0. **(0 points)** /opt/webwork/webwork2/conf/snippets/ASimpleCombinedHeaderFile.pg

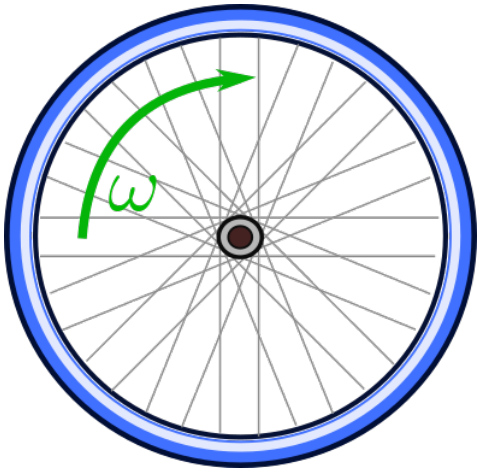
Alice Quillen **fall22phy141**

Assignment PHY141_WW9 due 11/11/2022 at 11:59pm EST

---

1. **(1 point)** setPHY141_WW9/torque.pg

On torque



A wheel has moment of inertia $I = 5$ kg m^2 and angular rotation rate $\omega = \dot{\theta} = a + bt$.
Here the coefficients $a = 2$ rad s^{-1} and $b = 2$ rad s^{-2}.
What is the torque τ on the wheel?
$\tau =$ ___ kg m^2 s^{-2}

---

2. **(1 point)** setPHY141_WW9/spin_axis.pg

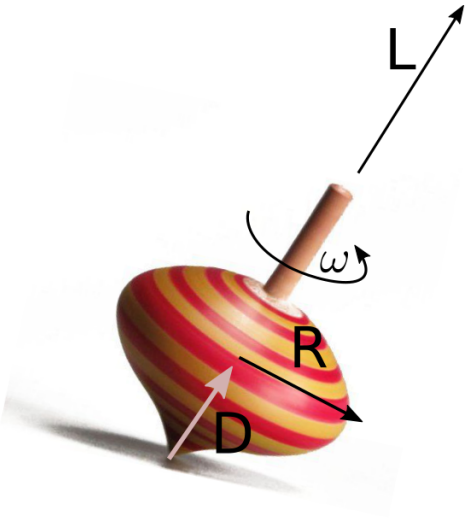
On Torque applied along a spin axis

The angular momentum of spinning top is initially $\mathbf{L}_0 = 2\hat{\mathbf{z}}$ kg m^2 s^{-1}.
The top's moment of inertia about the z-axis is $I = 0.5$ kg m^2.
What is the angular rotation rate of the top? _____ s^{-1}
A torque is exerted on the top in the same direction as the angular momentum $\tau = 0.2\hat{\mathbf{z}}$ kg m^2 s^{-2}.
This torque is applied for 1 s.
What is the top's angular momentum after the torque is applied?
Afterward $\mathbf{L} =$ _____ $\hat{\mathbf{x}}+$ _____ $\hat{\mathbf{y}}+$ _____ $\hat{\mathbf{z}}$ (kg m^2 s^{-1})
What is the angular rotation rate of the top after the torque is applied? _____ s^{-1}

---

3. **(1 point)** setPHY141_WW9/spin_axis2.pg

On Precession of a Top



A red top has mass M, and radius R. The distance between center of mass and its pivot point is D. The top's spin rate is ω. Its moment of inertia is $I = \alpha MR^2$. The top is precessing due to gravity at a precession rate Ω_{red}.

A blue top has the same spin, mass and distance D and coefficient α describing its moment of inertia. The blue top has a radius twice as large as that of the red top.
What is its precession rate?
$\Omega_{blue} =$ _____ Ω_{red}

A green top is the same as the red top, except that its length to center of mass D is twice as long as that of the red top.
What is its precession rate?
$\Omega_{green} =$ _____ Ω_{red}

A brown top is the same as the red top, except that it is spinning twice as fast.
What is its precession rate?
$\Omega_{brown} =$ _____ Ω_{red}