1. [2 marks] A feasible set has vertices $(0,3), (5,0)$ and $(2,5)$. Find the maximum value of $5x + 2y$ on the feasible set and state the point where the maximum occurs.

Vertices	$5x+2y$
$(0,3)$	6
$(5,0)$	25
$(2,5)$	20

The maximum value is 25 and it occurs at the point $(5,0)$.

2. [3 marks] Find the equation of the line that is perpendicular to $y = \frac{2}{3}x + 7$ and that passes through the point $(6, -11)$.

$y = \frac{2}{3}x + 7$ has $m = \frac{2}{3}$

Desired line has $m = -\frac{3}{2}$

(the lines are perpendicular)

Desired line: $y = mx + b$

$y = -\frac{3}{2}x + b$

Sub $x=6$, $y=-11$: $-11 = -\frac{3}{2}(6) + b$

$-11 = -9 + b$

$-2 = b$

$y = -\frac{3}{2}x - 2$

3. [3 marks] List all the inequalities that apply:
A company makes backpacks and purses. Each backpack takes 4 hours to sew and 2 hours to dye. Each purse takes 5 hours to sew and 1 hour to dye. Each day the company has at most 100 sewing hours and at most 40 dyeing hours available. Let x be the number of backpacks made each day and let y be the number of purses made each day.

	Backpacks (x)	Purses (y)	Available
Sew (hours)	4	5	100
Dye (hours)	2	1	40

← number of objects can't be negative

$4x+5y \leq 100,\ 2x+y \leq 40,\ x \geq 0,\ y \geq 0$

4. [3 marks] Find the intersection of $8x + 2y = -12$ and $-2x + y = 12$.

$8x+2y=-12$

$2y=-12-8x$

$y=-6-4x$

$-2x+y=12$

$y=12+2x$

$y=y$

$-6-4x=12+2x$

$-6x=18$

$x=-3$

$x=-3 \rightarrow$ either equation

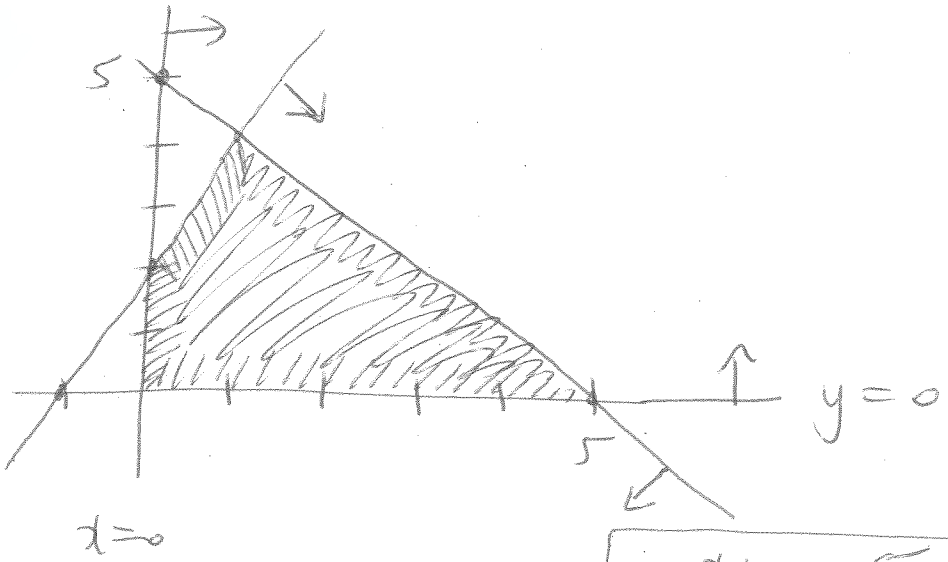
$y=12+2x$

$y=12-6$

$y=6$

$(-3,6)$

5. [2 marks] Graph the feasible set for the following system of inequalities:
$x + y \leq 5, \quad -2x + y \leq 2, \quad x \geq 0, \quad y \geq 0$



$x+y=5$
$(5,0)$
$(0,5)$
Test $(0,0)$: TRUE

$-2x+y=2$
$(-1,0)$
$(0,2)$
Test $(0,0)$: TRUE

6. [3 marks] Solve the following system using Gauss-Jordan Elimination:

$$\begin{aligned} x - 4y &= -23 \\ 2x - 7y &= -38 \end{aligned}$$

$$\begin{array}{c} x \quad y \quad \# \\ \left[\begin{array}{cc|c} 1 & -4 & -23 \\ 2 & -7 & -38 \end{array}\right] \end{array}$$

$R_2 - 2R_1$ $\left[\begin{array}{cc|c} 1 & -4 & -23 \\ 0 & 1 & 8 \end{array}\right]$

$R_1 + 4R_2$ $\left[\begin{array}{cc|c} 1 & 0 & 9 \\ 0 & 1 & 8 \end{array}\right]$

$x = 9$

$y = 8$

7. [4 marks] Solve the following system using Gauss-Jordan Elimination:

$$\begin{aligned} x + y + z &= 6 \\ 2x + 4y &= 14 \\ 5x + 9y + z &= 34 \end{aligned}$$

$$\begin{array}{c|ccc|c} & x & y & z & \# \\ & 1 & 1 & 1 & 6 \\ & 2 & 4 & 0 & 14 \\ & 5 & 9 & 1 & 34 \end{array}$$

$$\begin{array}{l|ccc|c} & 1 & 1 & 1 & 6 \\ R_2 - 2R_1 & 0 & 2 & -2 & 2 \\ R_3 - 5R_1 & 0 & 4 & -4 & 4 \end{array}$$

$$\begin{array}{l|ccc|c} & 1 & 1 & 1 & 6 \\ \frac{R_2}{2} & 0 & 1 & -1 & 1 \\ & 0 & 4 & -4 & 4 \end{array}$$

$$\begin{array}{l|ccc|c} & \textcircled{1} & 0 & 2 & 5 \\ R_1 - R_2 & 0 & \textcircled{1} & -1 & 1 \\ R_3 - 4R_2 & 0 & 0 & 0 & 0 \end{array}$$

z = any value

$x + 2z = 5 \Rightarrow x = 5 - 2z$

$y - z = 1 \Rightarrow y = 1 + z$