

Exercises for the Southern Hemisphere Astrolabe using the Adelaide Latitude Plate

1. Rising Position for a Star

Example: Where on the horizon will Betelgeuse rise?

Solution: Turn the plastic rete until Betelgeuse is on the eastern side of the horizon. You will see that Bellatrix will rise about 7 to 8° north of due east. – Remember each azimuth line on the Adelaide latitude plate is 15° – Betelgeuse rises about half way between two azimuth lines, thus half of 15 is 7 to 8 degrees.

Example: How high above the horizon will Sirius be when it crosses the meridian?

Solution: Rotate the rete until Sirius is on the meridian – the line that is runs through the circle of the latitude plate, up to the top of the plate. You will see that Sirius is about 69° above the horizon. – Remember that the circle that measure altitudes are called the almucantars and they are labelled 10° to 80°. Sirius when placed on the meridian is just by the number “70”, but on the “60” side of the circle thus we say it has an altitude of 69°.

Example: How much time will Altair spend above the horizon each day?

Solution: Position Altair so that it is on the eastern horizon. position the rule so that it points at 0 hours (at the bottom of the instrument on the outer rim of the mater) Hold the rule and the rete together and rotate the rete until Altair is now on the western horizon. Read the time shown by the rule which is 11 hours and 30 minutes.

Do the same exercise for Canopus and you get an answer of 17 hours and 45 minutes.

2. Problems involving the Sun

Example: Where on the horizon, in Adelaide, will the Sun rise on the 13th January in any year?

Solution: Turn to the back of the mater and rotate the alidade until it points to the 13th January. Read the zodiac position of the Sun from the outer dial. The Sun is 22° Capricorn. Turn to the rete. Rotate the rete until 22° Capricorn is on the eastern side of the horizon (The ecliptic is the blue circle on the rete with the 12 zodiac signs). You can see that the Sun will rise at about 30° south of due east.

Repeat this exercise for when the Sun is at 22° Cancer. You can see that the Sun rises on that morning at 20° north of due east.

Repeat this exercise for when the Sun is at 0° Aries – the Equinox. You will see the Sun will rise at exactly due East.

Example: What is the Noon altitude of the Sun for the 13th January?

Solution: Rotate the rete until 22⁰ Capricorn is on the meridian. Read the altitude from the Almucantars. You can see that the Sun will culminate at an altitude of about 80⁰ above the horizon.

Repeat this exercise for the 20th June. On the 20th June the Sun is at 29⁰ Gemini, which will culminate at an altitude of about 33⁰ above the horizon.

Example: How much daylight does Adelaide get on the 13th January?

Solution: Place 22⁰ Capricorn on the eastern horizon. Place the rule on the 0 hours mark. Hold the rule and the rete together and rotate the rete until 22⁰ Capricorn on the western horizon. Read the time from the mater, which will give you 14 hours.

Repeat this exercise for the 20th June, and you gain an answer of 9 hours and 45 minutes

Example: What is the time of Sunrise for the 13th January (sun dial time)

Solution: Place 22⁰ Capricorn on the eastern horizon. Align the rule to point at the Sun. Read off the time on the outer rim of the mater. Very close to 5am.

Example: What time is dawn for the 13th January (sun dial time)

Solution: Dawn or sunset does not happen when the sun is directly on the horizon. The dotted lines below the horizon line are the twilight lines. Dawn on the morning of the 13th January will happen when the Sun is at the second dotted line, and full light will be when the Sun is on the first dotted line. Thus dawn will be at 3.45 am and Sunrise will be seen to be at 4.15 am.

Repeat this example to find the time of Sunset and then darkness or the end of twilight for the 13th January. Sunset will be at (sun on the horizon) will be at 7. 15 pm. End of twilight will be at 8.45 pm.

3. Horoscopes Questions

Example: If a person born in Adelaide has an ascendant of 25⁰ Taurus what is their MC?

Solution: Place 25⁰ Taurus on the eastern horizon. Read off the zodiacal longitude, which is on the meridian. This is 0⁰ Pisces.

Example: If a person was born on the 15th July in Adelaide at local noon, what would their Ascendant and MC be?

Solution: Turn to the back of the mater and find the Ecliptical degree of the Sun on the 15th July. This is 22⁰ Cancer. Rotate the rete so that 22⁰ Cancer is on the meridian. Read off the degrees rising. 10⁰ Scorpio rising, and of course the MC will be 22⁰ Cancer, the degree of the Sun.

