④ $\vec{OA} = \begin{pmatrix} 3 \\ 0 \\ -4 \end{pmatrix}$; $\vec{OB} = \begin{pmatrix} 6 \\ -3 \\ 2 \end{pmatrix}$

i) $\cos\theta = \dfrac{A \cdot B}{|A| \cdot |B|}$

$A \cdot B \leftarrow$ dot Product

$|A| \cdot |B| \rightarrow$ distances

$$A \cdot B = \begin{pmatrix} 3 \\ 0 \\ -4 \end{pmatrix} \cdot \begin{pmatrix} 6 \\ -3 \\ 2 \end{pmatrix}$$

$$= (3 \cdot 6) + \underbrace{[(0) \cdot (-3)]}_{0} + [(-4) \cdot (2)]$$

$$= 18 - 8 = 10 \Rightarrow A \cdot B = 10$$

$$dA = \sqrt{3^2 + 0^2 + (-4)^2} = \sqrt{9 + 16} = 5$$

$$dB = \sqrt{6^2 + (-3)^2 + 2^2} = \sqrt{36 + 9 + 4} = 7$$

$$\boxed{\cos\theta = \frac{10}{5 \cdot 7} = \frac{2}{7} \Rightarrow \text{Cosine of } AOB}$$

ii) $\vec{OC} = \begin{pmatrix} k \\ -2k \\ 2k - 3 \end{pmatrix}$ $\quad \vec{AB} = b - a = \begin{pmatrix} 6 - 3 \\ -3 - 0 \\ 2 + 4 \end{pmatrix} = \begin{pmatrix} 3 \\ -3 \\ 6 \end{pmatrix}$

$\cancel{\vec{AB} = \vec{OC}}$

$$d_{AB} = d_{OC}$$

$$\Rightarrow 3^2 + (-3)^2 + 6^2 = k^2 + (-2k)^2 + (2k - 3)^2$$

$$9 + 9 + 36 = k^2 + 4k^2 + 4k^2 - 12k + 9$$

$$54 = 9k^2 - 12k + 9$$

$$\Rightarrow 9k^2 - 12k - 45 = 0$$

Using the Discriminant $\Delta = b^2 - 4ac$

with $\begin{cases} b = -12 \\ a = 9 \\ c = -45 \end{cases}$, We obtain $\boxed{k_1 = 3 \text{ and } k_2 = -\frac{5}{3} \text{ or } k_1 = -\frac{5}{3} \text{ and } k_2 = 3}$