OCTONIONS IN MATHEMATICA

1. GETTING STARTED

This document briefly describes the *Mathematica* packages written by Corinne Manogue and Tevian Dray for working with octonions.

- **Start** *Mathematica***.**

For things to work correctly, the directory containing the Octonion files must be in your path. This can be accomplished by using the `Join` command:

```
$Path = Join[$Path,{"Dir"}]
```

where `Dir` is the appropriate directory.

The syntax of `Dir` may vary depending on the operating system.

This command can also be added to your `init.m` file.

- **Load some essential commands by typing** `<<Octonion.m .`

This loads `Octonion.m`, `OctoSetup.m`, `OctoMult.m`, and one of `OctoPrintA.m`, `OctoPrintB.m`.

2. THE BASIC COMMANDS

Here is a list of the basic commands:

Lists are enclosed in curly brackets, as in $\{1, 2\}$.

`MakeVector[V]`	Turns list V into column vector
`MakeMatrix[M]`	Turns list M into square matrix
`Flatten[X,1]`	Turns matrix (or vector) X into list
`bar[q]`	Octonionic conjugate of q
`dagger[X]`	Hermitian conjugate of X
`Omult[p,q]`	Octonionic multiplication (same as `omult[p,q]`)
`MMult[X,Y]`	Matrix multiplication XY
`SMult[q,X]`	Scalar multiplication qX
`SMultR[X,q]`	Scalar multiplication Xq
`assoc[p,q,r]`	Associator $(pq)r - p(qr)$
`Tr[X]`	Trace of X
`Tilde[X]`	Tilde of 2×2 matrix X
`Odet[X]`	Determinant of 2×2 matrix X
`Jdet[X]`	Determinant of 3×3 matrix X
`VSq[V]`	Vector square $V^\dagger V$
`MSq[V]`	Matrix square $VV^\dagger$

Here are some dummy variables:

`oa – oi, ox – oz`	arbitrary octonions
`O1,O2,O3`	3 generic octonions
`Omatx`	arbitrary 2×2 matrix
`Ovec`	arbitrary 2-component vector
`Jmatx`	arbitrary 3×3 matrix
`Jvec`	arbitrary 3-component vector
`Qa – Qd`	3 arbitrary octonions in i, j, k quaternionic subalgebra