

PHYS 709: Advanced Mechanics I

Homework #0 - Due Friday, August 30, 10 am

Name:

This is typically given as an upper-level undergraduate problem. I'm not looking for your ability to solve, but focusing more on how you **present** the solution. Remember to use the simple physics problem-solving strategy:

1. Draw a sketch
2. Identify the knowns and unknowns
3. State the fundamental principles and assumptions
4. Comment on the results
 - (a) Any limiting cases? Unusual behavior? Or special case simplifications?
5. Lots of words to describe your logic!

The hypothetical problem

Consider the dynamics of an object dropped through a hole bored all the way through the Earth's center to the opposite surface; think, digging to Australia! (Apparently Gnarabup, Australia is the closest city to Jackson, MS's antipodal point; or Port-aux-Français, French Southern Territories to Memphis, TN's antipode).

- i. Find an expression for the force (as a function of distance from the Earth's center) on the body of mass m dropped through such a hole.
- ii. Using realistic numbers, estimate the time it would take for the body to emerge on the other side of the Earth.
- iii. Discuss/describe any consequences of the force.

You can assume the Earth has uniform density, is not rotating, and the hole is a pure vacuum [no melting at the Earth's core!].