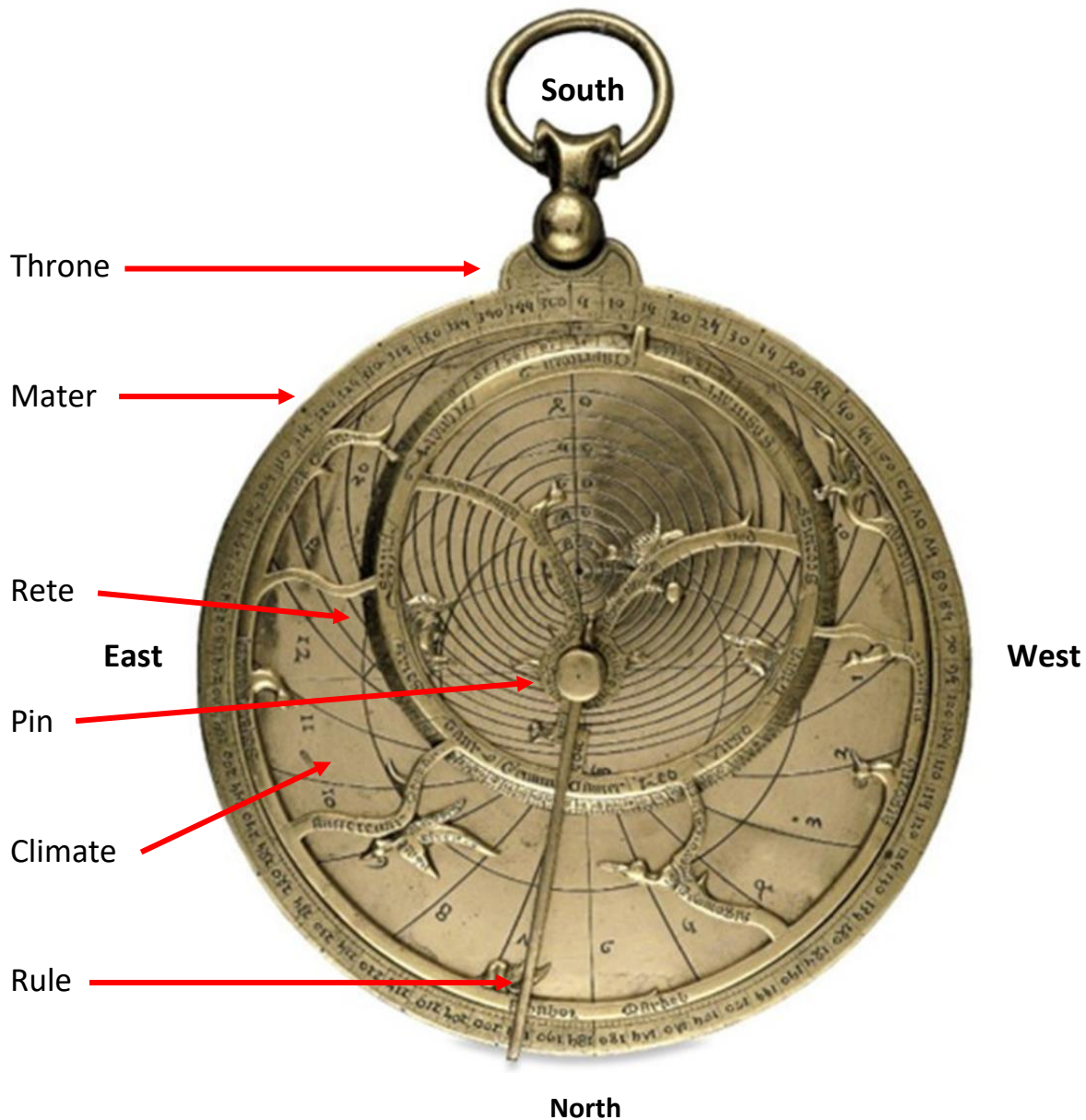


Using Your Astrolabe

So, you are working on your Astronomy Before the Telescope certification with the Astronomical League. You have built your Astrolabe. Now what? It seems easy enough to use – a rotating disk, two pointers. How hard can it be? But there are so many scales. This is a brief tutorial to help get you started.

Terminology (the parts of the Astrolabe):



(Public Domain)

Mater (or Mother) – This is the base upon which all the other pieces are attached.

Throne – this is the “handle” at the top of the Mater. It is how you hang the Astrolabe vertically to use it for observing. When you hold the Astrolabe horizontally with the front side up, the Throne is on the far side and is South. North is closest to you with East to its left, and West to its right.

Pin – This is the pin that is pushed through the center of all of the parts of the Astrolabe to hold it all together and to allow it to rotate.

Horse – This is a small locking pin that is used to hold the Pin in place and locks all the pieces together. (Not shown in the picture.)

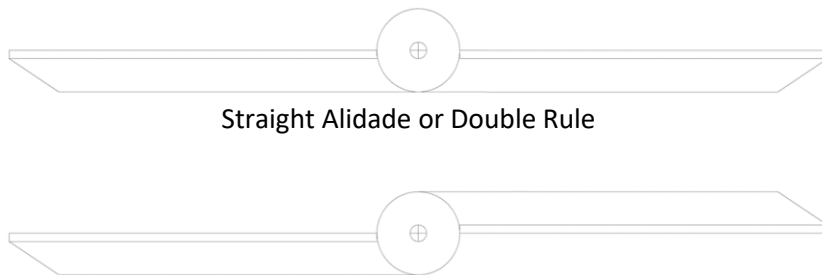
Limb – If your Astrolabe is designed to have replaceable Climates, then this is a raised ring designed to hold those plates, and there must be a means to keep the Climates oriented properly. If the Climate is actually printed on the front of the Mater then you do not need this. (Not shown in the picture.)

Climates (or Plates) – These are the disks that sit in the middle of the front of the Mater. They are tailored for the observer’s latitude. When Astrolabes were used as navigational instruments (and made of brass) they would come with a set of Climates for different latitudes. In our case, the Climate is likely printed onto the front of the Mater for your latitude.

Alidade – This is the double ended pointer that is attached to the back side of the Mater. It has two projections on it that allow you to sight on a star. (Not shown in the picture.) Some Alidades are made differently. Be sure that you use the edge of the Alidade that is aligned through the center of the Astrolabe when you are using it to read values on the back of the Mater. The projections do not need to be aligned through the center as long as they are parallel to the edge of the Alidade aligned through the center.



Straight Alidade or Double Rule



Offset Alidade or Double Rule

I used the top Alidade. It has two projections and I inserted old-timey flat thumbtacks in the two small circles shown. I use these to sight on stars.

For those who have a challenge using the two sights, another option is to glue a large diameter straw across the tabs.

The other two shown are two different or Alidades forms show both alignment options.

Rete – This is the overlay that shows the ecliptic and star locations. It sits on top of the Climate on the front side of the Mater. The Rete rotates independently from the other parts and is used to identify the position of the object in the sky or a date and time. Traditionally on brass Astrolabes, this would be a cutout. Your Astrolabe may have this printed on a piece of plastic.

Rule – This is the single or double ended pointed attached to the front side of the Mater. It is used in conjunction with the Rete to generate data for the sun and stars for specific dates and events.

Single Rule



Assembly Suggestions:

I printed the Mater and Climate for my longitude on heavy paper. I then cut them out and assembled them from front to back. I then laminated this with 10 mil lamination sheets and cut them out.

I printed my Alidade and Rule on heavy paper. I cut them out and laminated them individually then cut them out as well. I installed two old-timey flat thumbtacks through the circles on the tabs on the Alidade. The heads of the thumbtacks should be on the unprinted side of the Alidade.

