Introduction to linear algebra with MAPLE

Basic commands regarding matrices and vectors: You can input a matrix as follows.

> A:= matrix (2,2,[1,2,3,4]);

This will produce the matrix

$$A := \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}.$$

When you type in many entries, you can go over many lines as follows.

> A:= matrix(8,8,[1,2,3,4,5,6,7,8,
> 9,10, ... ;

A matrix is an array. So when you typed a wrong entry and want to correct it later, you can always do that by type in that particular entry as follows.

> A[2,3]:= 3;

The above commands defines the $(2, 3)$-entry of A as 3.
Diagonal matrices can be typed in as follows.

> A: = diag(1,2,3,4);

So we can produce the identity matrix in this way.

If you want a particular rule for the entries, you can use a function as follows.

> A:= matrix(3,4,(i,j)-> xˆi+j);

The zero matrix can be produced along this manner as follows.

> A:= matrix(3,4,0);

You can add a scalar multiple of the identity matrix to a matrix A which is already defined as follows.

> evalm(A+5);

This will add 5 times the identity matrix to A (but A has to be initialized).
Once you define a matrix, you can use the following operations for matrices.

+, -, *, ˆ addition, subtraction, scalar multiplication, exponent
&* matrix multiplication

In order to carry out matrix computations, you always have to use the command evalm( ). For example, after defining matrices A,B, the command

> A+B;

simply gives you the output A+B. To carry out the computation, you have to give the command

> evalm(A+B);

Try to compute $A^4 - 3A^2 + 5$ for the above matrix A.

We learned the notion of the norm of vectors. We can find it by the following command.

> norm(v,2); the norm of v.

Note that you need the number 2, because in slightly more advanced mathematics, there are many kinds of norms and what we use in our class is corresponds to the exponent 2.

The transpose of a matrix can be found by the following command.

> transpose(A); This gives you the transpose of A.

After you apply the method of least square, you may want to compare the data with your model. For that purpose the command "pointplot" is convenient. You first have to download plots package. Then this command requires a set of points expressed as $[1, 2], [3, 4]$, etc. For example,

```
> with(plots);
> pointplot({[1,2],[3,6]});
```

plots two points $(1, 2), (3, 6)$. If you get a function such as $y = 2x$ and want to compare with these points, you can proceed as follows.

```
> with(plots);
> p1:= pointplot({[1,2],[3,6]}):
> p2:= plot(2*x,x=0..4):
> display(p1,p2);
```

Note that in MAPLE, when you want to suppress the output, you can use : instead of ;. If you use ; in the second command, you end up with getting a bunch of data. The third command enables you to sketch two graphs simultaneously.