• Walk-In tutoring at Broward Hall
• Private-Appointment, one-on-one tutoring at Broward Hall
• Walk-In tutoring in LIT 215
• Supplemental Instruction
• Video resources for Math and Science classes at UF
• Written exam reviews and copies of previous exams

The teaching center is located in the basement of Broward Hall:

You can learn more about the services offered by the teaching center by visiting https://teachingcenter.ufl.edu/
1. In the figure below, a 55 kg rock climber is in a lie-back climb along a fissure, with hands pulling on one side of the fissure and feet pressed against the opposite side. The fissure has width $w = 0.20 \text{ m}$, and the center of mass of the climber is a horizontal distance $d = 0.40 \text{ m}$ from the fissure. The coefficient of static friction between hands and rock is $\mu_1 = 0.40$, and between boots and rock it is $\mu_2 = 1.2$. If the climber is pushing (and pulling) with the least amount of force possible for static equilibrium, what must be the vertical distance $h$ between hands and feet?

A. 0.65 m  B. 1.28 m  C. 0.23 m  D. 2.12 m  E. 0.88 m

2. In the figure below, a nonuniform bar is suspended at rest in a horizontal position by two massless cords. One cord makes the angle $\theta = 36.9^\circ$ with the vertical; the other makes the angle $\phi = 53.1^\circ$ with the vertical. If the length $L$ of the bar is 6.10 m, compute the distance $x$ from the left end of the bar to its center of mass.

A. 2.86 m  B. 2.20 m  C. 1.14 m  D. 3.78 m  E. 5.34 m

3. In the figure below, a 103 kg uniform log hangs by two steel wires, A and B, both of radius 1.20 mm. Before having to support the log, wire A was 2.50 m long and 2.00 mm shorter than wire B. The log is now horizontal. What is the magnitude of the force on it from wire A? (Young’s Modulus for steel is $200 \times 10^9 \text{ N/m}^2$)

A. 402 N  B. 347 N  C. 311 N  D. 866 N  E. 942 N
4. Four particles, each of mass 20.0 g, form a square with an edge length of $d = 0.600$ m. If $d$ is reduced to 0.200 m, what is the change in the gravitational potential energy of the four-particle system?

A. $-1.98 \times 10^{-13}$ J  
B. $-4.82 \times 10^{-13}$ J  
C. $3.36 \times 10^{-13}$ J  
D. $5.24 \times 10^{-13}$ J  
E. $-3.92 \times 10^{-13}$ J

5. A hypothetical planet has a mass of $5.0 \times 10^{23}$ kg, a radius of $3.0 \times 10^6$ m, and no atmosphere. A 10 kg space probe is to be launched vertically from its surface. If the probe is to achieve a maximum distance of $8.0 \times 10^6$ m from the center of the planet, with what initial kinetic energy must it be launched from the surface?

A. $2.3 \times 10^7$ J  
B. $6.9 \times 10^7$ J  
C. $9.6 \times 10^7$ J  
D. $1.1 \times 10^7$ J  
E. $4.7 \times 10^7$ J

6. A large aquarium of height 5.00 m is filled with fresh water to a depth of 2.00 m. One wall of the aquarium consists of thick plastic 8.00 m wide. By how much does the total force on that wall increase if the aquarium is next filled to a depth of 4.00 m?

A. $1.98 \times 10^5$ N  
B. $1.24 \times 10^5$ N  
C. $4.69 \times 10^5$ N  
D. $7.42 \times 10^5$ N  
E. $8.31 \times 10^5$ N

7. A hollow sphere of inner radius 8.0 cm and outer radius 9.0 cm floats half-submerged in a liquid of density $800 \, kg/m^3$. Calculate the density of the material of which the sphere is made.

A. $1.3 \times 10^3 \, kg/m^3$  
B. $2.2 \times 10^3 \, kg/m^3$  
C. $4.7 \times 10^3 \, kg/m^3$  
D. $8.4 \times 10^3 \, kg/m^3$  
E. $9.0 \times 10^3 \, kg/m^3$
8. In the figure below, water flows steadily from the left pipe section (radius \( r_1 = 2.00R \)), through the middle section (radius \( R \)), and into the right section (radius \( r_3 = 3.00R \)). The speed of the water in the middle section is 0.500 m/s. What is the net work done on 0.400 m\(^3\) of the water as it moves from the left section to the right section?

- A. 2.38 J
- B. -5.78 J
- C. -1.00 J
- D. 6.10 J
- E. -2.50 J

9. The figure below shows block 1 of mass 0.200 kg sliding to the right over a frictionless elevated surface at a speed of 8.00 m/s. The block undergoes an elastic collision with stationary block 2, which is attached to a spring of spring constant 1208.5 N/m. (Assume that the spring does not affect the collision.) After the collision, block 2 oscillates in simple harmonic motion with a period of 0.140 s, and block 1 slides off the opposite end of the elevated surface, landing a distance \( d \) from the base of that surface after falling height \( h = 4.90 \) m. What is the value of \( d \)?

- A. 1.59 m
- B. 4.00 m
- C. 6.33 m
- D. 12.68 m
- E. 10.10 m

10. A physical pendulum consists of two meter-long sticks of equal mass joined together as shown in the figure below. The pendulum has period of oscillation \( T_A \) when rotating about a pin inserted through point \( A \) and period \( T_B \) when rotating about a pin inserted through point \( B \). What is the ratio \( T_B/T_A \)?

- A. \( \sqrt{\frac{17}{5}} \)
- B. \( \sqrt{\frac{17}{15}} \)
- C. \( \sqrt{\frac{1}{15}} \)
- D. \( \sqrt{\frac{12}{5}} \)
- E. \( \sqrt{\frac{5}{17}} \)