ASTRONOMY 294z
History of the Universe
Professor Barbara Ryden

Problem Set # 1
Due Tuesday, January 15
AT CLASS TIME

NAME (please print clearly): _____

SCORE (instructor use only): _____

1) [20 points] Two Martian astronomers, Marvin and Marla, are located due north and south of each other on the planet Mars. Marvin sees the Sun directly overhead (at the zenith) at noon. At the same time, Marla sees the Sun 6 degrees away from the zenith. Marla is 355 kilometers north of Marvin. Compute the circumference of the planet Mars. [Hint: This is essentially the method of Eratosthenes for measuring the circumference of the Earth, as described in the lecture for January 3; we've merely transferred it from Earth to Mars.]

2) [20 points] Suppose that Aristarchus had measured an angle of 45 degrees between the Sun and the Moon when the Moon was in its first quarter phase. Draw an accurate diagram of the positions of Earth, Moon, and Sun necessary for this measurement to be correct. In this case, what is the ratio of the Earth – Sun distance to the Earth – Moon distance? [Hint: to measure this distance, you can use trigonometry or simple geometry — or you can use a ruler on the accurate diagram you just drew.]

3) [20 points] If the Earth – Moon distance were *greater than* the Earth – Sun distance, would an observer on the Earth be able to see the Moon in its first quarter phase? If your answer is "yes", draw a diagram showing how this could be true. If your answer is "no", explain why a first quarter Moon would be impossible.

4) [20 points] Modern measurements tell us that the average distance from the Earth to the Moon is 384,000 kilometers. Given that the Moon appears 1/2 degree across as seen from the Earth, what is the diameter of the Moon, in kilometers?

5) [20 points] Given that the circumference of the Earth is 40,000 kilometers, what is the Earth's diameter in kilometers? Given that there are 0.621 miles per kilometer, what is the Earth's diameter in miles? Given the results of problem (4), what is the ratio of the Earth's diameter to the Moon's diameter?