

# ASTRONOMY 020

## Problem Set #3

Due: October 3, 2003

1. Identify the seven days of the week with the planet that each is named after. (Hint: consider both the English and French names of the days of the week.)
2. Imagine that you are observing the Earth from Jupiter. What would you observe the Earth's synodic period to be?
3. Zeilik & Gregory, Chapter 1, problem 13.
4. Make a plot of  $\log P$  vs.  $\log a$ , for all nine planets, where  $P$  is the sidereal period of each planet in years, and  $a$  is the semimajor axis of each planet's orbit, in AU. Make a table of values of  $\log P$  and  $\log a$  to use in your graph, and use the plot to show that the points fall on a straight line of slope  $3/2$ . Refer to Appendix 3 in your textbook for solar system data.
5. Use the definition of an ellipse and a geometric argument to prove the relation

$$b^2 = a^2(1 - e^2), \quad (1)$$

where  $a$  is the semimajor axis of the ellipse,  $b$  is the semiminor axis, and  $e$  is the eccentricity.

### Practice problems:

1. Zeilik & Gregory, Chapter 1, problem 4.  
Answers: (a)  $g_M/g_\oplus = 0.17$ , (b)  $g_\odot/g_\oplus = 28$ , (c)  $g_J/g_\oplus = 2.54$  at Jupiter's equator.
2. Zeilik & Gregory, Chapter 1, problem 12.  
Answers: (a) Force is  $F = m a_{\text{person}}$ , where  $m$  is your mass and  $a_{\text{person}} = 6.7 \times 10^{-9}$  m/s<sup>2</sup>, (b)  $F = m a_{\text{Mars}}$ , where  $a_{\text{Mars}} = 7.0 \times 10^{-9}$  m/s<sup>2</sup>. The ratio of accelerations is  $a_{\text{Mars}}/a_{\text{person}} = 1.0$ , so it is hard to believe Mars has any significant (gravitational) influence on our lives.