$$\frac{d\vec{L}}{dt} = \vec{\tau}$$

$$d\vec{L} \; = \; \vec{\tau}\, dt$$

$$(\vec{L_f} - \vec{L_i}) \; = \; \vec{\tau}\, dt$$

$$\vec{L_f} \; = \; \vec{L_i} \; + \; \vec{\tau}\, dt$$

$$\begin{aligned} |dL| \; &= \; (\text{ radius })(\text{ angle }) \\ &= \quad (|L_i|) \qquad (d\phi) \\ |\tau\, dt| &= \quad (|L_i|) \qquad (d\phi) \end{aligned}$$

$$\left|\frac{d\phi}{dt}\right| =$$