**Task 1**

**for special case** (vector on the axis):

Therefore,

**For general case**, i.e.

For the first element,

Simplify,

Simplify,

With

Finally,

For the second element,

Simplify,

Finally,

Similarly, we can acquire all other 7 elements and prove:

**Task 2**

1)

A is a rotation matrix, so that

* scalar product of each row with itself must be 1
* scalar product of different rows has to be 0
* the same criterions hold for each column

Therefore,

Therefore,

2)

Or

It is not unique.

3)

The vector’s length (norm) is changed

**Task 3**

1) DCM

2) quaternion operation

Therefore, 1) corresponds to 2).