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Astronomy Olympiad**

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ЯЗЫК language	<i>English</i>
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Practical round

8. The binary star YY Gem is also known as Castor Ca & Castor Cb. It is known from preliminary observations that the period of this binary star is more than 8 hours but less than 12 hours. O. Struve & V. Zebergs (1959, ApJ, 130, 783) measured radial velocities of the two components and get the results presented at the enclosed “sheet of data”.

Velocities are given in km/s and time given is UT in the table.

8.1. Plot graph of the velocities of components vs time.

8.2. (α) Find exact orbital period of the components.

8.2. (β) Find exact orbital period, orbital radius and masses of the two components.

9. You are given the data for the mass (M , in masses of Jupiter) and surface gravity (g) of some exoplanets (see “sheet of data”).

9.1. Plot the $\log(M/M_J)$ against $\log(g)$.

9.2. It is given that the density (ρ) of these exoplanets varies approximately as a function of their mass (M) in following fashion:

$$\rho = \alpha \cdot M^\beta,$$

where β is an integer. Determine values of α and β .

9.3. What will be the surface gravity of Earth if the plot in part 9.2. is extended to it.

9.4. Is the value calculated in part 9.4. of the same order of magnitude as the actual value? Write in English “Yes” or “No”.

$$M_{\text{Jupiter}} = 318 M_{\text{Earth}}$$