Exam 2 Content and Format

- **Linear kinetics**
  - GRF, net force, Newton's laws
  - Weight, mass, Law of gravitation
  - Pressure
  - Friction
  - Momentum; impulse; coefficient of restitution
  - Centripetal and centrifugal forces
- **Angular kinetics**
  - Torque; net torque; Newton's laws
  - Center of mass
  - Angular momentum; moment of inertia
- **Vertical jumping**
  - Methods used to evaluate
  - Key factors

- Multiple choice: SCANTRON
- Draw and label
- Identify and describe
- Problems

- I will allow students to begin filling out the SCANTRON forms at 8:30 (10 minutes prior to the start of the exam).
- The exam will be proctored by Bryan Morrison (Ph.D. candidate)
- Pending approval, exam will end at 9:35 (if not approved, 9:30)

- BRING PENCIL
- BRING CALCULATOR

Questions

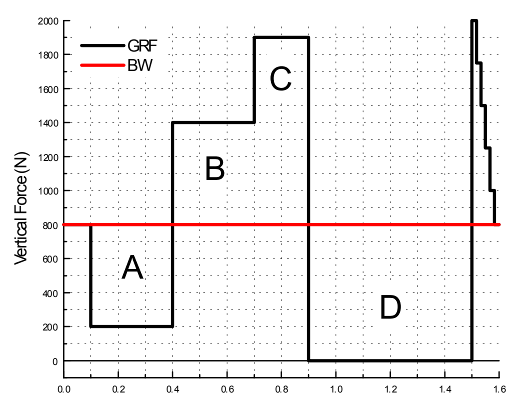
- What is the angular equivalent to mass? What two factors contribute directly to the magnitude of this angular equivalent to mass?
- Angular momentum is determined by the product of two quantities. What are they? What are the units that you would expect to be associated with angular momentum?
- Define Newton's second law in the context of angular motion. Briefly describe an everyday example of this relationship.
- A diver attempts a 3½ forward somersault dive. In observing the diving sequence, you notice that the diver's body is first "layed out", then "tucked", and then "layed out" again. Describe what happens to the diver's whole body angular momentum and the two factors that directly contribute to the diver's whole body angular momentum during the entire diving sequence (from layed out to tucked to layed out again).
- Whole body angular momentum involves both a *remote* and a *local* term. Define each of these.

Problem 1

- Olympic gymnast, Kerri Strug, landed her gold-medal winning vault on one-foot. Kerri weighs approximately 300 N and each foot has a surface area of about 212 cm^2. Answer the following questions:
  - At the peak of her vault, Kerri's CM was elevated to a height of approximately 3.1 m above her landing height. What was her vertical velocity (in m/s) at the instant she contacted the ground?
  - If Kerri came to a complete stop in exactly 0.42 s, what was the vertical impulse (in N·s) experienced during the landing phase?
  - If Kerri came to a complete stop in exactly 0.42 s, what was the average vertical force (in N) experienced during the landing phase?
  - What was the ground reaction force (N)?
  - What was the average pressure experienced by Kerri during her heroic one-footed landing (in N/cm^2)? If she would have been able to land on both feet, how would the pressure she had experienced change? Briefly explain.

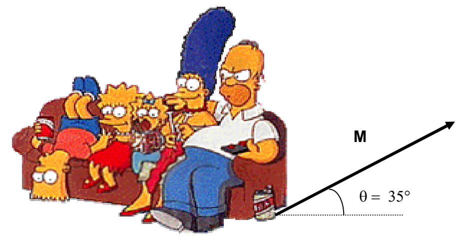
Problem 2

- An 800 N athlete performs a countermovement vertical jump. The simplified vertical force-time profile of his performance is provided below in the figure below.
  - Briefly describe what is physically happening to the athlete in areas A, B, C, and D
  - Compute the net vertical impulses in areas A, B, and C
  - Using the impulse-momentum relationship and the net impulse over regions A, B, and C, compute the vertical velocity at takeoff.
  - Using your answer for part c), compute the maximum height to which the athlete's CM was elevated during the jump.
  - Using the total time of flight (region D), compute the maximum height to which the athlete's CM was elevated during the jump.
  - Compare your answers from parts d) and e). Briefly describe some factors which could account for this difference.



Problem 3

- Prior to the application of the moving force, the couch was at rest.
- The couch has a weight of 490 N.
- The Simpson family has a weight of 2205 N.
- The coefficient of static friction between the carpet and the couch is μ_s= 0.60.
- The coefficient of dynamic friction between the carpet and the couch is μ_k= 0.54.
- The resultant "moving force", **M**, applied by the mover is directed 35 degrees upwards from the positive horizontal axis (refer to diagram). The magnitude of this force is 1400 N.



– What is the net (total) normal force acting on the couch?
– Under the conditions described above, will the Simpson's couch slide? Why or why not?
– What will happen to the couch if the mover continues to apply the same moving force, **M**?