Homework 04

Problem 1 (5 points)
Find the required precision of the star speed measurement to detect a Mars like planet around a Sun like star at the distance of 1.4 AU.

Problem 2 (5 points)
Solve problem 7.6 from the textbook (Binary star parameters).

Problem 3 (5 points)
Observation of a binary system yields that one of the stars is moving along an ellipse like orbit in xy plane. The observed ellipse is stretched along x axis with apparent values of the semimajor axis $a' = 1.9803$ AU and the semiminor axis $b' = 0.3473$ AU. A careful observation of both stars yields the location of the center of mass at position $x_{c.m.} = 0$ AU and $y_{c.m.} = 0.04862$ AU with respect to the center of the observed ellipse.

Find the real eccentricity, semimajor axis a, and the inclination angle. Assume that the real semiminor axis direction is orthogonal to the line of sight. Note: the observed data has uncertainty.

Problem 4 (5 points)
The first star has apparent magnitude $m_1 = 12$ and the peak wavelength of the radiation spectrum at $\lambda_1 = 600$ nm, it is located at distance $d_1 = 145$ pc from us. The second star has absolute magnitude $M_2 = 6$ and its temperature is $T_2 = 3400$ K. Find the ratio of stars radii R_1/R_2. Additionally, express the radius of each star in the units of the Sun radius.

Problem 5 (5 points)
Solve problem 3.12 from the textbook (derivation of Wein's displacement law).