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# Definition

|  |  |
| --- | --- |
| Commutativity |  |
|  |  |
|  |  |
|  |  |
| Assoociativity |  |
|  |  |
| Distributibity + etc |  |
|  |  |
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|  |  |
|  |  |

# Imaginary Rule

Prove:

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

# Operators

##### Addition and Subtration

##### Identity

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

Alternative form:

Matrix Form:

x = lhs.w \* rhs.x + lhs.x \* rhs.w + lhs.y \* rhs.z - lhs.z \* rhs.y;

y = lhs.w \* rhs.y + lhs.y \* rhs.w + lhs.z \* rhs.x - lhs.x \* rhs.z;

z = lhs.w \* rhs.z + lhs.z \* rhs.w + lhs.x \* rhs.y - lhs.y \* rhs.x;

w = lhs.w \* rhs.w - lhs.x \* rhs.x - lhs.y \* rhs.y - lhs.z \* rhs.z;

##### 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**: