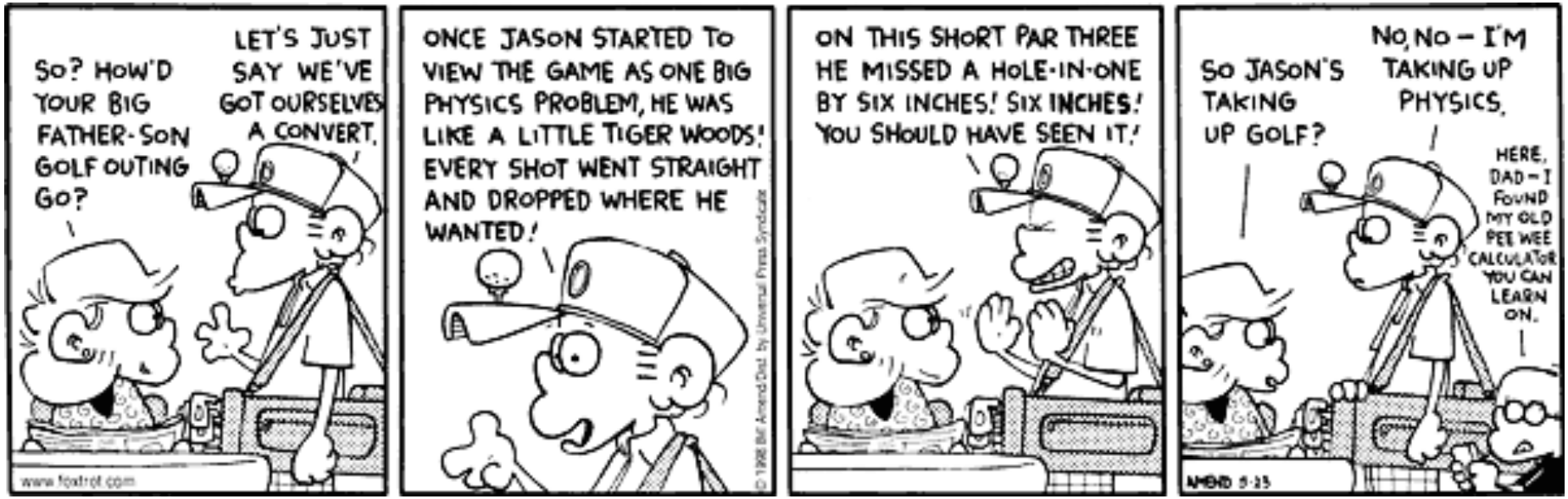
- **<u>Today's Topics:</u>** Tension, Stress & Strain
- **<u>Cartoon:</u> Bill Amend *Fox Trot***



An object is in equilibrium when the net force **and** the net torque on it is zero. Which of the following statements is correct?

A. Any object in equilibrium is at rest.

B. An object in equilibrium need not be at rest.

C. An object at rest must be in equilibrium.

(Hint: try to think of an example to disprove every statement!)

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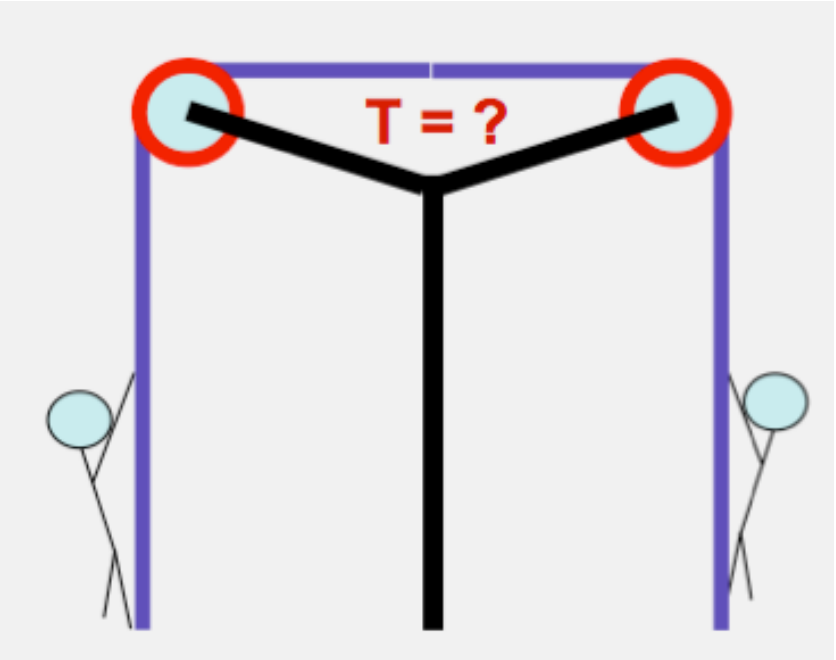
A -> an object that is moving at constant velocity is at equilibrium and NOT at rest. So it must be B.

