ASTR 120 Problem Set 1: Due Tuesday, September 5, 2017

General reminders: You must show all your work to get full credit. Also, if any website was useful, you need to give the URL in your answer. Note that any website is fair game; you just have to cite it. If any book including our textbook was useful, you need to indicate where in the textbook you used a particular fact. This will be true in all homeworks.

1. [0 points, but required!] Preliminaries

Complete the "Introduction to the Course" assignment on Canvas/ELMS, which includes reading the syllabus (note the instructions for submitting homework!) and registering for MasteringAstronomy (MA). If you have any difficulty, contact your professor or TA immediately!

2. [10 points] Answer the following questions based on the course syllabus:

(a) [2 points] Where can you find the university's excused absence policy?

(b) [2 points] If you earned 130/150 on midterm 1, 140/150 on midterm 2, 75% of the possible points on homework, 90% of the possible points in discussion, and 80% of the possible points in in-class activities, what score (out of 200) would you need on the final exam so you got at least a B overall in this course?

(c) [1 point] Who is your TA for this course and how would you contact them?

(d) [1 point] Who is your grader for this course and how would you contact them?

(e) [1 point] Define plagiarism (be very careful here!).

(f) [1 point] For what days are the midterms and final exam currently scheduled?

(g) [1 point] Is it permissible to work with other students on homework?

(h) [1 point] Can you submit homework in hardcopy form?

3. [5 points] On a scale where the Earth has the size of a basketball, what are the radii of the following: Charon, Ganymede, Mars, Earth, Jupiter, Sun, Betelgeuse, Milky Way, Virgo Cluster, Visible Universe? As always, show all your work, and for this problem you should give your answers in meters.

4. [5 points] Miranda is a moon of Uranus. Its surface gravity is $a = 0.079$ m s^{-2}. Starting from rest, the distance d traveled at an acceleration a for a time t is $d = \frac{1}{2}at^2$. Suppose that you are an extreme-sports enthusiast and you decide to dive off a 10 kilometer cliff of Miranda. Then:

a. How long, in seconds, would it take for you to hit the surface? Assume constant acceleration (Miranda has no atmosphere to provide drag).

b. Starting from rest, the speed v attained after time t at a constant acceleration a is $v = at$. How fast would you be going when you hit the surface, in meters per second?

5. [5 points] Formulae are useful, but you need to know when they are applicable and when they are not. Here, we will explore how accurate the small-angle formula is in various circumstances. In all of the following, you need to *derive* the angular distance requested; you cannot just look up the answer. Assume in each case that all orbits (including that of Earth) are perfect circles, and give the URL of any websites you used to look up numbers. Finally, to answer each question, you need to calculate the requested angle exactly, and also using the small-angle formula, and compare the two; is the small-angle formula sufficiently accurate?

a. What is the maximum angular distance of Mercury from the center of the Sun, as seen from Earth? **Hint:** think carefully about the geometry here!

b. What is the maximum angular distance of Venus from the center of the Sun, as seen from Earth?

c. What is the maximum angular distance of Proxima Centauri b from the center of the Proxima Centauri system, as seen from Earth?

Show all your work, and give all the numbers you used as your inputs.

Bonus Question [2 points]

Do Web research to determine the following. Give the URL of the website that you used to find the answers.

a. What is the official distinction between a star and a brown dwarf, and a brown dwarf and a planet?

b. What is the mass of the most massive star known? What is the radius of the largest-radius star known?