

Solving problems with the astrolabe



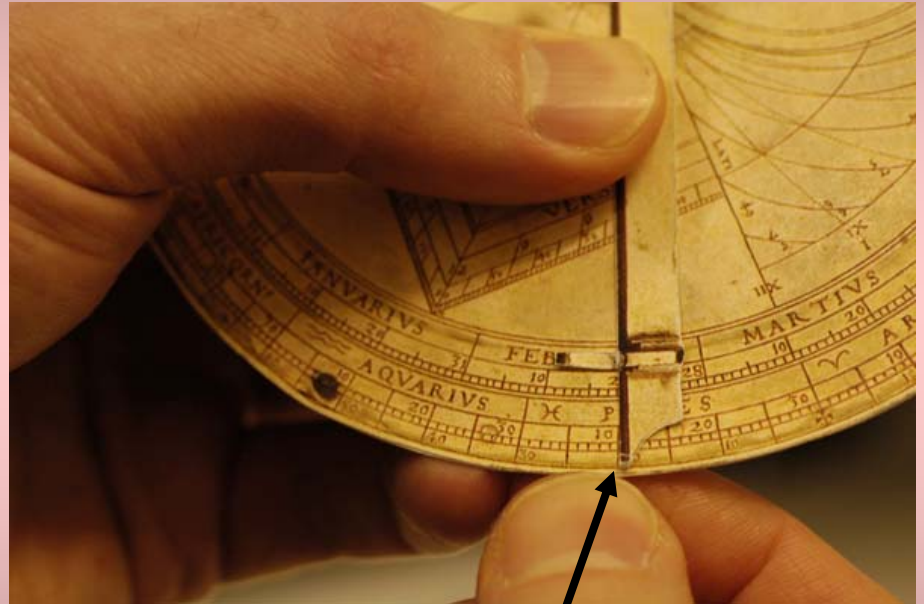
The astrolabe can be used to solve many types of astronomical problem

- The times of sunrise and sunset
- The time of day by the sun (local time)
- The positions of the stars at any time
- The time by the stars

The times of sunrise and sunset

Step 1

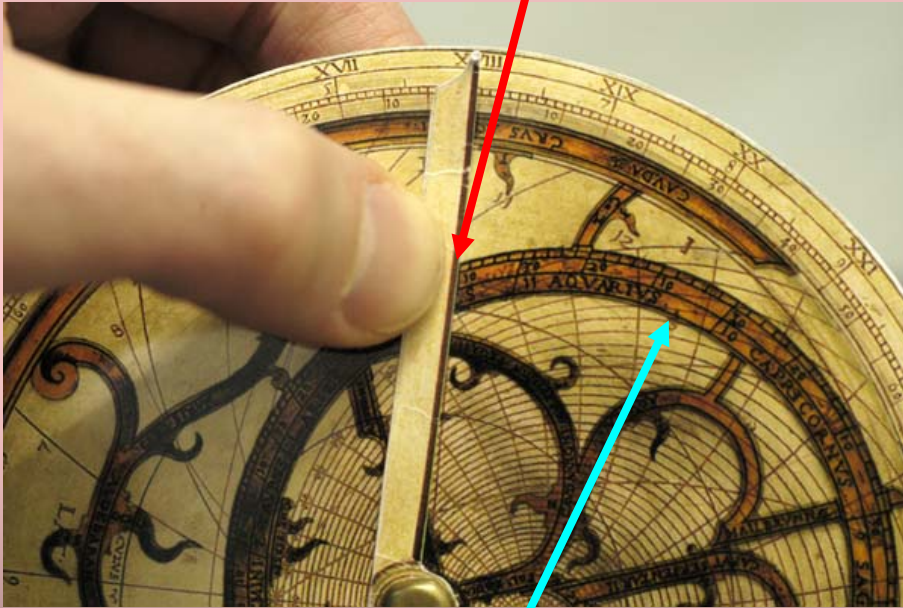
- On the back of the astrolabe, move the alidade (like the rule) to the date on the civil calendar scale.
- Read off the date in the Zodiac calendar on the outer scale



e.g. 18th February =
10th Pisces

Step 2

e.g. 10th Pisces



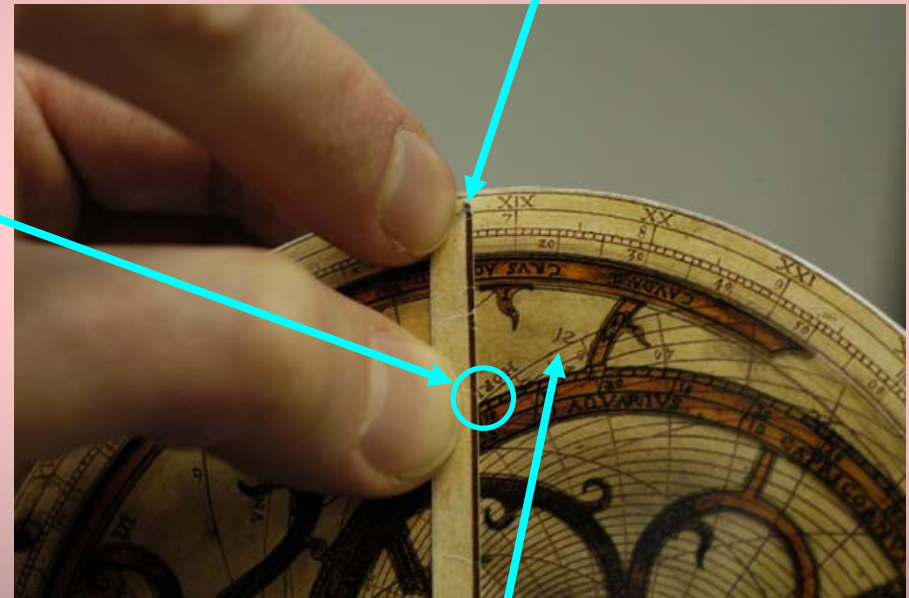
This ring is the ecliptic circle (sun's pathway during a year)

- Turn to the front of the astrolabe and position the rule at the correct date on the Zodiac scale on the ecliptic circle on the rete
- This marks the position of the sun relative to the stars

Step 3

- Rotate this point (where the rule crosses the Zodiac scale) until it just crosses the eastern horizon line (left hand side) on the tympan underneath
- Read the time of sunrise on the outer scale

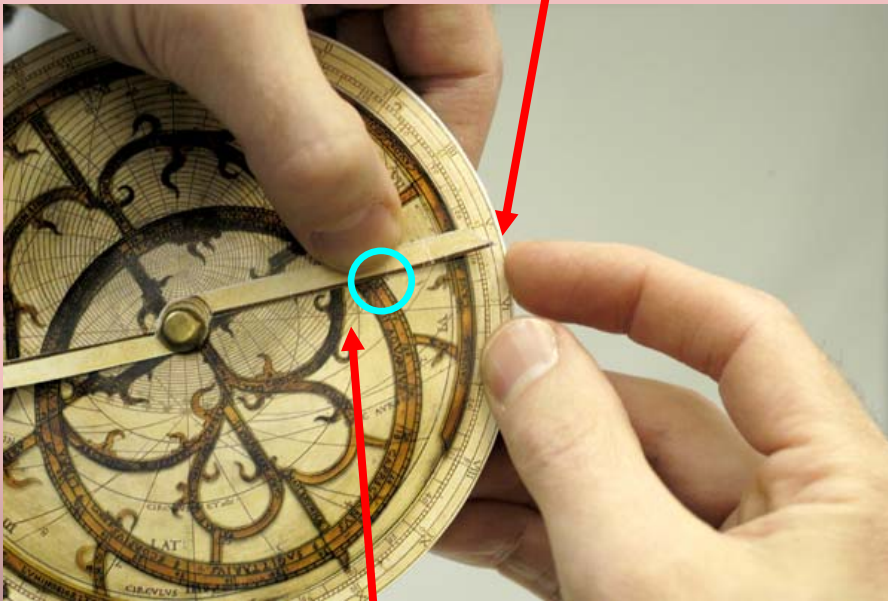
Read time here
e.g. 6.40 am



Horizon line
(Eastern side)

Step 4

Read time here
e.g. 5.15 pm



Western horizon line

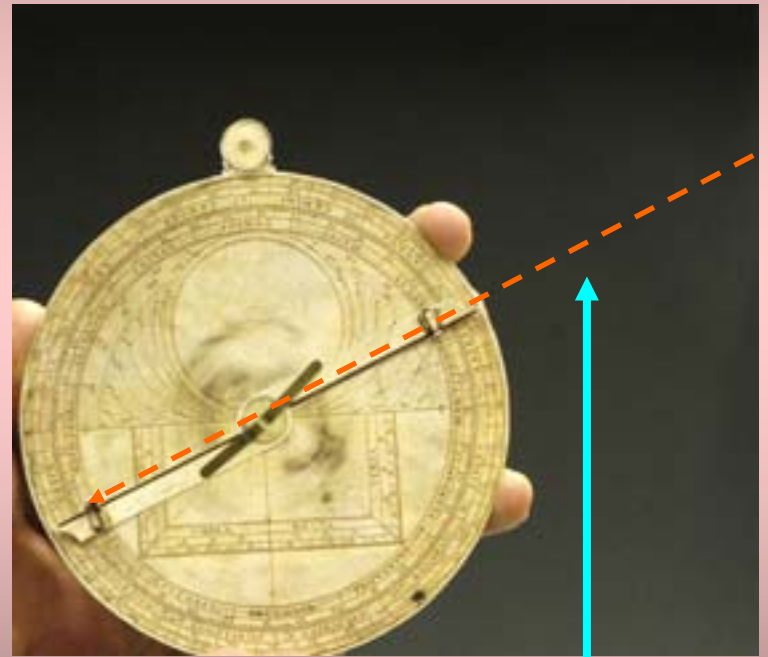
- To find the time of sunset, rotate the same point until it just crosses the western horizon (right hand side)
- Read the time of sunset on the outer scale

The time of day by the sun

- The astrolabe can be used to estimate the time of day by the altitude (height) of the sun during the day
- The time will be local time (like a sundial) which will vary from place to place according to longitude

Step 1

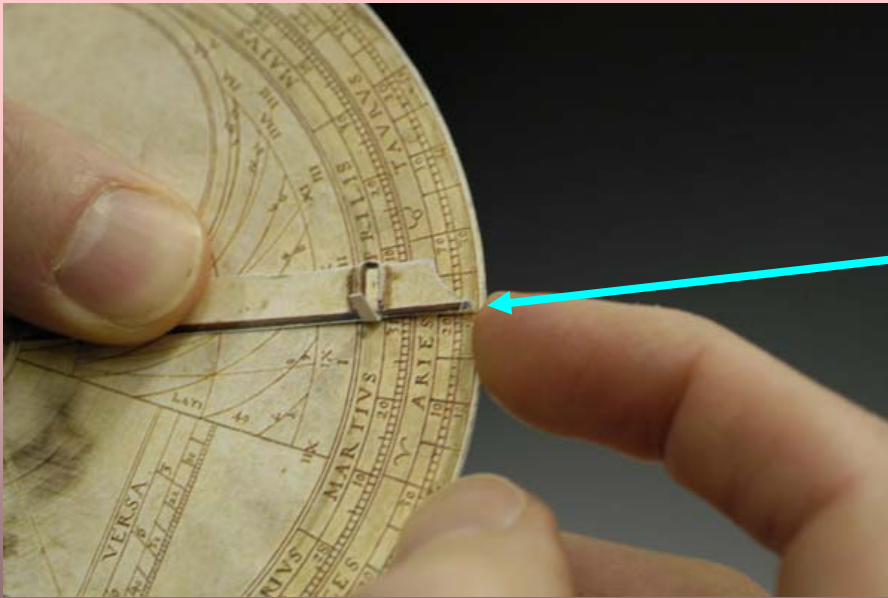
- Hang the astrolabe vertically
- On the back of the astrolabe, line up the sights on the alidade with the sun by aligning the spot of light cast through the first hole with the second hole
- **(REMEMBER: NEVER LOOK DIRECTLY AT THE SUN)**



Ray of sunlight

Step 2

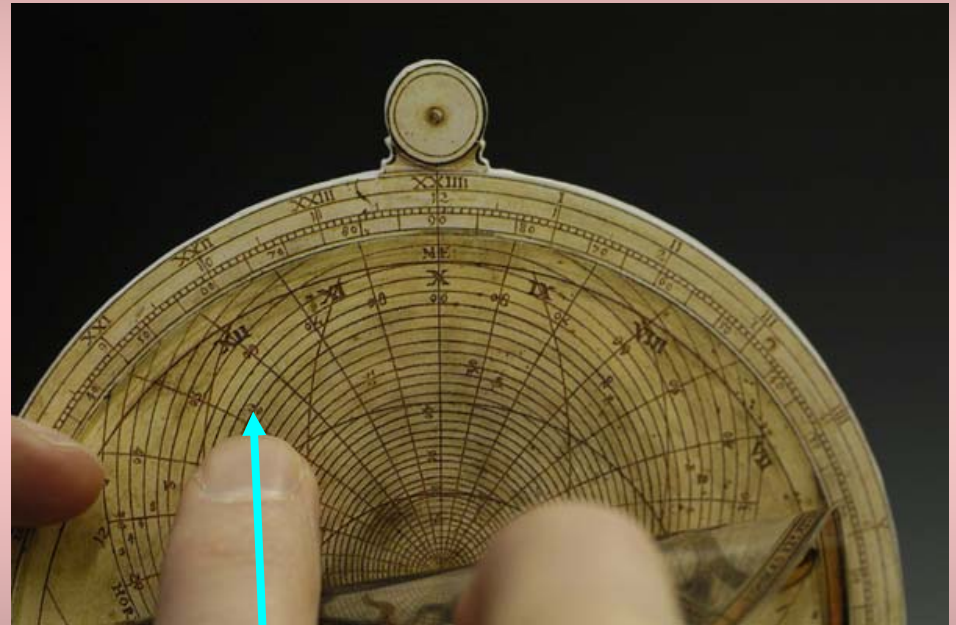
- Read the angle of altitude of the sun from the scale on the outer rim



e.g. 20 degrees
from the horizontal

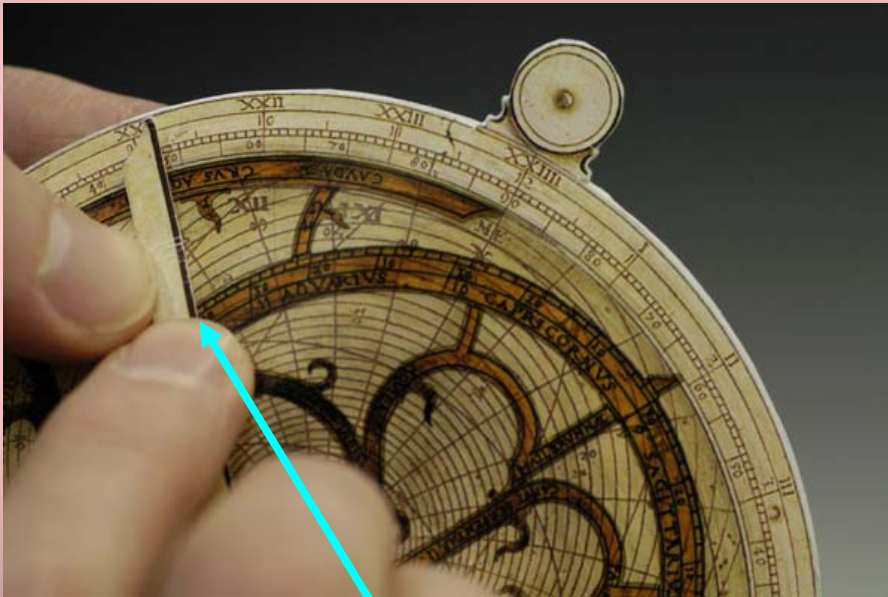
Step 3

- Turn to the front of the astrolabe
- Find the nearest altitude line to the one you have measured on the tympan (estimate the position if there isn't a line for your precise angle)



