PHY2048 Fall 2019 Extra Credit

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Abstract

These questions will count for up to 5 extra credit points on your Exam 2 score. You must submit your solutions on the day of the second exam to receive credit.

1. There are several forces that have the general form:

$$\vec{F} = \frac{\alpha}{x^2}\hat{i}$$

   which are known as "inverse-square" forces. How much work would be done on an object if you moved it along the x-axis, from $x = a$ to $x = b$, under the influence of such a force?

2. One example of an inverse-square force (see Problem 1) is the gravitational force between two objects of similar mass, where:

$$\alpha = -GMm$$

   where M is some mass located at $x = 0$, m is a mass with the ability to move along the x-axis, and $G = 6.67 \times 10^{-11}$ Nm^2/kg^2 is known as the universal gravitational constant. Using your result from Problem 1, calculate the work done on some mass $m = 1$kg, if $M = 10$kg and you moved it from $a = 2$m to $b = 5$m. Imagine this is performed way out in empty space, far from the Earth's gravitational pull.

3. How much would the gravitational potential energy of m change under the movement described in Problem 2? Recall that gravity is a conservative force.