

Night-Sky Observing 101 – Naked Eye & Optional Binoculars & Sky Watcher's Award

THE SCHEME – The night sky was once an intimate and practical part of our ancestors' lives. It is not just light pollution. Modern humans live in an artificial world isolated from nature. The Arkansas Natural Sky Association (ANSA) wants to encourage people to rediscover nature at night. The Central Arkansas Astronomical Association (CAAS) wants to help aspiring skywatchers. This program combines ANSA's online Observing 101 course with the first stage of CAAS's novice [Sky Watcher's Program](#), which challenges the emerging sky watcher to advance through a basic set of basic observational activities.

The Observing 101 course, held twice a year, begins a few days after the new moon sets close behind the sun as a thin crescent. Classes start at 7:00 PM, but the Zoom sessions typically open at least ten minutes early to get everyone in on time and provide Q&A time. Subsequent installments follow weekly at the same time and day of the week for two or three more weeks, after which we will meet monthly to follow everyone's progress, answer questions and share experiences until the next course starts or everyone has completed the observing program.

While the course discusses using binoculars, which can add greatly to the program, they are not essential. At its core, this is a naked-eye program. A library or other small telescope can substitute for binoculars.

Completing the program does not require a particularly dark sky. A convenient observing location not too far from home but away from the worst light pollution will do. A park outside of town, an open field, a rural churchyard, or your backyard if you live in a rural or suburban area away from a city center. Any open area where a light is not going to be nearby or can be hidden from view by an intervening obstacle.

The **first** week's activities especially don't require the darkest sky. After the **second** night, the moon will be gibbous, so the observing activity focus is on lunar explorations, finding bright stars and planets, and preparing for darker skies to come. By the **third** night, we will be entering two weeks of moonless evenings when a darker sky will be a plus.

Each night's program is briefly outlined below, with some useful references to explore and the observing activities that will solidify what you are learning and move you toward earning your certificate of completion. Do some of it, or do it all, or just attend the classes – it is up to each participant, but to earn the Sky Watcher's certificate, you must complete the [Observing Program](#), which can be downloaded from the observing 101 webpage. (A suggestion, observe with a friend or an older child. They don't have to take the class. Sharing what you are learning is a great way to solidify your knowledge.)

To get your certificate, email a copy of your completed observation notes to stella@darkskyarkansas.org. There is no time limit on completing the Observing Program.

FIRST NIGHT (just past new moon) – A perspective, humanity and the night sky & an introduction to sky watcher resources.

With a sliver of a moon, our sky is pretty dark, but we haven't learned enough to seriously navigate the stars and constellations. So we start with the moon and planets.

- **Astronomy as defining humanity;**
- **The functional night sky;**
- **The midwife of science;**
- **The ultimate source of perspective, inspiration, and reflection;**
- **Some basic sky terminology;**
- **Anatomy of the sky to include constellations, asterisms, star names, magnitudes & ecliptic;**
- **Review what we are going to observe this week**
- **Overtime – An introduction to binoculars**

Some Useful References:

- Learning the Constellations: [purchase online](#), or download [a pdf](#).

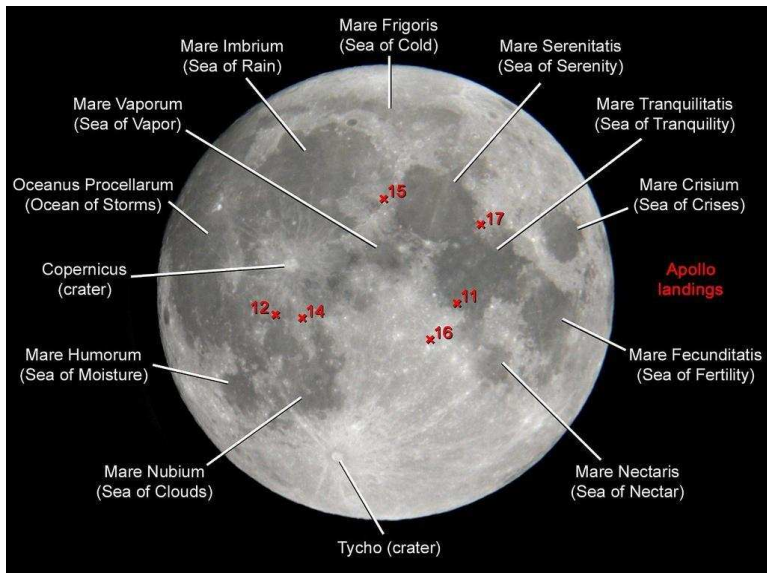
- [Time and Date](#) - a resource for the time of natural astronomical events
- [Moon Phase Calendar](#), or get an app.
- [EarthSky](#), [In-The-Sky.org](#), [Sky and Telescope's Sky-at-a-Glance](#), and [Astronomy's Sky-This-Week](#), all provide information on what's up and happening in the sky.
- Optional - [ANSA'S Binocular Guide](#)

1st Week's observing activities:

1. Hopefully, you are reading this before the first online class session. If so, go to [TimeandDate.com](#) and click on the sun/moon tab, then select the moon phase option and find when a new moon will occur. **Find a convenient location where you can witness the sunset.** The moon is out there, just above or below the sun; otherwise, there would be a solar eclipse. You can't see it because the sun, being behind it, there is nothing to light the surface facing us.
2. On the day after new, or as soon thereafter as you can do so, **look for the moon around sunset.** The one-day-old new moon will be a thin crescent and not very far above where the sun is, or has, just set. It may be hard to see, but each evening past new, it will be further from the sun and more illuminated.
3. Use [EarthSky](#) or one of the other online sources above to look up what planets are up in the evening sky. If up, **see if you can observe Mars or Venus**, they will not be far above where the sun as it sets in the west or where it will rise if they are up in the morning. Orbiting closer to the sun than we do, they never travel across the night sky like the outer planets. Venus, though, can sometimes be easily seen in the daytime sky if you can find it. [Here are some tricks to do so.](#)
4. **Draw an imaginary line from where the sunset through the moon and any planets that are up to where the sun will rise the next morning.** You have just defined the ecliptic – the path of the sun, moon, and planets through the sky. Because we are located 35 degrees north of the equator, the ecliptic, as seen from here, tends to be in the southern sky. Due to the tilt of the earth relative to the ecliptic, it is higher at night in the winter and lower in the summer – the opposite of the daytime when the sun and hence the ecliptic are higher in the summer and lower in the winter.
5. **Note that the planets don't twinkle like stars, how bright they are compared to most stars, and if up, the colors of Mars, Jupiter, and Saturn.** A bright star along the ecliptic, where a bright star should not be that does not twinkle, is a planet. When the color tells you which one it is, you are becoming night sky aware.
6. The earth goes around the sun faster than the outer planets. Being the next out, Mars's year is 687 earth days long, so it takes almost two years for us to catch it. But it takes just a little more than a year to catch the other outer planets. When we do catch up, that is called a conjunction. With this in mind, **note how far east or west on the ecliptic the planets currently are.** We have already past any outer planets that are in the western sky in the evening, so they will get lower and dimmer each night. We are still catching up to any outer planets that are in the eastern sky in the morning, so they will be getting higher and brighter each night. At conjunction, an outer planet will rise in the east near sunset, be in the middle of the ecliptic at midnight, and set in the west at sunrise, and of course, be at its brightest. Now, not only can you identify the planets in the sky, but you will know where our respective orbits are and about how long until the next conjunction.
7. (Late Fall through Spring) use one of the online sources above to **Find Orion, Betelgeuse and Rigel, noting their contrasting colors. Find Orion's belt, follow the belt line to the left to find Sirius, the brightest star.**

Optional binocular activities, if up.

1. **Find Orion's sword under his belt and the great Orion Nebula, the middle "star" of the sword. Going to the right, about along the line of Orion's belt, look at the beautiful open cluster, the Pleiades (the seven sisters) with the binoculars. Also, relook at all the bright stars and planets you've identified and note their colors through binoculars.**
2. If Jupiter is up and near conjunction, **see if you can make out its four "Galilean" moons**, so named because when Galileo turned his telescope on Jupiter, he noticed the moons, unlike stars moved around the planet. It was an aha moment that defined earth, with its moon, as but one more planet likely orbiting the sun like all the other planets. Also, **can you make out that Saturn has rings?** With his poor little telescope, Galileo drew Saturn as if it had ears. When will you see these best? Yes, near conjunction.



SECOND NIGHT (Just Past First Quarter Moon) – Observing Basics, organizing, and planning.

The moon is getting really bright, dimming the stars and constellations, so we focus on planning and organizing for when she is out of the way and enjoy observing her. We will also want to check back in with our newly familiar planets.

- Finding an observing site;
- Weather resources (clouds are bad);
- Sky conditions (transparency and seeing);
- Learning what's up, getting and reading sky charts, planetarium programs, and planispheres;
- Preparing an observing kit;

Some Useful References:

- Sky conditions and weather: <https://www.astrospheric.com>
- Finding dark-skies – <https://www.lightpollutionmap.info>
- [SkyMap](#) - provides a simple downloadable and printable monthly sky map.
- [Heavens Above](#) – the time of astronomical events, including ISS passages.

2nd Week Activities:

1. Put your observing kit together: Notepad, red flashlight, and whatever charts or apps you intend to use;
2. Find a reasonably dark observing site;
3. Check the weather and pick a promising night to observe;
4. As the moon will be progressing from Gibbous to Full:
 - a. **Note the dark and light areas of the moon.** Other than meteor strikes, there is nothing to alter the lunar surface, no wind, no rain, and no plate tectonics, so everything you see is very old. The dark areas “maria” (seas) are lava flows that occurred nearly four billion years ago. The rough “highland” areas are from meteor impacts, mostly from the “late great bombardment”, and are even older.
 - b. **Look for bright white areas and rays.** These are the youngest craters and ejecta from more recent impacts. If you have binoculars **view these features using them.**
 - c. **Note how each night the moon rises earlier (about 50') has progressed further east and hence sets later at night, and more of it is illuminated.**
 - d. When the moon is full, **find the “Rabbit on the moon”, and the “lady on the moon” and note that it now is just rising as the sun sets, is overhead at midnight, and sets at sunrise.** It is exactly opposite the sun now in the sky.
5. **Find those planets again** and think about where they are in the ecliptic and what that tells you about where our respective orbits are.

THIRD NIGHT (Just Past Full Moon) - how things move.

The moon is now leaving the evening sky, so we can start focusing on the stars, constellations, and so-called deep-sky objects. In time, this two-week period without a moon in the evening sky will likely become your favorite time to observe. Check the long-range forecast and plan to make several outings before the domineering moon comes back, maybe even before the fourth online session, so you can brag about how far you have come toward earning your certificate.

- How things move - stars, comets, meteors, the moon, and planets;

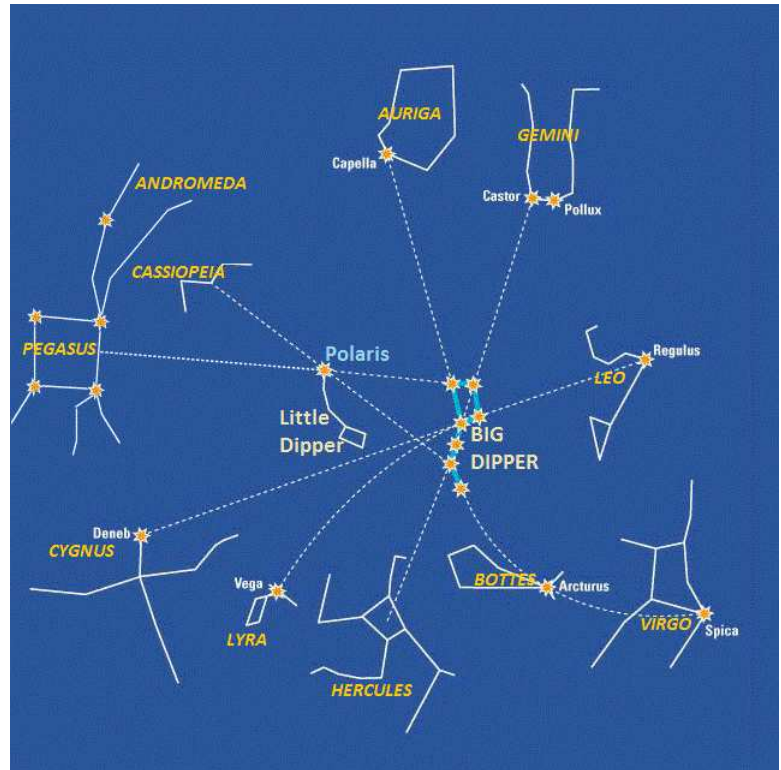
- Learning and navigating the constellations;
- Star hopping.

Some Useful References:

- [Stellarium](#) - a planetarium program

3RD. Week's observing activities:

1. Use Stellarium, or another planetarium program, or the current month's Skymap to visualize the current rotation of the circumpolar region of the sky.
2. Facing where the sunset, turn clockwise, approximately ninety degrees. If it is winter, the sun will have set south of due west, so add a bit. If summer, the sun will have set north off due west, so take a little off. **Use a compass or your cell phone to see how well you did finding North.**
3. Facing north, use your fist held at arm's length to estimate 35 degrees up (three and a half fists stacked up from the northern horizon) to **find Polaris**, a/k/a the "North Star" or "Pole Star". Verify it with the Big Dipper's pointer stars (the two stars that form the end of the dipper's cup). Polaris will be five times the distance between the pointer stars (see chart below).
4. **Trace out the Little Dipper**, the handle of which ends with Polaris, and **count the number of stars you can see**. In light-polluted skies, you may see just three. You can use how many stars you can see in the little dipper to estimate how dark your sky is.
5. Use the Circumpolar Chart above to **"star-hop" from the little dipper to Queen Cassiopeia, the Big dipper**, and any other asterism high enough to see. (Remember that while the pattern of the stars shown in the chart doesn't change, the orientation does from season to season and during the night, as the sky rotates, or rather as the earth rotates under the sky, so you will have to turn the chart in your mind to line things up.)
6. **Find the bright (named) stars in the evening sky that forms the appropriate seasonal asterism**. Note the color of each star that makes the asterism in your observing notes. Try to observe them and record them on more than one evening, and commit them to memory.
7. **Find the Seasonal asterism again and review the principal named stars**. Enter them in your log to help remember them.



Star Hopping – using a set of stars to find other star groups



Old moon in New moon's arms

Optional Challenge: In the evening, sketch the big dipper in relation to Polaris and the horizon, then before dawn, wake up and resketch the dipper and Polaris again, or if that hurts too much, use Stellarium to see what the dipper would look like if you had gotten up. ☺

FOURTH NIGHT – Observing with binocular and small telescopes and Night Sky stewardship

- Selecting and using binoculars.
- The Cosmic Zoo – the types of objects we can see with binoculars and small scopes.
- Selecting an Observing program.
- Impacts of light pollution, how to prevent it, and certify your home as night sky compatible
- Globe-at-night and how to use it to learn the constellations, their mythology and to determine how dark your observing site is and report it as a citizen scientist.



