



АСТРОНОМИЧЕСКОЕ  
ОБЩЕСТВО



EURO-ASIAN  
ASTRONOMICAL SOCIETY

## XI Азиатско-Тихоокеанская астрономическая олимпиада

## XI Asian-Pacific Astronomy Olympiad

Бангладеш, Дакка

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Dhaka, Bangladesh

Round

Theo

Group

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ЯЗЫК
language

**English**

### Theoretical round

- Sizes and masses.** In the table given at a separate sheet enumerate in growing order (from 1 to 13) the size and the mass of each object: Milky Way Galaxy, Andromeda Galaxy, Neutron star, Electron, Mercury, The first satellite “Sputnik I”, Venus, Pluto, Proton, Red dwarf, Black cat, White (Polar) bear, the Sun.
- Umbra and penumbra.** As you know, on clear sunny days, objects usually give rise to umbras and penumbras. Nowadays, the angle of the ecliptic plane to the celestial equator is  $\varepsilon_0 = 23^\circ 26.2'$  and is reduced by about  $\nu = 0.78'$  per century. Calculate in what century begins the period or in what century the period has ended when from the exactly vertical column located in Ashulia
  - umbra from the Sun
  - penumbra from the Sunwill disappear (or disappeared) at some sunny days of the year.  
Ashulia's coordinates are  $23^\circ 53.6' \text{ N}$ ,  $90^\circ 19.8' \text{ E}$ .  
Draw pictures explaining your solution.
- Star setting.** The Bengal Tiger likes to observe stars. According to his calculations, some star will rise today at  $19^{\text{h}}45^{\text{m}}$  and will culminate at  $21^{\text{h}}49^{\text{m}}$ . At what time yesterday did the star set? The refraction and horizon lowering can be disregarded. The solution has to include an artistic picture with an image of the Bengal Tiger-astronomer observing the star.
- Lunokhod.** While the Bengal Tiger holds astronomical observations near Dhaka, the White Bear traveled to the Moon. Possessing Lunokhod (lunar rover), he is moving along the lunar equator, with the Sun being observed at the horizon during all the way. Calculate the speed of Lunokhod. The solution has to include an artistic picture with an image of the Bear-astronomer riding on Lunokhod and observing the Sun.
- Distance between stars.** In our region of the Galaxy the stellar matter density is about  $1.5 \cdot 10^{29} \text{ kg}$  per cubic parsec. Assuming the stars are of solar type, estimate the average distance between the stars. Draw a picture explaining your solution.
- M32.** There are about 250 million stars in the elliptical galaxy M32 (a satellite of the Andromeda galaxy). The visual magnitude of this galaxy is  $9^{\text{m}}$ . Assuming luminosities of all the stars is equal, what is the visual magnitude of one star in this galaxy?