

Physics 101
Sample Midterm

1. (15 points) On a certain day in May, an observer on the equator sees that the direction of the sunrise is 12° north of due east. On the same day, in what direction will the sunrise be in Maryland? Is it more or less than 12° north or south of due east? Justify your answer with a diagram.
2. (10 points) Explain one observation that led Ptolemy to introduce epicycles in his model of planetary motion, and explain how epicycles account for the observation.
3. (15 points) Using Copernicus' model, explain how observations can determine the ratio $R_{\text{earth}}/R_{\text{Venus}}$ of the radii of the orbits of Earth and Venus. You may assume that the orbits are circular. *Hint:* Venus is an 'inner planet', meaning that it orbits between the earth and the sun.
4. (10 points) What led Kepler to propose elliptical motions of the planets?
5. (25 points) On a certain planet, a 2 kg stone dropped from rest falls 3 m in 1 s. What is the acceleration due to gravity on this planet?
6. (25 points) A person is walking on a boat and is speeding up. Draw a diagram showing all the forces on the person, both vertical and horizontal. Give the physical origin of each of the forces. Write Newton's second law for the person, for both the vertical and horizontal forces. Draw a diagram showing all the forces on the boat, both vertical and horizontal. Write Newton's second law for the person, for both the vertical and horizontal forces. Give the physical origin of each of the forces. Which forces in your diagrams are related by Newton's third law?