I used a hole punch to put a hole in the Throne to hang it from. Then I attached a large splitting ring in the hole.

I printed the Rete directly onto a transparency and cut it out. This lets me see through the parts that are normally cut out.

For the Pin through the center of the Alidade, I used a fancy furniture upholstery tack. For the Horse, I used an eraser from a pencil.

I then prepunch the holes in the center of the Mater, Rete, Alidade, and Rule (just to make life easier during the assembly process).

Follow this order when assembling:

1. Place the upholstery tack on the table, point upwards.
2. Attach the Rule to the tack with the printed side pointing downward.
3. Attach the Rete to the tack with the printed side pointing downward.
4. Attach the Mater to the tack with the top side pointing downward. This is the side with the clock hours around the outer edge.

5. Attach the Alidade to the tack with the printed side pointing upwards. This means that the two flat thumbtacks have their points upwards.
6. Attach the pencil eraser to the point on the upholstery tack.

Scales on the Astrolabe:

There is virtually no limit to the number and variety of scales that can be included on your Astrolabe Mater and Climates. We will stick to the basic ones that are useful in your pursuit of the Astronomical League's Astronomy Before the Telescope certification. Reference can be found on the internet that elaborate on the other possible scales. The scales will vary from design to design but they all are used in the same manner.

Mater (back):

- The outermost scale is the Altitude Scale. When the Astrolabe is hanging vertically, 0° is horizontal and 90° is vertical.
- Moving inward, the next scale is the Zodiacal Scale. This represents 12 evenly spaced sections for the constellations of the Zodiac. Each section is subdivided into individual days.
- Moving inward, the next scale is the Calendar Scale. This represents the 12 months of the years and are subdivided into individual days.
- Additional scales and markings may be included but will not be discussed here.

Mater (front):

- The outer scale is the Hour Scale. It is marked into 24 hours with subdivisions for minutes. My scale has a mark for each 4 minutes (or 15 marked divisions per hour).
- The inner scale is the Compass Scale. It is marked into degrees with the top being 0° , right is 90° , bottom is 180° , and left is 270° .

Climate:

- Climates are created for different latitudes. Their markings are specific to that latitude. It may be printed directly on the front side of the Mater.
- The pin in the center represents the North Star. This is the same as the gromet in the center of a planisphere.
- In the direction of the Throne is a circular grid.
 - The center of this grid represents your Azimuth.
 - The ovals moving outward from this zenith are lines of Altitude.
 - On my Climates these lines represent 5° increments.
 - 90° is the center.

- The furthest marking is the horizon at 0° .
 - The lines radiating outward from the zenith are lines of Azimuth.
 - On my Climates these lines represent 5° increments.
 - Although not marked on my Climates, the line radiating towards the Throne is South at 180° .
 - The line radiating through the North Star is 0° .
- There is a horizontal line. This is the line from East to West.
- There is a vertical line. This is the line from South to North, the Meridian.
- There are circles centered on the North Star.
 - These represent Declinations.
 - The North Star (the central pivot point) is 90° Declination.
 - The circles are:
 - The Tropic of Cancer is the smaller circle.
 - The Equator is the circle that crosses the horizon line at the same places as the horizontal line.
 - The Tropic of Capricorn is the outer circle.

Rete:

- Traditionally, the Rete is a cutout. Mine is printed on plastic and overlays the Climate.
- It is marked with the Ecliptic.
 - The 12 constellations (signs) of the Zodiac are shown.
 - Each constellation is broken into individual days. Note that the days are marked from right to left within each sign.
- Individual stars are marked on the Rete. This is either by using pointers or as a star chart like on a planisphere.

Rule and Alidade:

- These two pointers are often marked with measurement scales as well. These will not be discussed here.

Observation of an Object's Altitude:

Direct observation of the Sun is dangerous and should not be done with the Alidade and the Astrolabe.

When Astrolabes were needed for solar observations, tools were developed to avoid direct observation of the sun.

To make an observation of an object's Altitude follow these steps:

1. The Astrolabe should be suspended freely at eye level using the Throne.

2. The Alidade (on the back) of the Astrolabe should be rotated so that the object can be sighted along the two projections on the Alidade.
3. Hold the Alidade so that it will not accidentally rotate.
4. The Altitude of the object can be read on the outer scale on the Mater where the Alidade is pointing.

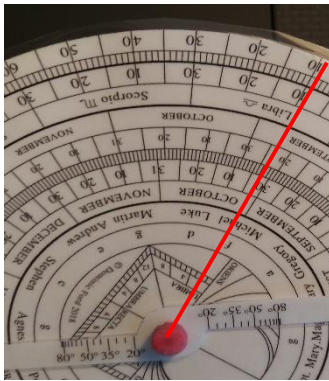
Converting Calendar Dates to Zodiacal Dates:

The first step in using your Astrolabe to predict dates, times, Altitudes, and Azimuths for astronomical events is to convert the calendar date to a zodiacal date.

Follow these steps:

1. Use the back of the Mater.
2. Rotate the Alidade until one of the pointers is pointing to your calendar date. Note the days of each month increase from right to left within each month's section.
3. Read the zodiacal date from the next scale moving outwards. You want to get the constellation (sign) as well as the day count. Note that the days increase from right to left within each constellation's section.

For example: October 2 on the calendar scale translates to Libra 13 on the zodiacal scale.



This is part of the back of my Astrolabe. There are way too many scales for simple use. Note the pencil eraser covering the point of the upholstery tack.

Both the Gregorian Calendar and the Julian Calendar are included. Note that the current calendar in use is the Gregorian Calendar. The Gregorian Calendar is the one closest to the center of the Astrolabe.

The red line passes through the inner calendar on October 2 and continues outward to the Zodiacal Scale on Libra 9.

Sunrise:

Note that noon on the Astrolabe is on the opposite edge of the disk from the Throne. If you hold the Throne towards you, the direction away from you is North. East is to the right. Follow these steps to determine the information for sunrise:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using the previous section.
3. Rotate the Rule until it points to the zodiacal date on the Rete.

4. Hold the Rete and the Rule so that they will rotate together without changing their relative positions.
5. Rotate the Rete with the Rule together until the ecliptic on the Rete and the Rule cross the horizon line on the Climate on the East side.
6. Determine the Time:
 - The time is read from the outer scale on the Mater. On my Mater each mark represents 4 minutes. I can interpolate to the specific minute.
 - Note that this is Standard Time. To get your result in Daylight Saving Time add one hour.
7. Determine the Azimuth:
 - Count the markings from either the North-South line (the Meridian) or from the East-West line on the Climate. On my Climate each mark is 5 degrees. I can interpolate between the markings to be more accurate. North is 0° . The horizon line to the East is 90° . If your pointer is above horizontal, you subtract your count. If it is below horizontal, you add your count.

Solar Transit:

Note that noon on the Astrolabe is on the opposite edge of the disk from the Throne. If you hold the Throne towards you, the direction away from you is North. East is to the right. Follow these steps to determine the information for sunrise:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rule until it points to the zodiacal date on the Rete.
4. Hold the Rete and the Rule so that they will rotate together without changing their relative positions.
5. Rotate the Rete with the Rule together until the ecliptic on the Rete and the Rule cross the Southern end of the North-South line (the Meridian) on the Climate.
6. Determine the Altitude:
 - The Altitude is the point where the Ecliptic crosses one of the ovals around the Zenith. Count the markings from either the Zenith point or from any marked oval around the Zenith. On my Climate each mark is 5 degrees. I can interpolate between the markings to be more accurate.

Sunset:

Note that noon on the Astrolabe is on the opposite edge of the disk from the Throne. If you hold the Throne towards you, the direction away from you is North. West is to the left. Follow these steps to determine the information for the rising of the star:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rete until it points to the zodiacal date on the Rete.
4. Hold the Rete and the Rule so that they will rotate together without changing their relative positions.
5. Rotate the Rete with the Rule together until the ecliptic on the Rete and the Rule cross the horizon line on the Climate on the West side.
6. Determine the Time:
 - a. The time is read from the outer scale on the Mater. On my Mater each mark represents 4 minutes. I can interpolate to the specific minute.
 - b. Note that this is Standard Time. To get your result in Daylight Saving Time add one hour.
7. Determine the Azimuth:
 - a. Count the markings from either the North-South line (the Meridian) or from the East-West line on the Climate. On my Climate each mark is 5 degrees. I can interpolate between the markings to be more accurate. North is 0° . The horizon line to the West is 270° . If your pointer is above horizontal, you add your count. If it is below horizontal, you subtract your count.

Azimuth and Time of Star Rise:

Note that midnight on the Astrolabe is on the edge of the disk at the Throne. If you hold the Throne away from you, the direction away from you is South. East is to the left. Follow these steps to determine the information for the rising of the star:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rete until the pointer for your star is on the East side of the Astrolabe. (If the Throne is pointing away from you, this is the left side.)
4. Rotate the Rule until it points to the zodiacal date on the Rete.
5. The Rule is pointing to the Time of the star's rising.
6. Count lines radiating from the Zenith along the outer edge of the Climate from either the North (0°) or South (180°) ends of the Meridian, or from the horizontal lines East (90°) or West (270°) ends. This is the star's Azimuth at setting.

Altitude of Star during Transit:

Note that midnight on the Astrolabe is on the edge of the disk at the Throne. If you hold the Throne away from you, the direction away from you is South. West is to the right. Follow these steps to determine the Altitude of the star at Transit:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rete until the pointer for your star is on the North-South line (the Meridian) on the Climate. (If the Throne is pointing away from you, this is the top.)
4. Count the ovals as they cross the Meridian on the Climate from either the North (0°) or South (180°) ends of the Meridian. This is the star's Altitude during Transit.

Azimuth and Time of Star Set:

Note that midnight on the Astrolabe is on the edge of the disk at the Throne. If you hold the Throne away from you, the direction away from you is South. West is to the right. Follow these steps to determine the information for sunset:

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rete until the pointer for your star is on the West side of the Astrolabe. (If the Throne is pointing away from you, this is the right side.)
4. Rotate the Rule until it points to the zodiacal date on the Rete.
5. The Rule is pointing to the Time of the star's rising.
6. Count lines radiating from the Zenith along the outer edge of the Climate from either the North (0°) or South (180°) ends of the Meridian, or from the horizontal lines East (90°) or West (270°) ends. This is the star's Azimuth at rising.

Altitude and Azimuth of a Star for a Specific Date and Time:

This is a bit trickier. The process is a bit different, so follow the steps closely.

Note that midnight on the Astrolabe is on the edge of the disk at the Throne. If you hold the Throne away from you, the direction away from you is South. East is to the left. Follow these steps to determine the Altitude and Azimuth of the star at a specific time.

1. Select a calendar date.
2. Convert the calendar date to a zodiacal date using a previous section.
3. Rotate the Rete until the pointer for your star is on the East side of the Astrolabe. (If the Throne is pointing away from you, this is the left side.)
4. Rotate the Rule until it points to the star's location on the Climate.
5. Hold the Rete and the Rule so that they will rotate together without changing their relative positions.
6. Rotate the Rete with the Rule together until the Rule is pointing to the desired time on the Mater. (Remember that the Astrolabe is using Standard Time.)

7. The star's Altitude is found by counting the number of oval lines between Zenith and the Horizon.
8. The star's Azimuth is found by counting the number lines radiating from the Zenith towards the Horizon.

Confirm Your Results:

You can confirm the accuracy of your results by looking up the values in planetarium software on your computer or the internet.