

Name: \_\_\_\_\_

Seat Assignment: \_\_\_\_\_

Specify your **EXAM ID** on the right. Use 000 if you do not know your exam ID.Circle your **LAB SECTION**

	102	212	216	217	218
8:10	<b>A102</b> Jackson	<b>A212</b> Adam	<b>A216</b> Min	<b>A217</b> Siavash	<b>A218</b> Erik
9:40	<b>B102</b> Jackson	<b>B212</b> Dhruv	<b>B216</b> Min	<b>B217</b> Siavash	<b>B218</b> Erik
11:10	<b>C102</b> Savannah	<b>C212</b> Adam	<b>C216</b> Will	<b>C217</b> Siavash	<b>C218</b> Erik
12:40	<b>D102</b> Savannah	<b>D212</b> Min	<b>D216</b> Will	<b>D217</b> Teague	<b>D218</b> Eric
2:10	<b>E102</b> Savannah	<b>E212</b> Adam	<b>E216</b> Dhruv	<b>E217</b> Teague	<b>E218</b> Eric
3:40	<b>F102</b> Jackson	<b>F212</b> Will	<b>F216</b> Dhruv	<b>F217</b> Teague	<b>F218</b> Eric

0	<input type="radio"/>	0	<input type="radio"/>	0	<input type="radio"/>
1	<input type="radio"/>	1	<input type="radio"/>	1	<input type="radio"/>
2	<input type="radio"/>	2	<input type="radio"/>	2	<input type="radio"/>
3	<input type="radio"/>	3	<input type="radio"/>	3	<input type="radio"/>
4	<input type="radio"/>	4	<input type="radio"/>	4	<input type="radio"/>
5	<input type="radio"/>	5	<input type="radio"/>	5	<input type="radio"/>
6	<input type="radio"/>	6	<input type="radio"/>	6	<input type="radio"/>
7	<input type="radio"/>	7	<input type="radio"/>	7	<input type="radio"/>
8	<input type="radio"/>	8	<input type="radio"/>	8	<input type="radio"/>
9	<input type="radio"/>	9	<input type="radio"/>	9	<input type="radio"/>

**Instructions**

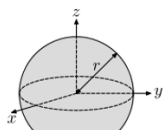
- Sit in your assigned seat.
- Do not open the exam until instructed to do so.
- Completely color in the dot for your chosen answers on multiple choice.
- Do not leave if there is less than 5 minutes to go in the exam.
- When time is called, immediately stop writing, remain seated, and pass your exam to the center aisle.
- Working after time is called results in an automatic deduction.

**Guidelines**

- Assume 3 significant figures for all given numbers unless otherwise stated
- Show all of your work – no work, no credit
- Write your final answer in the box provided
- Include units for all answers and directions for all vectors

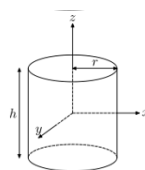
**Moment of Inertia:**

Solid sphere



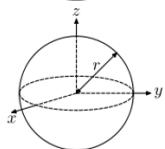
$$I = \frac{2}{5}mr^2$$

Solid cylinder



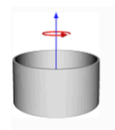
$$I_z = \frac{1}{2}mr^2$$

Hollow sphere



$$I = \frac{2}{3}mr^2$$

Thin-walled hollow cylinder



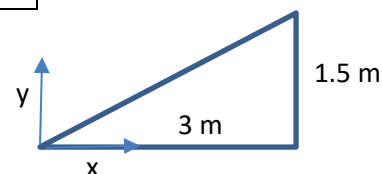
$$I = mr^2$$

1. (2 pts) A wheel is rotating in a counter-clockwise direction at a constant angular speed of 40 rev/min. Which of the following is true about the net torque acting on the wheel?

Net torque is zero	Net torque is positive	Net torque is zero
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. (2 pts) What is the x coordinate of the center of mass of this object:

1 m	1.5 m	2 m	3 m
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



3. (2 pts) A figure skater is rotating at 2.5 rev/s with her arms extended. She pulls her arms in and her angular speed increases to 4 rev/s. What quantity is conserved?

Rotational kinetic energy	Angular acceleration	Angular momentum
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. (2 pts) A 2.0 m diameter wheel starts from rest and speeds up at a constant rate reaching an angular velocity of 10 rev/s in 6 seconds. How many revolutions has it made after 6 seconds?

