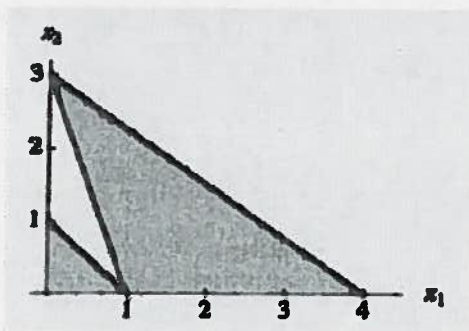## 13 Quiz 3 (Nov. 10) Name: _SOLUTIONS_

All questions relate to the shaded region of the x_1-x_2 plane shown below. It's the region of points in the x_1-x_2 plane satisfying $x_1 \geq 0$, $x_2 \geq 0$ and

- EITHER [constraint 1]

- OR both [constraint 2] AND [constraint 3].

1. Write down the actual inequalities [constraint 1], [constraint 2] and [constraint 3]. Be sure to say which is [constraint 1].

$$1: \quad x_1 + x_2 \leq 1$$

$$2,3: \quad 3x_1 + 4x_2 \leq 12$$
$$3x_1 + x_2 \leq 3$$

2. By introducing some auxiliary variables, describe the shaded region using a system of linear constraints. Be sure to write down *all* the necessary constraints to describe the region.

Introduce y_1, $\boxed{0 \leq y_1 \leq 1}$, $\boxed{y_1 \text{ integer}}$, to turn on/off $x_1 + x_2 \leq 1$:

add constraint $\boxed{x_1 + x_2 \leq 1 + 6[1-y_1]}$ → if $y_1 = 1$, 1 satisfied

if $y_1 = 0$, no part of feasible region cut off

$[x_1 \leq 4, x_2 \leq 3$ on feasible region$]$

Introduce y_2, $\boxed{0 \leq y_2 \leq 1}$, $\boxed{y_2 \text{ integer}}$, to turn on/off 2,3, via:

$\boxed{3x_1 + 4x_2 \leq 12 + 12[1-y_2]}$, $\boxed{3x_1 + x_2 \leq 3 + 12[1-y_2]}$

Also add $\boxed{y_1 + y_2 \geq 1}$ to make sure at least one of 1, $\{2,3\}$ hold.

80