(Hint: try to think of an exam
disprove every statement!)

The same climber and her identical twin hang without moving from opposite ends of a massless rope that is strung over two pulleys, as shown. What is the tension in the rope now?



A. $T_r = m_c g$
B. $T_r = 2\ m_c g$
C. $T_r = 0$
D. $T_r = 0.5\ m_c g$
E. Not enough information given to answer the question

(note: g = accel. due to gravity)

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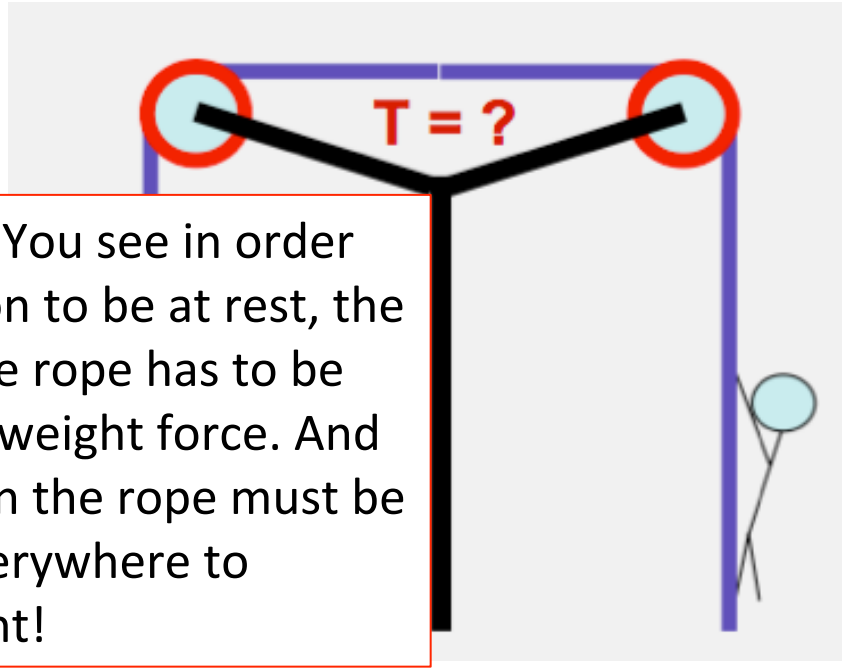

Draw a FBD! You see in order for the person to be at rest, the tension in the rope has to be equal to the weight force. And the tension in the rope must be the same everywhere to remain taught!

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Announcements

- Help room hours shift
  - Karen missed her hour from 10-11am yesterday. She's sorry. She'll make it up by having an hour on Monday from 1:30pm – 2:30pm.
  - Our in-lecture LAs are working too much, so we're eliminating a couple of office hours for them (updates on LON CAPA)
- Reading Questions for Chapter 5 due on Sunday at midnight
- Exam 1 on Sept 29th

Exam 101 - Logistics

- 55 minutes long
- ~6-7 questions (no multiple choice)
- Covers chapter 1-5
- Questions from reading materials, topics discussed in lecture (including clicker questions), LON-CAPA homework, and hands-on sessions.
- Exams will be graded and handed back to you the following week.

