MATH 2270-2

Additional homework to be handed in Friday October 26:

section 5.4 page 223, **#22, 23;** (matrix least squares)
and the following "fundamental subspaces" problem:

```
> restart:with(plots):with(linalg):
```

Problem I: Let L(x)=Ax , for the matrix A defined by

```
> A:=matrix([[ 1,0,-1,2,3],
             [ 3,2,-2,1,-1],
             [1,2,0,-3,-7],
             [0,-2,-1,5,10]]);
```

$$A := \begin{bmatrix} 1 & 0 & -1 & 2 & 3 \\ 3 & 2 & -2 & 1 & -1 \\ 1 & 2 & 0 & -3 & -7 \\ 0 & -2 & -1 & 5 & 10 \end{bmatrix}$$

Ia) Find bases for the four fundamental subspaces associated to this map (and matrix). In the domain space you will be looking for the kernel of A and the row space of A. In the codomain you want the image of A (= column space), and the kernel of the transpose of A. You should be able to deduce all of your answers from

```
> rref(A);
  rref(transpose(A));
```

$$\begin{bmatrix} 1 & 0 & -1 & 2 & 3 \\ 0 & 1 & \frac{1}{2} & \frac{-5}{2} & -5 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & -2 & 3 \\ 0 & 1 & 1 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

1b) Verify that the two domain spaces are perpendicular to each other, and that the two codomain spaces also are, by checking orthogonality between the bases you found in part (a).