

$$0 = y_1(\dot{q}_1 \wedge \ddot{q}_1) + \dot{y}_1(\ddot{q}_1 \wedge q_1) + \ddot{y}_1(q_1 \wedge \dot{q}_1)$$

$$= y_1|\dot{q}_1|^3\kappa_1 - \dot{y}_1\dot{\ell}_1 + \ddot{y}_1\ell_1$$