Exam 101 - Logistics

- You should bring
  - Pencils
  - Eraser
  - Calculator
  - **ONE** 3”x5” index card with hand-written notes
- We will provide
  - Formula sheet (it’s on LON-CAPA if you want to see it)
  - Scratch paper

Exam 101 - Studying

- Formula sheet, review sheet, free response problem grading rubric, exam review guide, and old exams are all posted in "Exam prep materials" folder on LON-CAPA
- My suggestion; don't spend lots of time on memorization – focus on concepts and creating the various representations (FBDs, setting up N2 equations, etc)
- Make use of the help room, faculty office hours, studying with fellow students
- Review session on Wednesday, 9/24 at 7pm in this room!

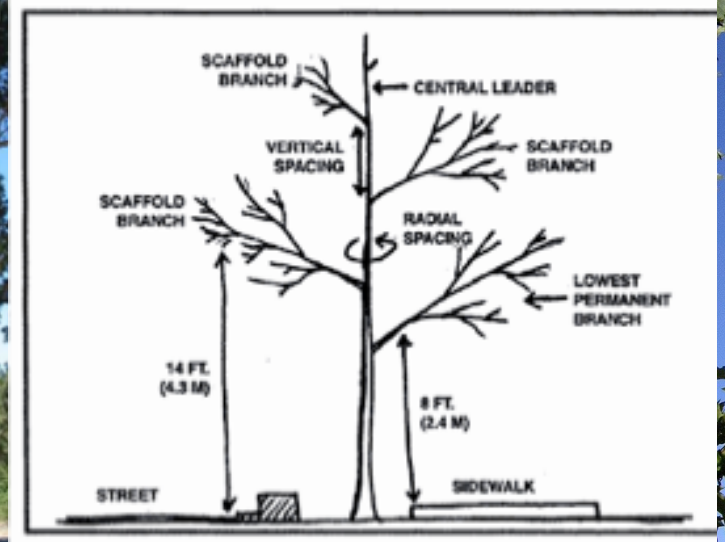
Exam 101 – Correction Problem

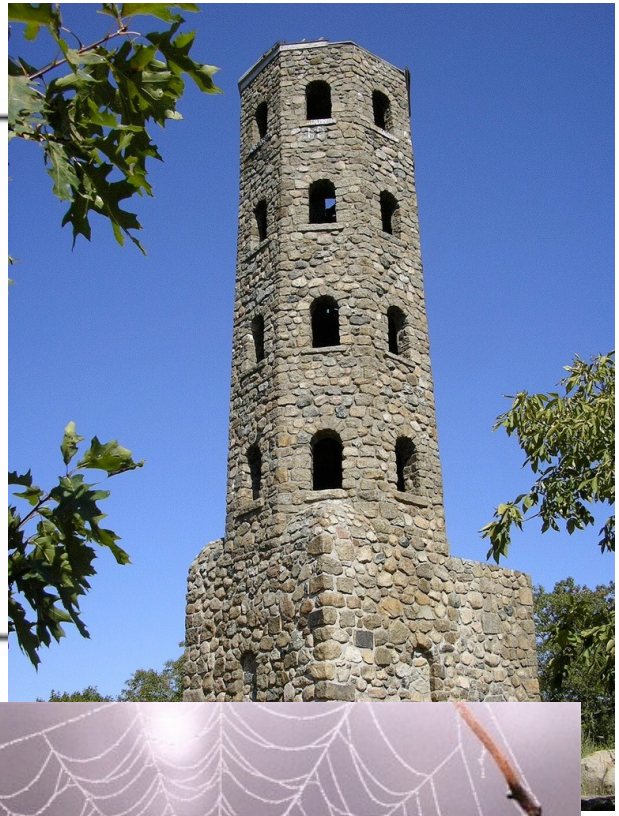
- A way to correct one question on the exam! (any question that you **attempted** on the exam - including ones with multiple parts)
- PDF of exam will be posted to LON-CAPA right after the exam
- You need to provide a solution to your (entire!) problem of choice at the **beginning of Wednesday's lecture**
- You get back **half the point difference** between the question score and the correction problem (Free points!)
- You'll get back the correction problem with your exam the following week - your exam score will include the points gained back.

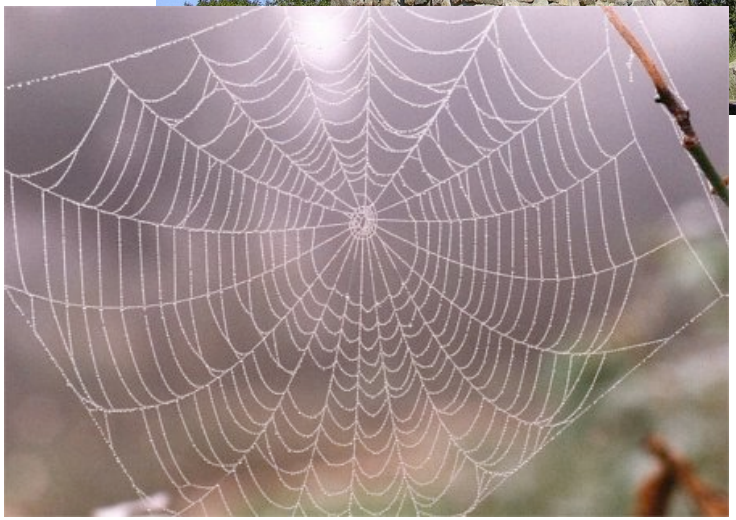
In addition to the review session on Wednesday evening; I'll have additional office hours next week for people who are studying. When is the best time for me to add hours?

A. Tues morning 11am – 12:30pm
B. Wed afternoon 4pm – 5:30pm
C. Thurs evening 6pm – 7:30pm
D. Fri 4pm – 5:30pm
E. None of these work for me

Supporting by tension vs. compression



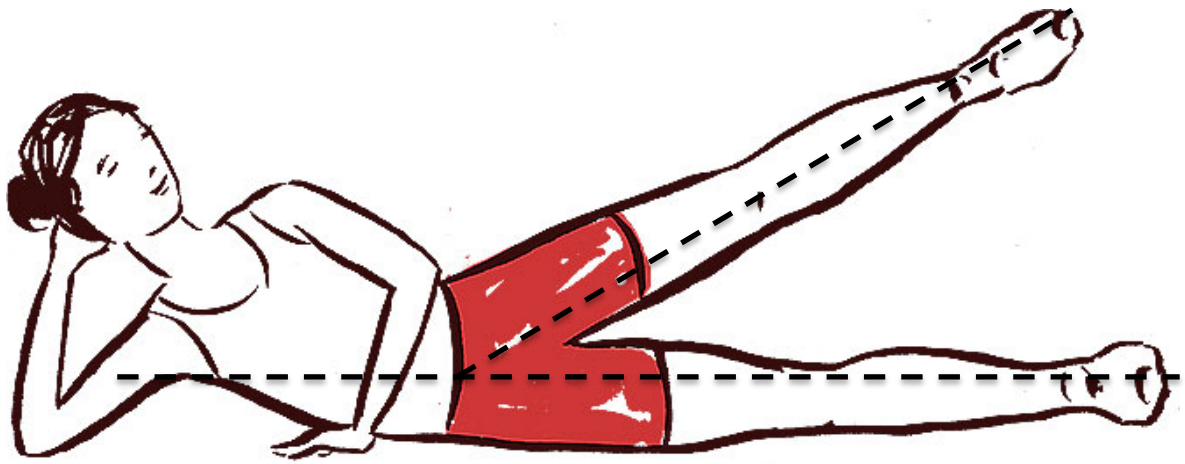




Chapter 4: Understanding Staying Put

A person doing leg lifts, raises one leg to an angle of 30 degrees. She has a 9kg weight attached to her ankle .84 meters from her hip. What is the torque on her leg due to this weight?

