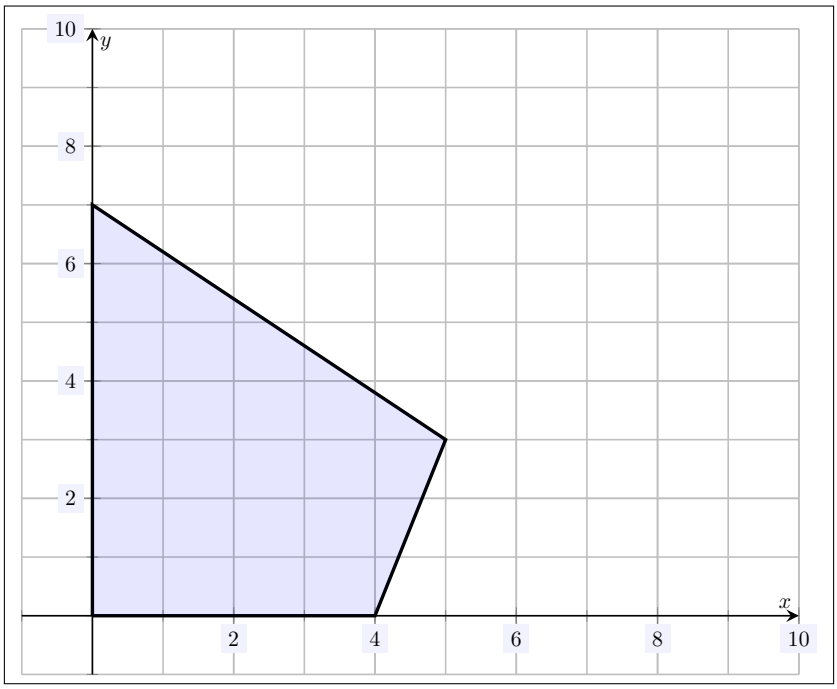
(a) Is the point $(4, 5)$ in the region? Explain. Is the point $(1, 3)$ in the region? Explain.

(b) As accurately as possible, sketch the region.

(c) Is the region bounded or unbounded?

(d) Find the 'corner points' for this region.

Problem 2. (10pt) Find a system of inequalities that give the following region:



Problem 3. (10pt) Use the Fundamental of Theorem of Linear Programming to find the maximum and minimum values for the function $f(x, y)$ below given the constraints—also given below.

$$f(x, y) = x + 3y$$

$$\begin{cases} x + 5y \leq 25 \\ x + y \leq 9 \\ -2x + y \geq -12 \\ x, y \geq 0 \end{cases}$$

Problem 4. (10pt) Consider the maximization problem given below:

$$\max z = x_1 + 3x_2 - 2x_3$$

$$\begin{cases} x_1 + x_2 + x_3 \leq 8 \\ 2x_1 - 3x_2 + x_3 \leq 5 \\ -x_1 + 4x_2 - 2x_3 \leq 2 \\ x_1, x_2, x_3 \geq 0 \end{cases}$$

(a) Does the point $(-1, 0, 1)$ satisfy the inequalities above? Explain.

(b) Is the point $(2, 3, 1)$ in the feasible region? Explain.

(c) Is the point $(2, 1, 2)$ a feasible point? Explain. If this is a feasible point, find the corresponding z value.

(d) Can $(2, 1, 2)$ be a solution to this maximization problem? Explain. [Hint: Can you change some of the variables 'a bit' to increase z while still satisfying all the inequalities?]

Problem 5. (10pt) Write the initial simplex tableau corresponding to the standard maximization problem given below:

$$\max z = 3x_1 - 4x_2 + x_3$$

$$\begin{cases} 2x_1 - x_2 + 4x_3 \leq 8 \\ x_1 + 6x_3 \leq 5 \\ x_1, x_2, x_3 \geq 0 \end{cases}$$

Problem 6. (10pt) Below is the final simplex tableau corresponding to a standard maximization problem:

0	−0.286	0	−0.929	1	−0.071	−0.357	321.0
1	1.07	0	1.36	0	0.143	0.214	607.0
0	0.214	1	0.571	0	−0.071	0.143	71.4
0	31.8	0	44.3	0	6.38	15.3	35771.43

(a) How many inequalities were there for this problem?

(b) How many slack variables are present for this problem?

(c) How many decision variables were there for this problem?

(d) Write the solution to this maximization problem. Your solution should include the maximum values as well as the values for all the decision and slack variables.