

Exercises for the Astrolabe using the Bath 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 Betelgeuse will rise about 12^0 north of due east.

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 20^0 above the horizon.

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 top 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 13 hours and 45 minutes.

Do the same exercise for Antares and you get an answer of 7 hours and 15 minutes.

2. Problems involving the Sun

Example: Where on the horizon, in Bath, will the Sun set on the 13th May in any year?

Solution: Turn to the back of the mater and rotate the alidade until it points to the 13th May. Read the zodiac position of the Sun from the outer dial. The Sun is 21^0 Taurus. Turn to the rete. Rotate the rete until 21^0 Taurus is on the western 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 set at just over 30^0 north of due west, or an azimuth of 301^0 .

Repeat this exercise for when the Sun is at 22^0 Scorpio. You can see that the Sun sets on that day at 30^0 south of due west, or an azimuth of 240^0 .

Repeat this exercise for Sun Rise with the Sun is at 0^0 Aries – the Equinox. You will see the Sun will rise at exactly due East and then sets at exactly due West.

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

Solution: Rotate the rete until 21^0 Taurus is on the meridian. Read the altitude from the Almucantars. (lines of altitude on a astrolabe latitude plate) You can see that the Sun will culminate at an altitude of about 55^0 above the horizon.

Repeat this exercise for the 20th January. On the 20th January the Sun is at 29^0 Capricorn, which will culminate at an altitude of about 19^0 above the horizon.

Example: How much day light is there on the 20th January for Bath, UK?

Solution: Place 29⁰ 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 29⁰ Capricorn on the western horizon. Read the time from the mater, which will give you 8 hours and 30 minutes.

Repeat this exercise for the 20th June, and you gain an answer of 16 hours 30 minutes.

Example: Finding Sunrise (Sun on the Ascendant)

What is the time of Sunrise for the 20th January (sun dial time)

Solution: Place 29⁰ Capricorn on the eastern horizon. Align the rule to point at the Sun. Read off the time on the outer rim opposite side of the mater. (You can see that the two "points" of the rule are in line with each other). Answer 7:45 am (sun dial time).

Example: What time is dawn for the 20th 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 20th 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 6:15 am and Sunrise (full light) will be seen to be just before 7 am.

Repeat this example to find the time of Sunset (Sun on the Descendant) and then darkness or the end of twilight (sun on second line) for the 20th January. Sunset will be at (sun on the horizon) 4:15 pm. End of twilight will be at 5:45 pm.

Star visible – the third line.

The third dotted line on the latitude plate is when the stars are fully visible – So on the night of 20th January in Bath the stars will be visible by 6:20 pm. (Weather permitting).

3. Horoscopes Questions

Example: If a person born in Bath 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 20⁰-23⁰ Capricorn.

Example: If a person was born on the 15th July in Bath 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 20⁰ Cancer is on the meridian. Read off the degrees rising. 13⁰ Libra rising, and of course the MC will be 20⁰ Cancer, the degree of the Sun.

Example: On 13th May 2003, transiting Mars is about 13⁰ Aquarius. Will you see it in the evening sky, if so at what time will it rise, culminate and set?

Solution: Place 13⁰ Aquarius on the eastern horizon. Move the rule to point to the Sun because that is the timekeeper. The Sun is at 22⁰ Taurus on the 13th of May,

so placing the rule to point at the Sun we can read the time as being 1:45 am (remember this is not daylight saving time, but sun-dial time) So Mars will rise at 1:45 am.

Now move 13° Aquarius to the western horizon and read the time for the rule pointing at 22° Taurus and we find a time of 10:15 am.

So Mars will rise at 1:45 am and set at 10:15 am, so if you wish to see Mars you will have to get up well before dawn.

Indeed at dawn on the 13th May, 2003 (which will be at about 2 am) Mars will have an elevation of 14° above the horizon. Remember dawn is when 22° Taurus is in the east on the second dotted line. If you place the rete in this dawn position then look at the elevation of 13° Aquarius you will see that it about 14° .

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).

Shadow not longer then your height.

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. (The scale of 1 to 10 on the other side of the shadow box is for using a standard measuring stick.)

The scale based on 6 is actually implying that when your shadow is the same length as your height then read this a SIX units. So if you are more or less then 6 of your feet tall you will need to make mental adjustments. This may seem cumbersome but the reality is the you will always have your feet and body with you as you travel around, so by mentally noting the ratio of your height to the length of your feet you will always have a gnomon and ruler with you.

Let us say your shadow is 5 *of your feet* long. Using the numbers at the bottom of the shadow box, move the alidade to point at the number “5”. Now read the number on the outer grid of the Equation on the opposite side of the alidade. This figure is 53° of altitude. Thus the Sun’s altitude is 53°

Let us say that it is the 13th May so that we know the Sun is at 22° Taurus. On the front of the astrolabe move the rete so that 22° Taurus is at 53° of altitude. Point the rule to the Sun and read the time, which is about 1:30 pm.

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.

Shadow longer than your height.

Stand and make a note of the end of your shadow. Measure its length *using your own feet*. Let us say that your shadow is 18 of *your feet long*. The longest possible shadow that the astrolabe can measure is 6 feet, so we must work out how tall you would need to be to only cast a shadow 6 feet long.

Therefore, 6:18 is the same as 1:3 – so the triangle of you and your shadow has a ratio of 1:3

Hence if the shadow was only 6 feet long then you would only be 2 feet tall.

Using the VERTICAL numbers in the shadow box place the alidade on the number 2 and read the Sun's elevation, which is 22° .

