

# PHYS 1901 Assignment 1

Due: Thursday, October 15, 2015

*This assignment is the most quantitative assessment you will be asked to complete in this course. Please ask for help if you need it. **Don't delay trying the assignment, parts of it are hard!** The goal of this assignment is to help you understand the importance of the scientific method and how the application of even a small amount of mathematics can reveal so much about our place in the Universe.*

1. Journalists serve an important role in society by accurately reporting sound scientific results to the public. To fill this role, journalists need to guard against “junk science” which so easily fools desk editors throughout the world. Please read the following story: 10 marks  
<http://www.npr.org/sections/thesalt/2015/05/28/410313446/why-a-journalist-scammed-the-media-into-spreading-bad-chocolate-science>
  - (a) In a 500 words, explain what journalist John Bohannon accomplished with his study. How do you feel about the ethics of his methods?
  - (b) How can journalists' awareness of the scientific method improve the quality of scientific reporting? What steps could journalists take to ensure quality scientific reporting?
  
2. Suppose that you are standing in a field just outside the city of Ottawa ( $45^\circ\text{N}$ ). In answering questions (a) and (b) **draw and label** a basic picture of the celestial sphere as viewed by you at your location with the position of the horizon, the celestial equator, the ecliptic, both celestial poles, the position of the solstices and equinoxes, and the sun indicated. Be sure to include the angle between the horizon and the angle between the north celestial pole and the horizon in your diagram. 8 marks
  - (a) It is sunrise on the first day of fall.
  - (b) It is sunset on the first day of winter.<sup>1</sup>
  - (c) **Bonus question (3 marks):** From the position of Inuvik, Northwest Territories, draw the celestial sphere at midnight on December 21.

---

<sup>1</sup>This one is challenging. Hint: start by locating the position of the equinoxes and the solstices on your diagram.

3. Galileo, Kepler, and Newton changed humanity's understanding of the heavens. 6 marks
- (a) Explain the significance of Galileo's discovery that Venus showed all phases, just like our moon.
  - (b) How did Newton explain Kepler's Laws?
4. NASA launched the Voyager 1 spacecraft on September 5, 1977 to examine Jupiter and Saturn. After successfully completing its mission, Voyager 1 found itself on a trajectory that will take it out of the solar system forever. Currently Voyager 1 is 132 AU from the sun. 15 marks
- (a) What is the average speed of Voyager 1, in km/s, since it was launched?
  - (b) If we built a spaceship which could travel at the speed of Voyager 1, how long would it take to reach the nearest star, Proxima Centauri?
  - (c) NASA continues to explore the outer solar system. Write a brief summary (no more than 200 words!) on the NASA Juno mission.
5. Part I) **This question is challenging – don't delay trying it!** You have just been selected as the new researcher for the travel book *The Hitchhiker's Guide to the Galaxy!* In your new job, you find yourself on the pleasure planet Risa. On your way into the Risan solar system, you notice that the in-flight brochure tells you that Risa's moon is 1/4 the diameter of Risa, that Risa is  $2 \times 10^8$  km from its sun, and that Risa's moon is  $5 \times 10^5$  km from Risa. On Risa's surface, you notice that the sun and the moon have the same angular size of  $1^\circ$  in the sky. In answering the following questions, make sure to show all your reasoning. 9 marks
- (a) What is the diameter of Risa's sun in kilometres?
  - (b) What is the diameter of Risa's moon in kilometres?
  - (c) What is the diameter of Risa in kilometres?
6. Part II) After having enjoyed the Risan hospitality and having written your report for *The Hitchhiker's Guide to the Galaxy*, you notice a planet in the Risan sky. You learn from talking to the local aliens that the orbital period of the planet is 343 Risan years. 3 marks
- (a) What is the distance to the planet from the Risan sun in kilometres?

---

51 marks

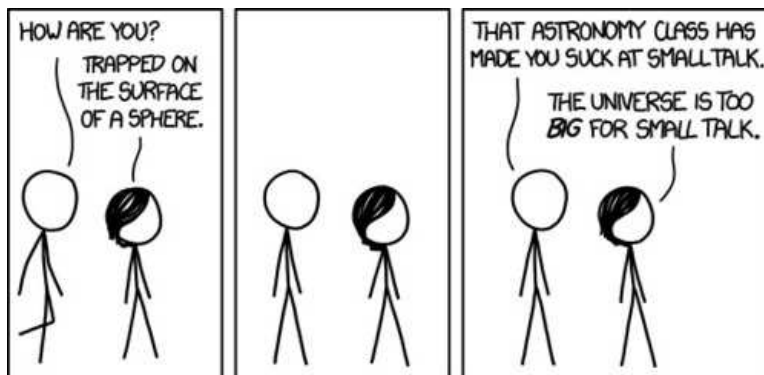


Figure 1: From the comic strip xkcd (<http://xkcd.com>)