

Names: _____ / _____ / _____

Chapter 7
Matrix Manipulation

To enter a matrix into the TI-86 choose **2nd MATRIX** from the keyboard then from the bar menu choose **EDIT** by pressing the appropriate "F" key. You are asked to give a name to the matrix you wish to define or edit. Note the bar menu shows the names of all matrices which you have previously defined, any one of them could be entered now for editing by pressing the appropriate "F" key. Let's name our new matrix M. Notice the cursor indicates we are already in the **ALPHA** mode, so simply press M from the keyboard and press **ENTER**, **<ENTER>**. Now you are asked for the number of rows, choose 3 **<ENTER>**. Next enter 3 for the number of columns **<ENTER>**. You are asked for the entries in the 1st column. Press in the number 1 and use the down arrow to go to the next row. Continue using the down arrow key until you have entered the matrix

$$M = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}.$$

Now **<ENTER>** to store your matrix into the machine. To view M, reenter the **MATRIX** package and choose **NAMES** from the bar menu. Select M via the appropriate "F" key and **<ENTER>**. The matrix M should be displayed on you screen. Choose **EXIT** from the keyboard to return to the previous bar menu, in this case the **MATRIX** menu. Use **EDIT** as above to define the matrices

$$N = \begin{bmatrix} 0 & 1 \\ 2 & 1 \\ 1 & 1 \end{bmatrix} \quad P = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$

$$Q = \begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix} \quad \text{and} \quad R = \begin{bmatrix} 1/2 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}.$$

Next we need to enter these same matrices into MAPLE using the same names. To enter M requires the following command sequence:

```
>with(linalg):
>M:=matrix([[1,0,1],[2,1,0],[0,1,1]]);
```

In similar fashion enter N,P,Q,and R. Attach a printout of the MAPLE worksheet containing these matrices. This "hard copy" will be nice to have in front of you as

you do the matrix manipulations required below.

With the TI-86 we can use the matrices M, N, P, Q, and R as terms in algebraic expressions (as long as the dimensions match up properly), simply enter your expression onto the screen and when you are satisfied it is what you wish to compute **<ENTER>**. The matrices can be entered by either pressing the appropriate "F" key from the **NAMES** bar menu or directly from the key board via **ALPHA** and the letter.

Compute each of the following expressions using the TI-86 and MAPLE. In each case provide the output from the technology. In the event of an error message, provide that message and explain what is going on. (The TI-86 expressions are obvious for the most part, algebra is algebra, and the bar menu contains the rest. The MAPLE command for matrix multiplication is **&***. Also MAPLE often requires the command **evalm()**; to actually show the matrix gotten from the matrix calculation.)

	TI-86	MAPLE
2N	<input type="text"/>	<input type="text"/>
M+P	<input type="text"/>	<input type="text"/>
M-P	<input type="text"/>	<input type="text"/>
M^2	<input type="text"/>	<input type="text"/>

$M+N$

$M*N$

$N*M$

$M*P$

$P*M$

What do these last two calculations tell you about matrix multiplication?

$(M+P)*N$

$\det(N)$

det(M)

det(P)

det(M*P)

What do these last three calculations suggest about determinates and products of matrices?

inverse(M) (With th TI-86 you can either write it as M^{-1} or use **2nd x⁻¹** from the keyboard.)

At this point try >Frac on your TI-86 and evalf in MAPLE. Write the new answers.

M times inverse(M)

det(inverse(M))

What do these last three calculations suggest about the relation between det of a matrix and det of its inverse?

Q⁵

transpose(M) (With the TI-86 choose t from the bar menu.)

det(transpose(M))

What do these last three calculations suggest about M and its transpose?

transpose(R)

Try inverting the matrix

$$T = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & -1 \end{bmatrix}.$$

What happens?

Why?

Compute the determinate of T, what is it?

By example demonstrate the following general fact:

$$(m_1 * m_2)^{-1} = (m_2^{-1}) * (m_1^{-1})$$

for all invertible matrices m_1 and m_2 .

Of course MAPLE allows for symbols, functions, etc to be matrix entries. To illustrate enter the matrix

$$S = \begin{bmatrix} x^2+1 & x^3 & 2 \\ 5x & 1 & 0 \\ 1 & 2 & 1 \end{bmatrix}$$

and compute

det(S)=

and

S^{-1}

