Typing in vectors

To type in a vector, use a set of squiggly braces to surround the components, and separate the components with commas: for example, to save the vector $\mathbf{v} = (2, -3, 5, 0, 1)$, execute

```
v = {2,-3,5,0,1}
```

Typing in matrices

To type in a matrix, use one of two methods:

1. Use squiggly braces and commas to separate the entries. Each row should be surrounded by a squiggly brace, and the entire matrix should be surrounded by a set of squiggly braces, and everything should be separated by commas. For example, to define A as

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

one could execute

```
A = {{1, 2}, {3, 4}}
```

Note that if you have a column matrix like $\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$, this matrix can be defined by thinking of B as a vector and typing something like `B = {1, 2, 3}` (instead of having to type `B = {{1}, {2}, {3}}`).

2. On the Basic Math Assistant palette, under Basic Commands, click the matrix. Then type `A =` , then click the matrix in the palette. To add rows and columns, click AddRow or AddColumn until the matrix is the appropriate size. Then go into the matrix and type in each entry, moving between the locations using the [TAB] key or clicking on the location you want.

If the entries of the matrix are functions, then define the matrix as a function by executing `A[t_] = ...` instead of `A = ...`

Once you have defined all necessary matrices, *Mathematica* commands for operations on those matrices are given on the back:

	EXPRESSION	MATHEMATICA SYNTAX
VECTOR OPERATIONS	Vector addition / subtraction:	
	$(2,5,-1)+(5,0,2)$	{2,5,-1} + {5,0,2}
	$\mathbf{v}-\mathbf{w}$	v - w
	Scalar multiplication:	
	$3(1,2,-3,-4)$	3{1,2,-3,-4}
	$5\mathbf{v}-3\mathbf{w}$	5v - 3w
	Dot product $\mathbf{v}\cdot\mathbf{w}$	v.w
	$(3,-4)\cdot(2,10)$	{3,-4}.{2,10}
	Norm $\|\|\mathbf{v}\|\|$	Norm[v]
	Unit vector in same direction as $\mathbf{v}$	Normalize[v]
	(i.e. $\frac{\mathbf{v}}{\|\|\mathbf{v}\|\|}$)	
	Projection of $\mathbf{v}$ onto $\mathbf{w}$	Projection[v,w]
	(i.e. $proj_{\mathbf{w}}\mathbf{v}$)	
	Angle between two vectors	VectorAngle[v,w] (answer is in radians)
		(to get degrees, click degree measure in the suggestions bar)
	Cross product $\mathbf{v}\times\mathbf{w}$	Cross[v,w]
	To get the number of components of $\mathbf{v}$	Length[v]
	To get the i^{th} component of $\mathbf{v}$	v[[i]]
MATRIX OPERATIONS	Matrix addition / subtraction	
	$A+B$	A + B
	$A-B$	A - B
	Scalar multiplication	
	$3A$	3A
	nA	n A (space important)
	$-5A+\frac{1}{2}B$	-5A + (1/2)B
	Matrix product AB	A.B (the period is important)
	A^2	A.A or MatrixPower[A,2] (**not** A^2)
	A^7	MatrixPower[A,7]
	Trace $tr(A)$	Tr[A]
	Determinant $\det A$	Det[A]
	Transpose A^T	Transpose[A]
	To get the entry of matrix A in the i^{th} row	A[[i,j]]
	and j^{th} column	
	To call the $n\times n$ identity matrix I	IdentityMatrix[n]
OTHER OPERATIONS	Matrix inverse A^{-1}	Inverse[A] (**not** A^-1)
	Reduced row-echelon form of A	RowReduce[A]
	Matrix exponential $e^A=\exp(A)$	MatrixExp[A]
	Find derivative of a matrix of functions	A'[t]
	Eigenvalues and eigenvectors of A	Eigensystem[A]
	Just the eigenvalues of A	Eigenvalues[A]
	Just the eigenvectors of A	Eigenvectors[A]
	Find $\det(A-xI)$	CharacteristicPolynomial[A,x]
	Determine if A is diagonalizable or not	DiagonalizableMatrixQ[A]
	Determine if A is positive definite	PositiveDefiniteMatrixQ[A]
	Determine if A is negative definite	NegativeDefiniteMatrixQ[A]

To make *Mathematica* display an answer as a matrix:

1. follow your command with // MatrixForm, or
2. once you've executed the command, choose Display as... matrix from the suggestions bar.