

Name \_\_\_\_\_

Astronomy 161 – An Introduction to Solar System Astronomy  
Autumn Quarter 2009 – Prof. Gaudi  
Homework #2

**Due Monday, October 12 in class**

Instructions

Answer the following six multiple choice questions by circling the correct answer.

**No late homework will be accepted.**

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Aliens abduct you in order to test your knowledge of what we've discussed in Astronomy 161. They deposit you on a planet, and tell you nothing except that the name of planet is Normalia, and it is located in the system Regularus. They give you plenty of food to survive for a long time, as well as some rudimentary equipment that allows you to make simple measurements of the positions of celestial bodies. They also give you a precise and stable clock.

During your stay on Normalia, you make the following observations: (*Note you are very lazy so you never leave the place where they deposited you.*)

1. The central sun of the Regularus system appears as a bright disk about 1 degree in diameter that rises from a fixed point on your horizon (which you subsequently call due East), travels to your zenith in exactly three hours, and then sets three hours later at a fixed point on your horizon that is exactly 180 degrees from the point where it rose (you subsequently call this fixed point where it sets due West). Six hours later, the sun rises again, and this behavior is repeated exactly during your entire stay.
2. By measuring the time when several bright stars cross your meridian every night, you infer that the sun is moving west to east relative to the stars, by an amount that is constant and exactly one degree for every Normalia "day" (sunrise to sunrise).

3. Normalia has a moon, which you call Simplicia. Simplicia appears as a pale disk about  $1/2$  a degree in diameter that goes through phases. You observe that from where you are standing on Normalia, every 720 hours Simplicia eclipses the sun. You also notice that it takes exactly the same amount of time for Simplicia to go through one cycle of its phases.
4. You notice that the eclipses of the sun are always annular and the moon always appears to cover the same fraction of the sun in the middle of the eclipse.

After a long time, the aliens come back and proceed to ask you five questions. They tell you that if you get them all correct, you may go home.

Question 1 (20 points)

What is the obliquity of the ecliptic for Normalia?

- a) 10 degrees
- b) 23.5 degrees
- c) 0 degrees
- d) I don't have enough information to figure it out.
- e) 180 degrees

Question 2 (20 points)

What is the length of a Normalia "year" (the time it takes for the sun to come back to the same position with respect to the stars)?

- a) 180 Earth days
- b) I don't have enough information to figure it out.
- c) 180 Normalia days
- d) 360 Earth days
- e) 30 Earth days

Question 3 (10 points)

What is the angle between the plane of the orbit of Simplicia and the

ecliptic?

- a) More than 1 degree.
- b) Less than 1 degree, but I don't know any better than that.
- c) Less than 1/2 a degree, but I don't know any better than that.
- d) I don't have enough information to figure it out.
- e) about 5 degrees

Question 4 (10 points)

Is Simplicia's orbit circular?

- a) I don't have enough information to figure it out.
- b) no
- c) yes

Question 5 (20 points)

How often and during what phases do eclipses of Simplicia occur?

- a) Every 60 Normalia days, new moon
- b) Every 30 Normalia days, new moon
- c) Every 60 Earth days, full moon
- d) I don't have enough information to figure it out.
- e) Every 60 Normalia days, full moon

Question 6 (20 points)

Do you witness umbral or penumbral eclipses of Simplicia, or both?

- a) penumbral
- b) umbral
- c) both
- d) I don't have enough information to figure it out.