1. **The angular position of a point on the rim of a rotating wheel is given by:**

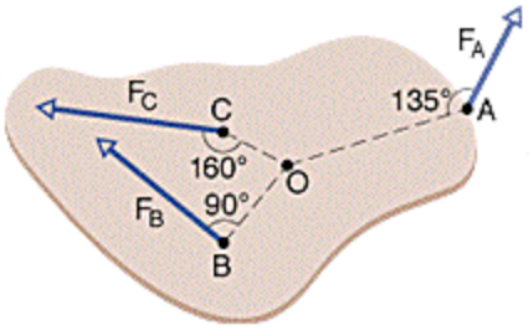
$$\theta = 9t - 2t^2 + t^3$$

where θ is in radians and t is in seconds.

   a. **What is the angular velocity at t = 4 [s]?**
   b. **What is the angular velocity at t = 6.0 [s]?**
   c. **What is the average angular acceleration for the time interval that begins at t = 4 [s] and ends at t = 6.0 [s]?**
   d. **What is the instantaneous angular acceleration at the beginning of this time interval?**
   e. **What is the instantaneous angular acceleration at the end of this time interval?**

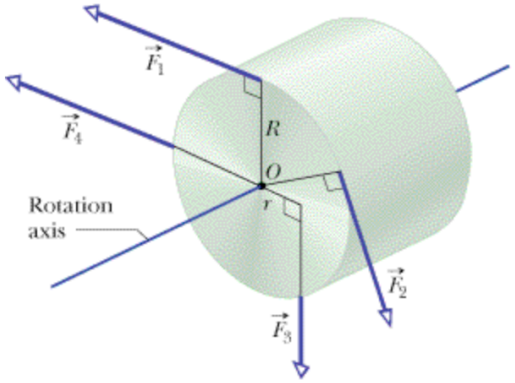
2. **A force F(t) = 4sin(2t) [m/s] acts on an object for the time interval 1 [s] to 5 [s].**
   a. **What is the impulse that acts on the object?**
   b. **If the mass of the object is 0.15 [kg], what is the change in velocity of the object? (use radian mode for trig functions)**

3. **The body in the figure is pivoted at O. Three forces act on it in the directions shown on the figure. F_A = 11 [N] at point A, 8.0 m from O. F_B = 15 [N] at point B, 4.0 [m] from O. F_C = 17 [N] at point C, 3.0 [m] from O. What is the net torque about the pivot point O? Assume clockwise to be positive.**

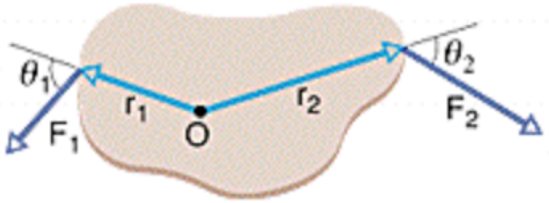


4. **A certain one-dimensional conservative force is given as a function of x by the expression $F = -kx^4$, where F is in [N] and x is in [m]. What is the potential energy function for this force?**

5. **In the figure below a cylinder having a mass of 4 [kg] can rotate about its central axis through point O. Forces are applied as shown: F_1 = 9 [N], F_2 = 6 [N], F_3 = 3 [N], and F_4 = 4 [N]. Also, r = 5 [cm] and R = 12 [cm]. What is the net torque about the pivot point O? Assume clockwise to be positive.**



6. **The body in the figure below is pivoted at O, and two forces act on it as shown. Assume clockwise to be positive.**



If r_1 = 1.40 [m], r_2 = 2.14 [m], F_1 = 3.70 [N], F_2 = 5.31 [N], θ_1 = 75.0°, and θ_2 = 60.0°, what is the net torque about the pivot point O?

1a. 41 [rad/s]
1b. 93 [rad/s]
1c. 26 [rad/s^2]
1d. 20 [rad/s^2]
1e. 32 [rad/s^2]

2a. 0.846 [Ns]
2b. 5.64 [m/s]

3. -19.7 [Nm] (negative implies counterclockwise net torque)

4. $U = kx^5/5 + C$ [J]

5. -0.21 [Nm] (negative implies counterclockwise net torque)

6. 4.84 [Nm] (positive implies clockwise net torque)