# Rotational Dynamics - 1

**Bicycle (1):**

$$\omega = \frac{v}{r}\,\mathrm{rad}\,, \quad T = \frac{2\pi\,\mathrm{rad}}{\omega}\,.$$

**Belt Drive (2):** Use relation of frequencies

$$f_a\, r_a = f_c\, r_c\,, \quad \omega_a = 2\pi\, f_a\,\mathrm{rad/rev}\,, \quad \alpha_a\, t = \omega_a\,.$$

**Spinning Wheel and Arrow (3).** Times have to agree:

$$\frac{L_{\mathrm{arrow}}}{v_{\mathrm{arrow}}} = \frac{L_{\mathrm{wheel}}}{v_{\mathrm{wheel}}}\,, \quad L_{\mathrm{wheel}} = \frac{R}{8}\,.$$

**Cyclist (4).**

$$\theta = \alpha\,\frac{t^2}{2}\,, \quad \omega = \alpha\, t\,, \quad d = \theta\, r/\mathrm{rad}\,.$$

# Rotational Dynamics - 2

**Rotational Variables (5).** Use just numbers. Fix units on output. Given is $\theta(t)$. Then

$$\omega(t) = \frac{d\theta}{d\,t}\,, \quad \alpha = \frac{d\omega}{d\,t}\,, \quad \overline{\alpha} = \frac{\omega_2 - \omega_2}{t_2 - t_1}\,.$$

**Crumb on rotating table (6):**

$$T = \frac{\mathrm{rev}}{f}\,, \quad v = \frac{2\pi\, r}{T}\,, \quad a = ?\,.$$

**Torque on a Door (7):**

$$\tau = r\, F\, \sin(\theta)\,.$$