INTRODUCTION TO MATRIX OPERATIONS IN MATHEMATICA

We will start by learning how to input a matrix in *Mathematica*. Below we define a 2x2 matrix (named matrixA) and print it out in standard matrix form.

In[141]:=

```
matrixA = {{1, 1}, {2, 3}};
matrixA // MatrixForm
```

Out[142]//MatrixForm=

$$\begin{pmatrix} 1 & 1 \\ 2 & 3 \end{pmatrix}$$

Each row of the matrix is treated as a list of numbers, so each row is bounded by braces (curly brackets). The entire matrix is a list of lists, so the two rows are bounded by braces.

The semi-colon at the end of the first line suppresses output. The second line prints the matrix in standard matrix form.

Exercises for you:

1) Write the *Mathematica* code that will produce the matrix

$$\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$$

2) Write the code that will produce the column vector :

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

Matrix Multiplication:

Let's define two matrices:

In[146]:=

```
matrixC =  {{1, 2, 3}, {4, 5, 7}, {9, 8, 5}};
matrixD = {{1, 2}, {−2, 3}, {−3, 4}};
```

We can multiply these matrices via:

In[148]:= **matrixC.matrixD // MatrixForm**

Out[148]//MatrixForm=

$$\begin{pmatrix} -12 & 20 \\ -27 & 51 \\ -22 & 62 \end{pmatrix}$$

where the symbol between the matrices is simply a period.

The inverse of a matrix satisfies the relationship:

$$A\,A^{-1} = I$$

where I is the identity matrix, the matrix where all diagonal elements are 1, and all other elements are zero, as in :

IdentityMatrix[3] // MatrixForm

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

The identity matrix has the same multiplication properties as the number 1, in other words:

$$I\,A = A\,I = A$$

Mathematica makes it easy to find the inverse of a matrix. Using matrixA from above:

In[150]:= **Inverse[matrixA] // MatrixForm**

Out[150]//MatrixForm=

$$\begin{pmatrix} 3 & -1 \\ -2 & 1 \end{pmatrix}$$

And we verify that this is in fact the inverse of A:

In[149]:= **matrixA.Inverse[matrixA] // MatrixForm**

Out[149]//MatrixForm=

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

Exercises for you:

1) Construct a 3 x3 matrix and compute its inverse.

2) Construct a 3 x3 matrix with two identical rows; compute the inverse. What result do you get?