* 1. Given our axis parameters of [a , b, c] to get the composite matrix, we would need to get the individual rotation matrices for the x , y and z dimensions and then multiply them in order of rotation. As such our three rotation matrices would be Rx(a), Ry(b) and Rz(c). We then multiply them together to get M = Rz(c) Ry(b)Rx(a)
  2. Our Rotation matrix from 𝒜 to ℬ is M, the joint’s co-ordinates in 𝒜 as p and our Rotation matrix in B is defined as N. To get the points new co-ordinate system we first apply the transformation matrix M on the points p to convert the points from 𝒜 to B (let this be denoted as q). Therefore, we get the formula q=Mp.

After that we apply transformation matrix N to these points q to get our new points in B. Let us denote these new points as x for clarity.

Therefore, to get our points in system 𝒜, we need to find the inverse of M (denoted as M­­-1) to get our points from system ℬ 🡪 𝒜. This gives us the formula M-1x. Recall that the formula for x is Nq and the formula for q is Mp, we can combine the 2 formulae to give us M-1NMp to give us the points in system A. In conclusion, our transformation matrix N’ is M-1NM.

* 1. Given that l is the length and our direction vector is d. We can get the value of p by performing the following formula: p = l \* d/|d|
  2. Recall that N’ = M-1NM is the rotation matrix for the local co-ordinate space we found that p = l \* d/|d|and M = Rz(c) Ry(b)Rx(a). We also know that M0 is the transformation matrix from parent’s local system to global system. Therefore, the final formula p’= M0 N’ p which can be expanded to M0 (M-1NM) (l \* d/|d|)

[Part 2 link](https://drive.google.com/file/d/1imvcu_w8AI4QtEyR4OcDx_6K--kXfW8d/view?usp=share_link)