Let us still assume that it is the 13th May so that we know the Sun is at 22° Taurus. On the front of the astrolabe move the rete so that 22° Taurus is at 22° of altitude on the western side of the instrument. (You are always expected to know if it is morning or afternoon – Sun is east or sun in west). Point the rule to the Sun and read the time, which is about 5:30 pm.

4. Measuring the Time at Night via the Stars

Example: It is the 13th May and Arcturus is high in the sky and but still rising in the east What time is it?

When you have the vents glued to the alidade

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 Arcturus 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 50° of altitude. Rotate the rete until Arcturus is on the 50° almucantar. Now pass the rule through the position of the sun (22° Taurus) and you can see that the time is about 9:50 pm.

Setting the Rete – You can set the rete either by knowing the elevation of a celestial body and then rotating the rete so that that body is shown at that elevation. Alternatively if you know the time then you can place the rule through the ecliptical degree position of the Sun then holding the rete and the rule together, rotate the rete so that the opposite side of the ruler points to the known clock time.

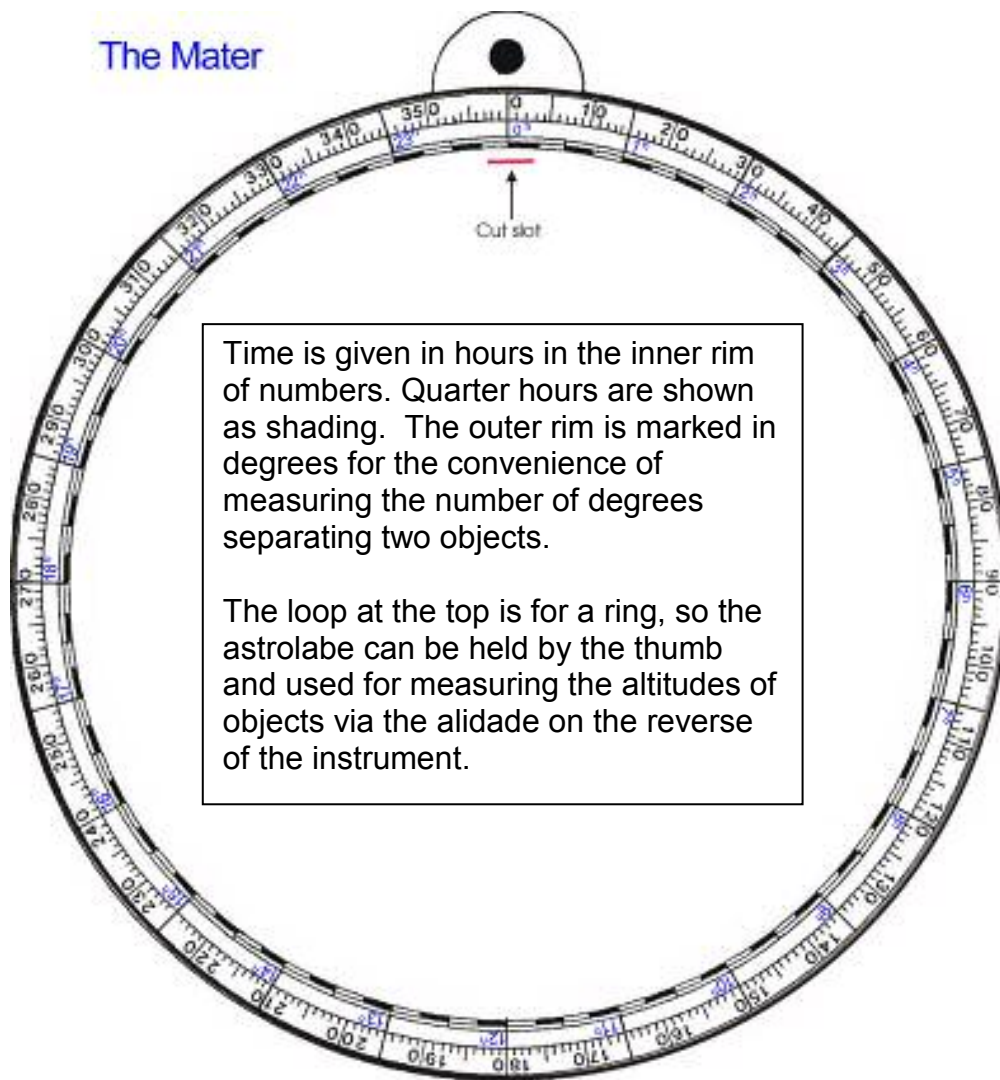
5. Finding a bright star in the sky

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 May, then move 22⁰ Taurus, 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 south, with east and thus rising stars to your left.(this is the correct orientation for the instrument) You can see the Vega, in the constellation Lyre at an elevation of 30⁰. Use your hand to check this fist with thumb and little finger extended is about 15 to 20 degrees. Vega's azimuth will be about 70⁰ from due north in an easterly direction.

If you look towards the west you will see another bright star. Using your hand as a measure, measure its elevation and let us say you find this to be about 20⁰ above the horizon. In looking at the rete you can see that Capella is to the west and at that altitude. If you also had a compass you could check the azimuth of Capella. The astrolabe it telling you that the stars azimuth is about 47⁰ west from due north.



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 is aligned with the "0" degrees 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 Vega as an example we can see that the declination is about 35^0 North.
- Using the side of the ruler which is not scaled with declination note the time BUT read the time scale in an ANTICLOCK wise direction. You can see that Vega has a Right Ascension of about 18 hours 35 minutes.