I. One end of a uniform horizontal 100 N beam is hinged at a vertical wall. It is held by a cable that connects to the beam 3 m from the wall, as shown to the right. A 300 N object is suspended from the free end of the beam.

a) Determine the angle $\alpha$.

b) Determine the tension in the cable.

c) Determine the y components of the force of the pin on the beam.
II. Three forces of equal magnitude are applied to a 3-m by 2-m rectangle. Forces \( \vec{F}_1 \) and \( \vec{F}_2 \) act at 45° angles to the vertical as shown, while \( \vec{F}_3 \) acts horizontally.

a) Is the net torque about point \( A \) clockwise, counterclockwise, or zero?  
**Explain how you determined your answer.**

b) Is the net torque about point \( B \) clockwise, counterclockwise, or zero?  
**Explain how you determined your answer.**

c) Is the net torque about point \( C \) clockwise, counterclockwise, or zero?  
**Explain how you determined your answer.**
3. Ekapluto is an unknown planet that has two moons in circular orbit. Moon A has a mass of \( 4 \times 10^{20} \text{ kg} \), a mean orbital radius of \( 3.0 \times 10^8 \text{ m} \) and an orbital period of \( 4 \times 10^6 \text{ s} \). Moon B has a mass of \( 1.5 \times 10^{20} \text{ kg} \) and a mean orbital radius of \( 3.9 \times 10^8 \text{ m} \). The orbital period of Moon B is closest to
   a) \( 5.6 \times 10^6 \text{ s} \)
   b) \( 5.9 \times 10^6 \text{ s} \)
   c) \( 6.6 \times 10^6 \text{ s} \)
   d) \( 6.9 \times 10^6 \text{ s} \)
   e) \( 7.3 \times 10^6 \text{ s} \)

4. A moon travels at a speed \( v_o \) around its planet. If the radius of the moon’s orbit about the planet is doubled (while the planet’s radius and mass remain constant), the new speed of the moon, \( v_f \), is
   a) \( v_f = \sqrt{2} v_o \)
   b) \( v_f = 2v_o \)
   c) not changed.
   d) \( v_f = v_o / \sqrt{2} \)
   e) \( v_f = v_o / 2 \)

5. A wheel starts from rest and rotates with a constant angular acceleration about a fixed axis. It completes the first revolution \( 4.0 \text{ s} \) after it started. How long after it started will the wheel complete the second revolution?
   a) \( 6.9 \text{ s} \)
   b) \( 7.6 \text{ s} \)
   c) \( 8.0 \text{ s} \)
   d) \( 12 \text{ s} \)
   e) \( 5.7 \text{ s} \)
6. The turntable of a record player has an angular velocity of 8.0 rad/s when it is turned off. The turntable comes to rest 2.5 s after being turned off. The turntable is a disk whose mass is 0.6 kg and radius is 0.2 m. How big is the constant braking torque that stops the turntable?
   a) 15 x 10^{-2} N\cdot m
   b) 31 x 10^{-2} N\cdot m
   c) 1.9 x 10^{-2} N\cdot m
   d) 7.7 x 10^{-2} N\cdot m
   e) 3.8 x 10^{-2} N\cdot m

7. Two disks of identical mass but different radii (r and 3r) are spinning on frictionless bearings at the same angular speed \( \omega_0 \) but in different directions. The two disks are brought slowly together. The resulting frictional force between the surfaces eventually brings them to a common angular velocity. The entire process takes place such that no external torques act on the system. Find the final angular velocity of the disks.
   a) \( \frac{4}{5} \omega_0 \)
   b) \( \frac{1}{3} \omega_0 \)
   c) \( \frac{1}{2} \omega_0 \)
   d) \( \frac{1}{9} \omega_0 \)
   e) 0

8. A 5.2 m uniform ladder weighing 90 N rests against a frictionless wall as shown in the diagram. If the coefficient of static friction between the ladder and the ground is 0.61, find the value of the angle \( \theta \).
   a) 32°
   b) 52°
   c) 47°
   d) 43°
   e) 39°