Math 2250−4
Wednesday March 30.

Exam 2 is tomorrow Thursday. Go to your regular section time unless you've cleared a change with Victor. Remember that the exam begins 5 minutes early and ends 5 minutes late, so you'll either take the test between 10:40−11:40 or 11:45−12:45.

We'll go over the review topics from the review sheet. The following problems will help illustrate many of these topics.

Vector space theory from Chapter 4:

Shown below is a matrix A, its reduced row echelon form and its reduced column echelon form. Find bases for the solution space to the homogeneous equation $Ax = 0$, as well for the row space and for the column space. Use the discussion to review the concepts and theorems related to span, linear independence/dependence and basis.

```
> with(LinearAlgebra) :
  A := Matrix(3, 5, [-3, 2, 1, 0, 1,
                      6, -4, 0, 2, 2,
                      3, -2, 1, 2, 3]);
```

$$A := \begin{bmatrix} -3 & 2 & 1 & 0 & 1 \\ 6 & -4 & 0 & 2 & 2 \\ 3 & -2 & 1 & 2 & 3 \end{bmatrix} \quad (1)$$

```
> ReducedRowEchelonForm(A);
```

$$\begin{bmatrix} 1 & -\frac{2}{3} & 0 & \frac{1}{3} & \frac{1}{3} \\ 0 & 0 & 1 & 1 & 2 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \quad (2)$$

```
> Transpose(ReducedRowEchelonForm(Transpose(A)));
      # reduced column echelon form
```

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \end{bmatrix} \quad (3)$$

```
>
```

Differential Equations and Laplace transform theory from Chapters 5, 3.7, 10:

Solve the initial value problem below, once using Chapter 5 ($x = x_P + x_H$) techniques, and once using Laplace transform techniques. Discuss appropriate modeling situations where this and related IVPs could arise. Use vector space concepts to justify why the general solution $x = x_P + x_H$, and discuss the dimension of the space of solutions x_H to the homogeneous problem.

$$x''(t) + 4 \cdot x'(t) + 3 \cdot x(t) = -30 \cdot \sin(3 \cdot t)$$
$$x(0) = 2$$
$$x'(0) = -1.$$