A. 65 Nm
B. 37.3 Nm
C. 74.8 Nm
D. 0 Nm
E. Something else



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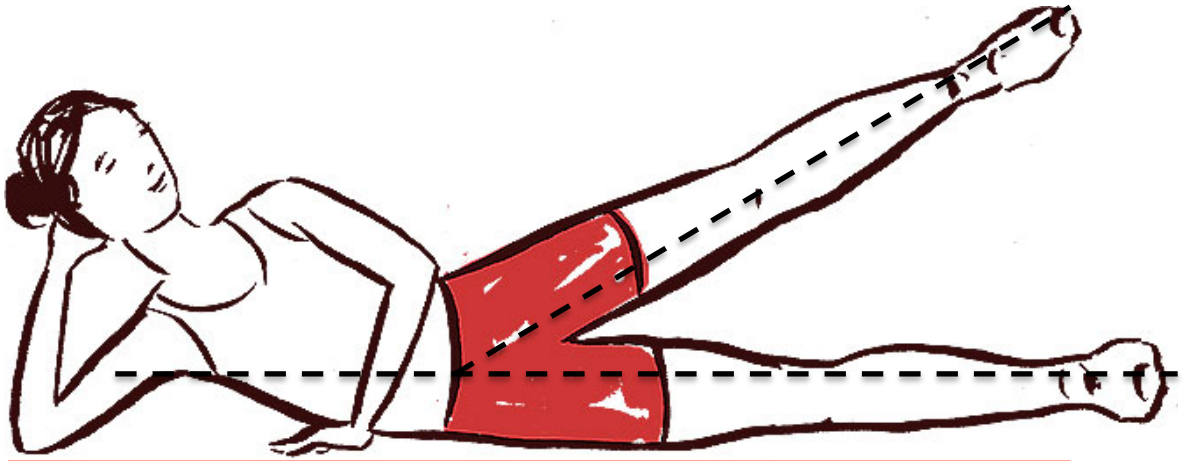
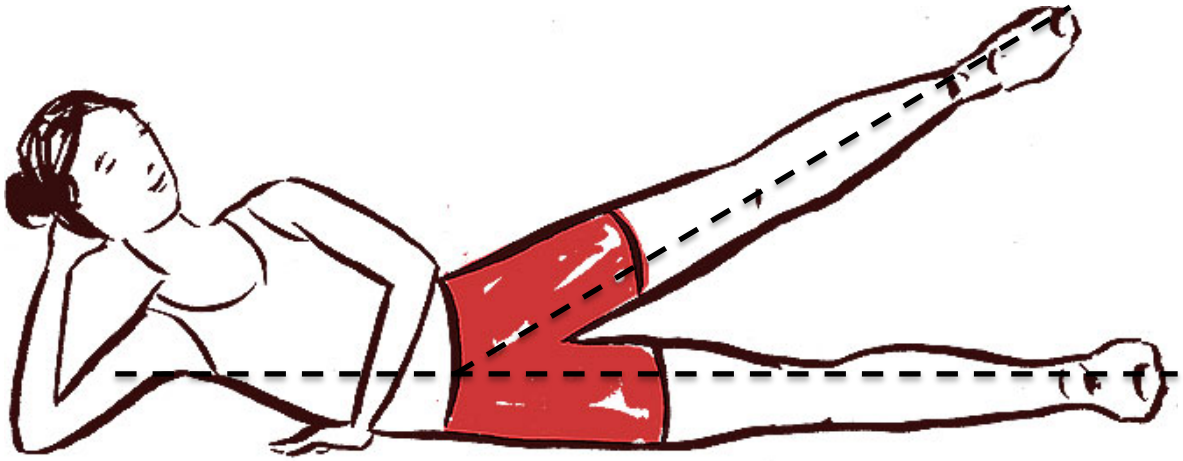


Remember the torque is equal to the piece of the force that is perpendicular to the moment arm! So in this case we should be using cos(30 deg) or sin(60 deg)

If she raises her leg higher, the will the torque from the ankle weight increase, decrease, or stay the same?

A. Increase
B. Decrease
C. Stay the same
D. Something else



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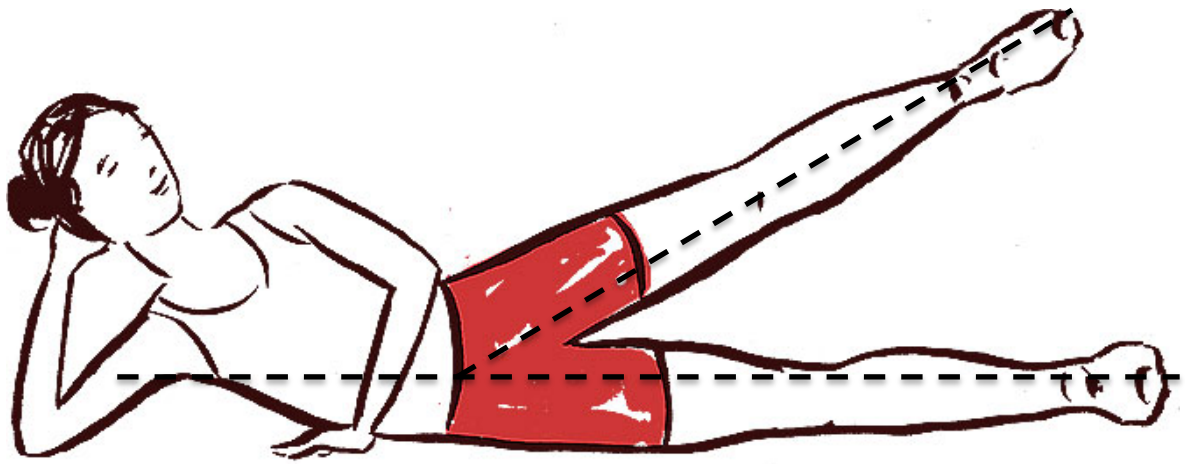
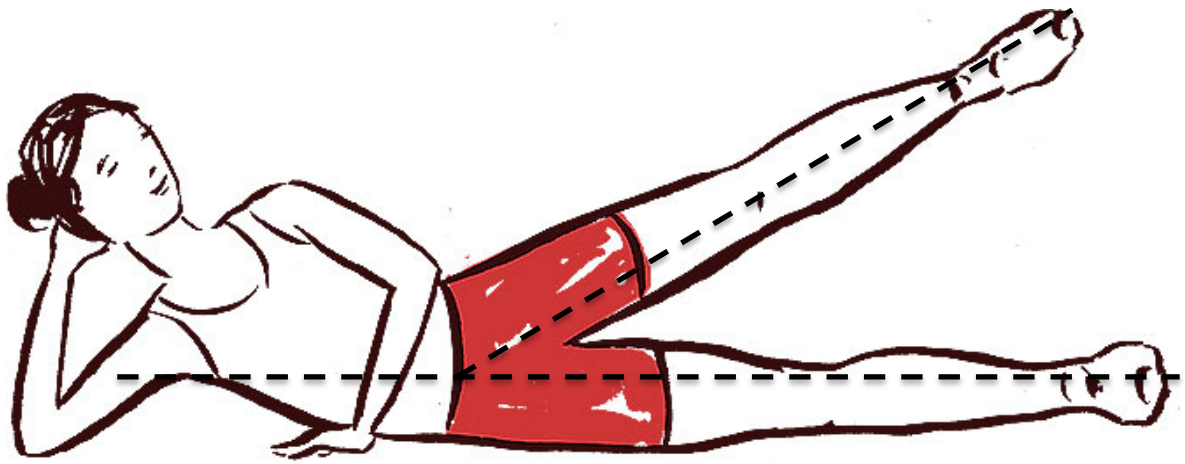


As she lifts her leg, less and less of the weight force from the ankle weight is pointing perpendicular to her leg (aka the angle is getting bigger)

Her leg weights approximately 15kg, what is the torque exerted by her leg? (Her leg is still .84 meters long.)

A. 107 Nm
B. 53.5Nm
C. 123.6 Nm
D. Something else



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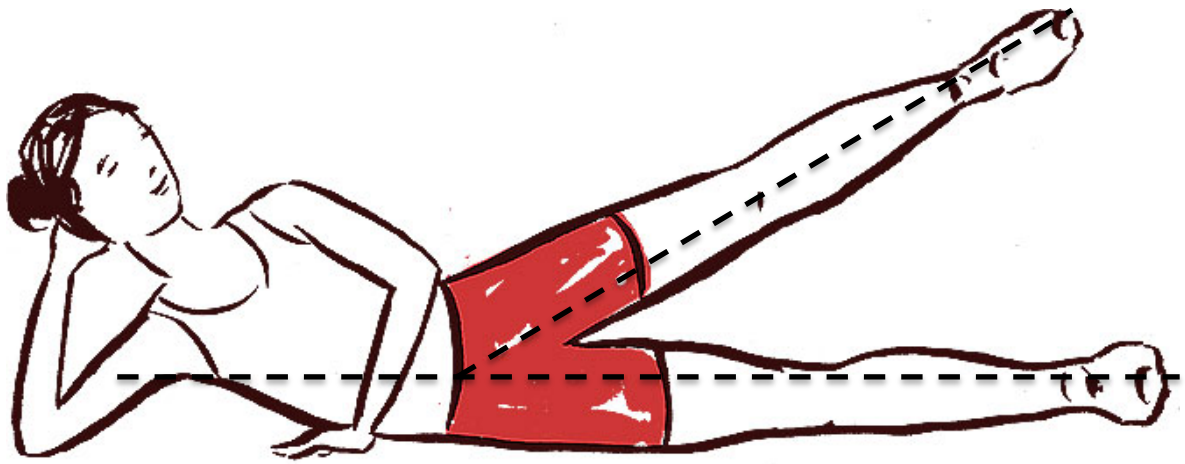
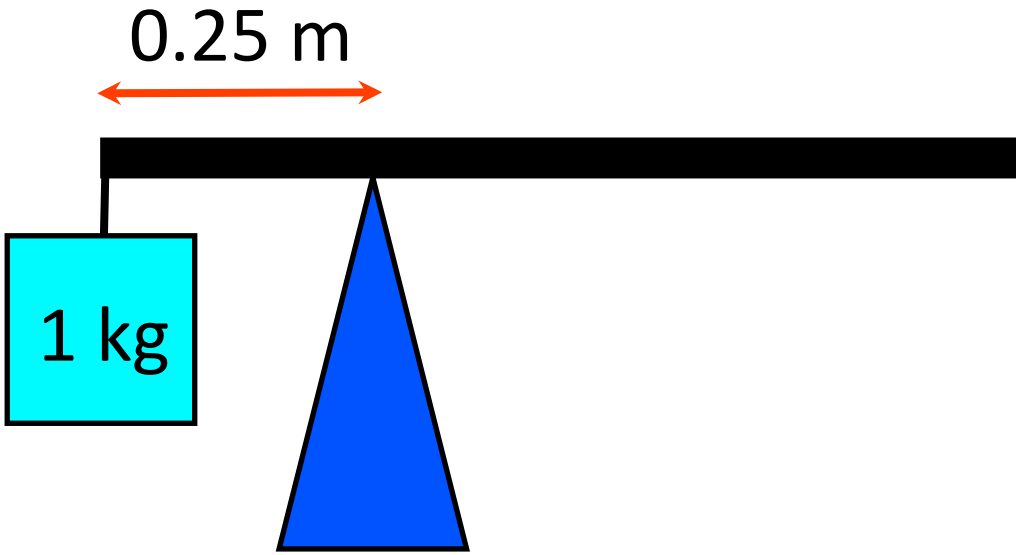


The center of mass of her leg will be in the middle of length of her leg (.42m). This is where the weight force is being exerted.

A uniform, massive beam with a length of 1 meter and mass of 1 kg is placed across a fulcrum and has a 1 kg mass attached to it, as shown. When released, will it rotate?



A. Yes, counterclockwise - the 1kg weight exerts a force perpendicular to the lever arm with the net torque pointing out of the screen.
B. Yes, clockwise, because the 1kg weight exerts a force perpendicular to the lever arm with the torque pointing into the screen.
C. Yes, counterclockwise, because the torque from the 1kg weight is greater than the torque from the mass of the beam.
D. No it will not rotate, because the force of gravity on the beam balances the force of the 1kg weight on the beam.
E. Not enough information to determine