20 degree altitude line

Step 4

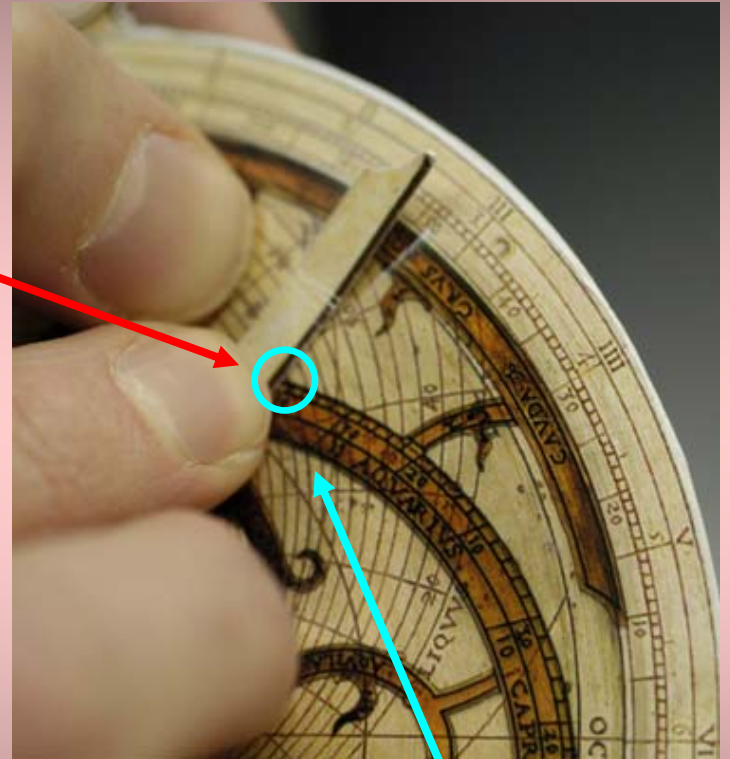


e.g. 10th Pisces

- Find the date in the Zodiac calendar as before by using the scales on the back of the astrolabe
- Position the rule on the correct Zodiac date on the front to mark the position of the sun

Step 5

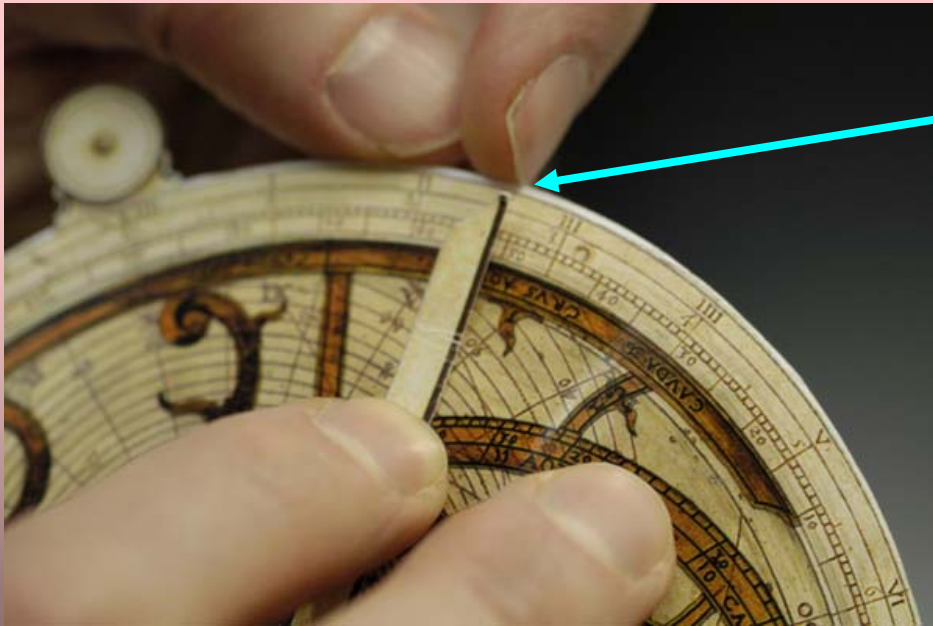
- Rotate this point (where the rule crosses the Zodiac scale) until it just crosses the altitude line that you have measured for the sun
- If it's morning, then choose the left hand side of the astrolabe. If it's afternoon, then choose the right hand side.



20 degree altitude line

Step 6

- Read the time from the outer scale



e.g. 2.40 pm

Problems

Try your hand at the following problems

Good luck!

Determining the times of sunrise and sunset

- Determine the times of sunrise and sunset on the following days:
 - i) 25 January
 - ii) 12 December
 - iii) 12 June
- i) Ans: Sunrise 7.30am, sunset 4.30pm
- ii) Ans: Sunrise 8.15am, sunset 3.45pm
- iii) Ans: Sunrise 3.30am, sunset 8.30pm

Determine the time by the sun

- Estimate the solar time for the following:
 - i) 8 February, with the sun at 10°
 - ii) 3 September, with the sun at 30°
 - iii) 24 July, with the sun at 15°
- i) Ans: 8.15am or 3.45 pm
- ii) Ans: 11.15am or 12.45pm
- iii) Ans: 6.00am or 6.00pm

Determining the altitude of the sun by the date and time

- i) Calculate the altitude of the sun at 9.00 am on 31 December
 - ii) Calculate the maximum and minimum altitudes of the sun at midday over the course of a year (hint, on which dates would the sun be at their maximum and minimum positions)
- i) Ans: 6° altitude
 - ii) Ans: Min = 14° , Max = 62°