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# Definition

##### Commutativity

##### Assoociativity

##### Distributibity + etc

# 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

##### Maclaurin series expansion

# 3D Rotation

# Quaternion Matrix

##### Trigo Identity

##### SubSTitution

We know that:

Step 1:

1st row 2nd col:

Therefore:

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:

Step 3:

Therefore:

2nd row 2nd col:

3rd row 3rd col:

Finally: