Physics 170 Midterm 1 Review Package

UBC Engineering Undergraduate Society

Attempt questions to the best of your ability. If you’re short on time, or looking for a challenge, see the tables further down this page for specific questions that you should attempt first. There is a formula sheet attached on the last page. This review package consists of 7 pages, including 1 cover page and 5 questions. The questions are meant to be the level of a real examination or slightly above, in order to prepare you for the real exam. Material from lectures and from the relevant textbook sections is examinable, and the problems for this package were chosen with that in mind, as well as considerations based on past examination question difficulty and style. Problems are ranked in difficulty as (⋆) for easy, (⋆⋆) for medium, and (⋆⋆⋆) for difficult. Note that sometimes difficulty can be subjective, so do not be discouraged if you are stuck on a (⋆) problem.

Solutions posted at: http://ubcengineers.ca/services/academic/tutoring/

If you believe that there is an error in these solutions, or have any questions, comments, or suggestions regarding EUS Tutoring sessions, please e-mail us at: tutoring@ubcengineers.ca. If you are interested in helping with EUS tutoring sessions in the future or other academic events run by the EUS, please e-mail vpacademic@ubcengineers.ca.

Want a warm up? These are the easier problems
Short on study time? These cover most of the material
Want a challenge? These are some tougher questions

Some of the problems in this package were not created by the EUS. Those problems originated from one of the following sources:

• Fundamentals of Physics / David Halliday, Robert Resnick, Jearl Walker. – 9th ed.

• Exercises for the Feynman Lectures on Physics / Matthew Sands, Richard Feynman, Robert Leighton.

All solutions prepared by the EUS.

Good Luck!
1. A 2.00m tall refrigerator of mass \( m \) has a static coefficient of friction \( \mu_s = 0.100 \). When a pulling force of 300 N is applied as shown, the refrigerator barely slips and barely tips.

(a) Find \( m \) and \( x \).

(b) With this information only, is it possible to find \( y \)? Why or why not?
2. The diagram below shows a set of 3 forces and one moment acting on a rigid body.

(a) Find the equivalent force and couple moment acting at point $O$.

(b) Reduce all forces and moments to a single wrench acting on point $P$. Find the resulting force and moment vectors as well as the distances $x$ and $y$. 

![Diagram of forces and moment acting on a rigid body](image)
3. The Diagram below shows a mass supported by three cables which are anchored to fixed supports.

(a) Determine the tension in each of the three cables if the cylinder has a mass of 75 kg.

(b) If each cable can withstand a maximum tension of 1000 N, determine the largest mass that this system can support.
4. Replace the two forces in the diagram below with a single force and couple moment acting at point O.
5. Consider the system below of a cantilevered beam with two forces and one couple moment acting on it.

(a) Determine the equivalent force and moment acting at point A and the I beam.

(b) Can the forces and couple moment acting on this beam be reduced to a single force? If so, determine this force and its location along the beam.

(c) What conditions need to be met in order to reduce a system of forces and moments to a single force? (Hint: consider the wrench problem where the system can at most be reduced to a force and couple moment)