$$M_K = I_K \Omega_K$$

$$\Rightarrow \quad \left.\begin{aligned} I_1 \frac{d\Omega_1}{dt} + (I_3 - I_2)\,\Omega_2\Omega_3 &= K_1 \\ I_2 \frac{d\Omega_2}{dt} + (I_1 - I_3)\,\Omega_1\Omega_3 &= K_2 \\ I_3 \frac{d\Omega_3}{dt} + (I_1 - I_2)\,\Omega_1\Omega_2 &= K_3 \end{aligned}\right\} \text{Euler equations}$$

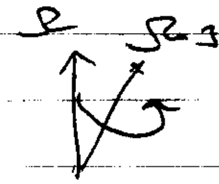
<u>Example</u> Free symmetric top, then

$$I_1 = I_2$$
$$K = 0$$
$$\Rightarrow \frac{d\Omega_3}{dt} = 0 \Rightarrow \Omega_3 = \text{constant}$$

$$\frac{d\Omega_1}{dt} = -\frac{(I_3 - I_1)}{I_1}\,\Omega_2\Omega_3 \equiv -\omega\,\Omega_2$$

$$\frac{d\Omega_2}{dt} = -\frac{(I_1 - I_3)}{I_1}\,\Omega_1\Omega_3 \equiv \omega\,\Omega_1$$

$$\Rightarrow \Omega_1 = A\cos\omega t$$
$$\Omega_2 = A\sin\omega t$$



$\Rightarrow \Omega$ rotates about Ω_3 with frequency ω

$M_K = I_K \Omega_K \Rightarrow \vec{M}$ rotates about Ω_3 <u>in body fixed frame</u>

<u>Exercise</u>: show that this result is consistent with previous expression for precession.