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# **Definition**

|  |  |
| --- | --- |
| Commutativity |  |
| Associativity |  |
| Distributivity, etc. |  |
| Dot Product |  |
| Identity Rule |  |
| Conjugate Rule |  |

# **Imaginary Rule**

Prove:

|  |  |
| --- | --- |
| ij = k |  |
| jk = i |  |
| ki = j |  |
| ji = -k |  |
| kj = -i |  |
| ik = -j |  |

# **Operators**

## Addition and Subtraction

## Identity

## Multiplication (Note: Using IMAGINARY RULE as well)

Alternative form:

Matrix Form:

## Conjugate

Prove:

## Invert

From Complex number Conjugate:

We can solve Invert:

Prove:

# **2D Rotation**

## From Maclaurin series expansion

# **3D Rotation**

Quaternion Matrix:

## Trigo Identity To use (mark in Red)

## Using Substitution

**We know that:**

Conversion broken down into 2

**Step 1:**

1st row 2nd col:

Therefore, so on and so forth:

1st row 3nd col:

2nd row 1st col:

2nd row 3nd col:

3rd row 1st col:

3rd row 2nd col:

**Step 2:**

1st row 1st col:

Step 2.5:

Therefore Step 3:

Therefore, so on and so forth:

2nd row 2nd col:

3rd row 3rd col:

**Finally**: