# Solution - Exercise [2]
### Introduction to Computer Graphics - B-IT Master Course

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November 16, 2015

## Exercise 1

Given are two points p1,p2 on the unit sphere in ?3. Using a quaternion the point p1 is to be rotated onto the point p2.

    a. Give a formula to determine the angle of rotation $\alpha$

$$\alpha = \arccos\left\{\frac{q_1 \cdot q_2}{|q_1| \cdot |q_2|}\right\}$$

    b. Give a formula to detemine the rotation axis v

$$v = q_1 \cdot q_2$$

    c. Write down the quaternion q which performs the rotation with angle $\alpha$ around v

$$a = rotationangle$$
$$x, y, z = rotationaxis$$
$$q = \cos\left(\frac{a}{2}\right) + i\left(x\sin\frac{a}{2}\right) + j\left(y\sin\frac{a}{2}\right) + k\left(z\sin\frac{a}{2}\right)$$

    d. Write down the relationship between p1 and p2 using quaternion multiplication

$$q1 = q1_0 + \mathbf{i}q1_1 + \mathbf{j}q1_2 + \mathbf{k}q1_3$$
$$q2 = q2_0 + \mathbf{i}q2_1 + \mathbf{j}q2_2 + \mathbf{k}q2_3$$

$q1 \times q2 = (q1_0 q2_0 - q1_1 q2_1 - q1_3 q2_3 - q1_4) + \mathbf{i}(q1_1 q2_0 + q1_0 q2_1 + q1_3 q2_3 - q1_4 q2_2) + \mathbf{j}(q1_0 q2_2 - q1_1 q2_3 + q1_2 q2_0 + q1_3 q2_1) + \mathbf{k}(q1_0 q2_3 + q1_1 q2_2 - q1_2 q2_1 + q1_3 q2_0)$

## Exercise 2

And some more text . . .