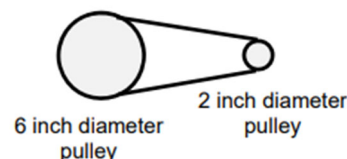
30 rev	60 rev	120 rev
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. (2 pts) When a rigid body rotates about a fixed axis, all points on the body have the same:

Tangential speed	Centripetal Acceleration	Angular Acceleration	Linear displacement
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. (2 pts) The angular velocity of the 6 inch diameter pulley is 2.5 rad/s. What is the angular velocity of the 2 inch diameter pulley?

0.833 rad/s	7.5 rad/s	16 rad/s
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



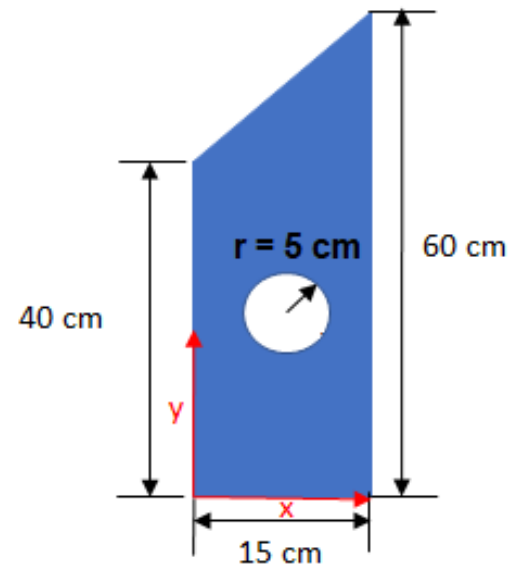
7. (2 pts) A wheel starts at rests and speeds up at a constant rate. If it makes 6 revolutions in the first 2 seconds, how many revolutions has it made after 4 seconds?

12 rev	18 rev	24 rev
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8. (2 pts) A solid cylinder and a hollow cylinder roll down identical inclines. Which reaches the bottom first?

The solid cylinder	The hollow cylinder	They reach the bottom at the same time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

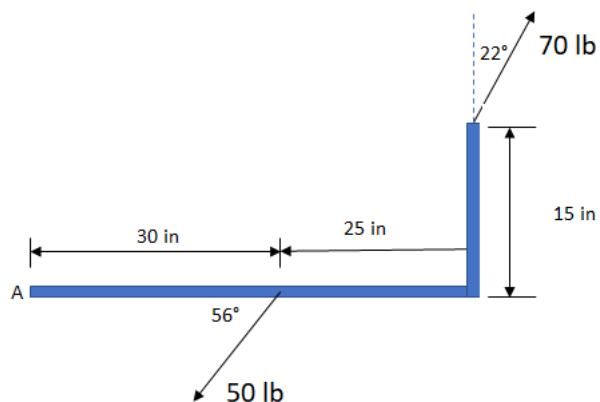
9. (14 pts) The object shown has a uniform thickness and density. The center of the hole is located at (7.5 cm, 20 cm). Using a coordinate system with the origin at the lower left corner of the object, what is the x coordinate of the center of mass?



10. (14 pts) A uniform solid cylinder ( $r = 1.60$  m and  $m = 2.30$  kg) starts from rest and rolls without slipping to the bottom of an inclined plane. If the angular velocity of the disk is 5.35 rad/s at the bottom, what is the height of the inclined plane?

11. (14 pts) A potter's wheel ( $I = 64 \text{ slug}\cdot\text{ft}^2$ ) is spinning at 40 rev/min. The potter drops a lump of clay onto the wheel, where it lands and sticks 1.2 ft from the rotational axis. After this happens, the angular speed of the wheel and clay is 38 rev/min. What is the mass of the clay?

12. (14 pts) What is the net torque about point A (counterclockwise positive)?



13. (14 pts ) A force of  $\langle 68, -32, -18 \rangle$  lbs is applied at point A  $\langle 7, 0, 12 \rangle$  ft. What is the magnitude of the torque about the point  $\langle 5, 2, 0 \rangle$ ?

14. (14 pts) A barbell consists of 2 identical solid spheres each with a radius of 0.17 m and a mass of 50 kg. The two spheres are connected by a 0.96 m long uniform steel rod with a mass of 12 kg. What is the moment of inertia of the barbell about an axis through the center?

