

PHYSICS 331 ADVANCED CLASSICAL MECHANICS
Problem Set 12

Problem 1

Thornton and Marion: Chapter 5, Problem 7. *Complete and submit part (c).*

- (a) Calculate the gravitational potential due to a thin rod of length ℓ and mass M at a distance R from the centre of the rod and in a direction perpendicular to the rod.
- (b) Take the answer that you obtained in part (a) and examine the limiting behaviour for large R . Specifically, verify that $\Phi \rightarrow \frac{-GM}{R}$ for large R . Can you see *why* we should arrive at this result for large R ? NB: This is a valuable means of checking your answer to part (a). If you see the anticipated limiting behaviour, then you probably calculated correctly.
- (c) Next, use your answer to determine an approximate potential very close to the rod, i.e. for $R \ll \ell$. From this approximation, determine the gravitational field near the rod. Use Gauss' law to check this result.

Problem 2

Thornton and Marion: Chapter 5, Problem 1.

Problem 3

Thornton and Marion: Chapter 5, Problem 9.

This is interesting in that your answer is in the form of an elliptic integral that you can then evaluate under specific limiting conditions.

Other Things

If you plan to prepare corrections to Test 1, please make your corrections in either a different coloured ink or on a separate sheet of paper. Be sure to include your original test with your corrections attached. They will be due on Friday. Please come to see me if you have any questions.