Example: If a person was born at 10 am in the morning on the 15th July in Adelaide, what would be their MC and Ascendant?

Solution: This is a harder question to answer simple because the Astrolabe works with Sun dial hours and not standard government hours nor even longitude equivalent hours. Sun dial hours are not of equal length, during the day nor during the year. However, we can approximant the answer.

- a) The distance between the horizon and the meridian is the daylight morning hours of that day. On the 15th July the Sun is at 22⁰ Cancer. Rotate the rete so that 22⁰ Cancer is on the meridian and read off the altitude of the Sun. This is a few degrees less then 40⁰.
- b) Find the time of Sunrise on that morning – This is about 7 am.
- c) The time between Sunrise and noon is therefore 5 hours and in our example the person is born at 10 am (we are ignoring the difference in hours) which we now know is 3 hours after sunrise and 2 hours before noon.
- d) 3/5 of the altitude of the Sun is about 25⁰ of altitude. Rotate the rete until 22⁰ Cancer is about 25⁰ on the almucantars now read off the Ascendant and MC which is 15⁰ Virgo and an MC of 21⁰ Gemini. (The actual Asc is 13 Virgo with an MC of 19 Gemini)

Example: On 13th January 2002, transiting Saturn is about 8⁰ Gemini. Will you see it in the evening sky, if so at what time will it rise, culminate and set?

Solution: Place 8⁰ Gemini on the eastern horizon. Move the rule to point to the Sun because that is the timekeeper. The Sun is at 22⁰ Capricorn on the 13th of January, so placing the rule to point at the Sun we can read the time as being 3. 30 pm (remember this is not daylight saving time, but sun-dial time) So Saturn will rise at 3.30 pm. (about 4.30 pm Daylight Saving time)

Now move 8⁰ Gemini to the meridian and read the time for the rule pointing at 22⁰ Capricorn and we find a time of 8.30 pm. So as the Sun sets, and it gets dark we will see Saturn culminating at about 37⁰ of altitude. Now move the rete so that 8⁰ Gemini is on the western side of the horizon and once again place the rule through the ecliptical position of the Sun. The time when Saturn will set is 2.15 am.

3 Measuring the Altitude of the Sun using the Shadow Box, and then telling the time.

Example: Use the Shadow Box to measure the altitude of the Sun

Solution: The Shadow Box is the rectangle box on the back of the mater. Most people are about six to seven of *their own feet* tall. This means you can use yourself as a gnome (stick for casting a shadow). Stand and make a note of the end of your shadow. Measure its length *using your own feet*. Using the left hand side of the shadow box that is in a scale of 6, turn the alidade to point to the length of your shadow. Let us say your shadow is 4 *of your feet* long. Using the numbers at the bottom of the shadow box, move the alidade to point at the number “4”. Now read the number on the outer

grid of the mater on the opposite side of the alidade. This figure is 61^0 of altitude. Thus the Sun's altitude is 61^0

Let us say that it is the 13th January so that we know the Sun is at 22^0 Capricorn. On the front of the astrolabe move the rete so that 22^0 Capricorn is at 61^0 of altitude. Point the rule to the Sun and read the time, which is about 10.15 am.

The same concept can be done by using the vents, not by looking through them but by pointing the astrolabe at the sun and moving the alidade so that the light from the whole in the leading vent shines through the whole in the second vent. With the alidade so position, you can then read the altitude of the Sun.

4. Measuring the Time at Night via the Stars

Example: It is the 13th January and Regulus is rising in the east. What time is it?

Solution: Place your thumb through the ring at the top of the astrolabe, Holding the instrument to your eye, sight along the alidade until you can see Regulus between the holes of the two vents. With the alidade in this position, now read the altitude of the star. Let us say that you gain a reading of 30^0 altitude. Rotate the rete until Regulus is on the 30^0 almucantar. Now pass the rule through the position of the sun (22^0 Capricorn) and you can see that the time is about 1 am.

5. Finding a bright star in the sky

The astrolabe is designed to be facing North, with the south pole behind your back.

Example: You see a bright star and you wonder what it is.

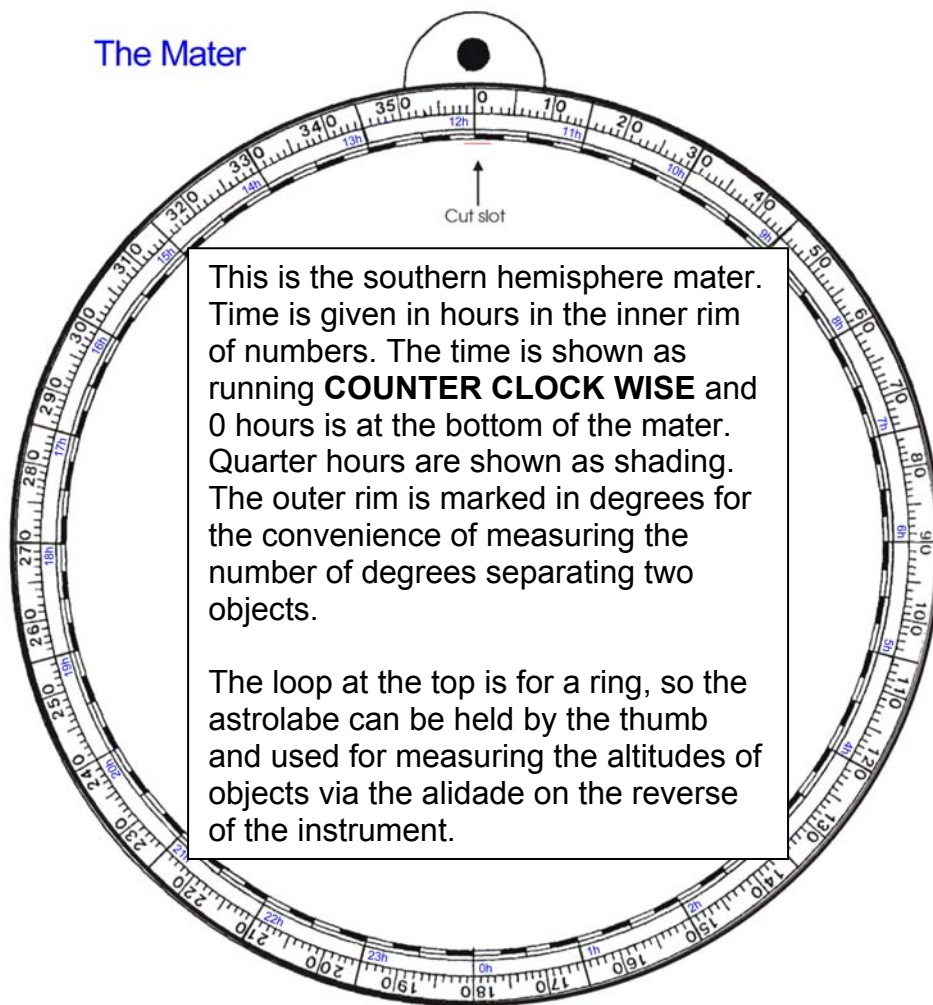
Solution: Set the rete for the correct time. If it is the evening of the 13th January, then move 22^0 Capricorn, with the rule until the rule is pointing at the correct time. Lets us say 10 pm at night (11pm daylight saving time). The rete is now set to show you the sky at that moment.

Facing North, with east and thus rising stars to your right.(this is the correct orientation for the instrument) You can see the Orion, with the bright stars of Betelgeuse, Bellatrix and Rigel is culminating. But to the east you see another bright star.

Using your hand (a fist with thumb and little finger extended is about 15 to 20 degrees), measure the altitude of the star. In doing this you find that the star is two hand spans from the horizon, or you can measure it yourself with your astrolabe. This means that the star is about 40^0 of altitude. In looking at the rete you can see that Procyon is to the east and at that altitude. If you also had a compass you could check the azimuth of Procyon. The astrolabe it telling you that the stars azimuth is about 45^0 from due north.

[The point at the top of the latitude plate is 0^0 north. On the Adelaide plate each arc that comes out from the centre circle is 15^0 of azimuth. We can see that for that time Procyon has an azimuth of 45^0 from due north and 40^0 of altitude.]

The Mater



The Mater

The mater is the original mother-broad and is the base of the instrument. Onto the mater is placed the latitude plates, the rete and the ruler.

Measuring a star's Right Ascension and Declination

Ensure that the meridian on the latitude plate (the red line) is aligned with the "0" hours on the mater.

- Align 0^0 Aries of the rete with the meridian on the latitude plate and 0^0 on the mater.
- Rotate the ruler so the edge with the declination runs through the star you are measuring. Using Canopus as an example we can see that the declination is about 50^0 South.
- Using the side of the ruler which is not scaled with declination note the time. You can see that the ruler is pointing to a time of 5 hours 45 minutes. Subtract this from 12 hours which gives an answer of 6 hours 15 minutes. This is the Right Ascension of about Canopus.