Practical problem: Night observation

1. **Determining declination**
   The two pictures below show a small asterism, both as seen directly on the sky and a mirror image. The position of the asterism is also marked with a rectangle on the larger-scale map.

   Find this asterism and point your telescope to it.
   Use the refractor and stopwatch to estimate the declination of star *Sx* by timing the apparent motion of the stars, with the illuminated reticle as a reference.
   Give your measurements and working, and estimate the error in your result.
   For each set of measurements you make, draw the view in eyepiece on the answer sheet.
   (Use the blank circular field on the answer sheet.)

   Mark the drawing with the compass directions N and E. Draw the reticle and the tracks of the stars to show the motion measured using the stopwatch.
   Mark the ends of each timed track and show which time measurement refers to which track – for example, for measurement "T1" marking the ends "Start T1" and "End T1".

   The angle of the reticle can be easily adjusted by rotating the eyepiece around its optical axis. If you change the angle of the reticle for a new measurement, draw a new diagram.

   The declinations of the field stars S1 and S2 are :
   S_1 : $\delta = +19^\circ\,48'\,18''$ S_2 : $\delta = +20^\circ\,06'\,10''$
   Assume that: $\delta(\mathrm{S2}) > \delta(\mathrm{Sx}) > \delta(\mathrm{S1})$.

Tip 1 (if leaders want it!)
The coordinates of the object can be estimated by measuring the time of transit between the lines of the reticle. Adjust the position angle of one arm of the reticle to be parallel to the pair of stars S_1 and S_2.
Measure the time difference between the moment when the pair S_1-S_2 crosses the line and the moment when Sx crosses it.
You can measure the time between transits of star S_1 and the line S_2-Sx in the same way.

Tip 2 (if leaders want it!)
One arm of the cross is parallel to the direction S_1-S_2. Start measuring when S_1 is in the centre of the cross.
Δt_X is the time taken by Sx to transit between the two arms of the cross.
Δt_2 is the time taken by S_2 to move from one arm to the second arm of the cross.

$$\frac{\Delta t_2}{\Delta t_x} = \frac{\delta_2 - \delta_1}{\delta_x - \delta_1}$$