The Double Cluster, Chris Lasley

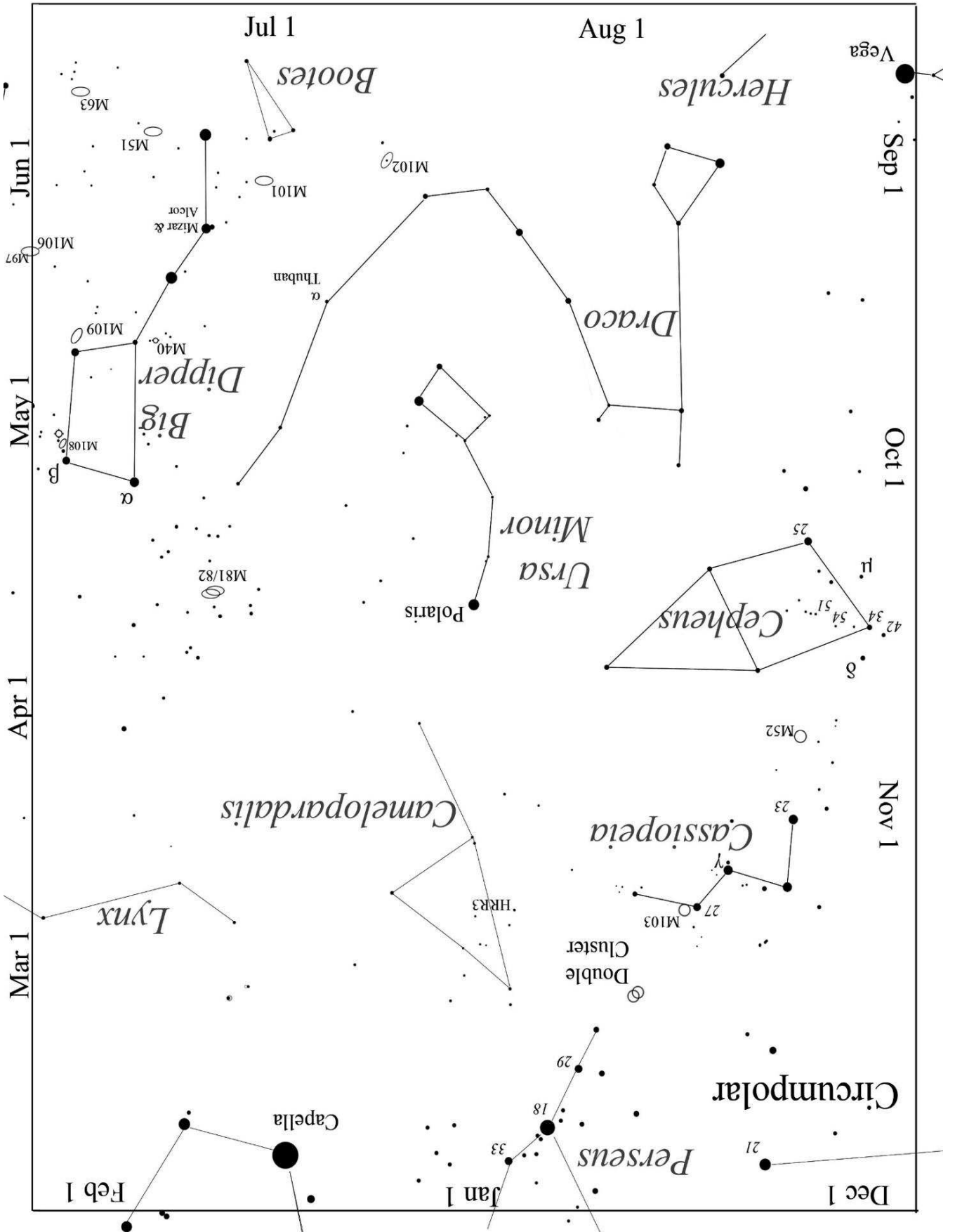
Some Useful References:

- [Library Telescope Object to View page.](#)
- [Dark-Sky Friendly Home Certification - IDA](#)
- [Globe-at-Night](#)

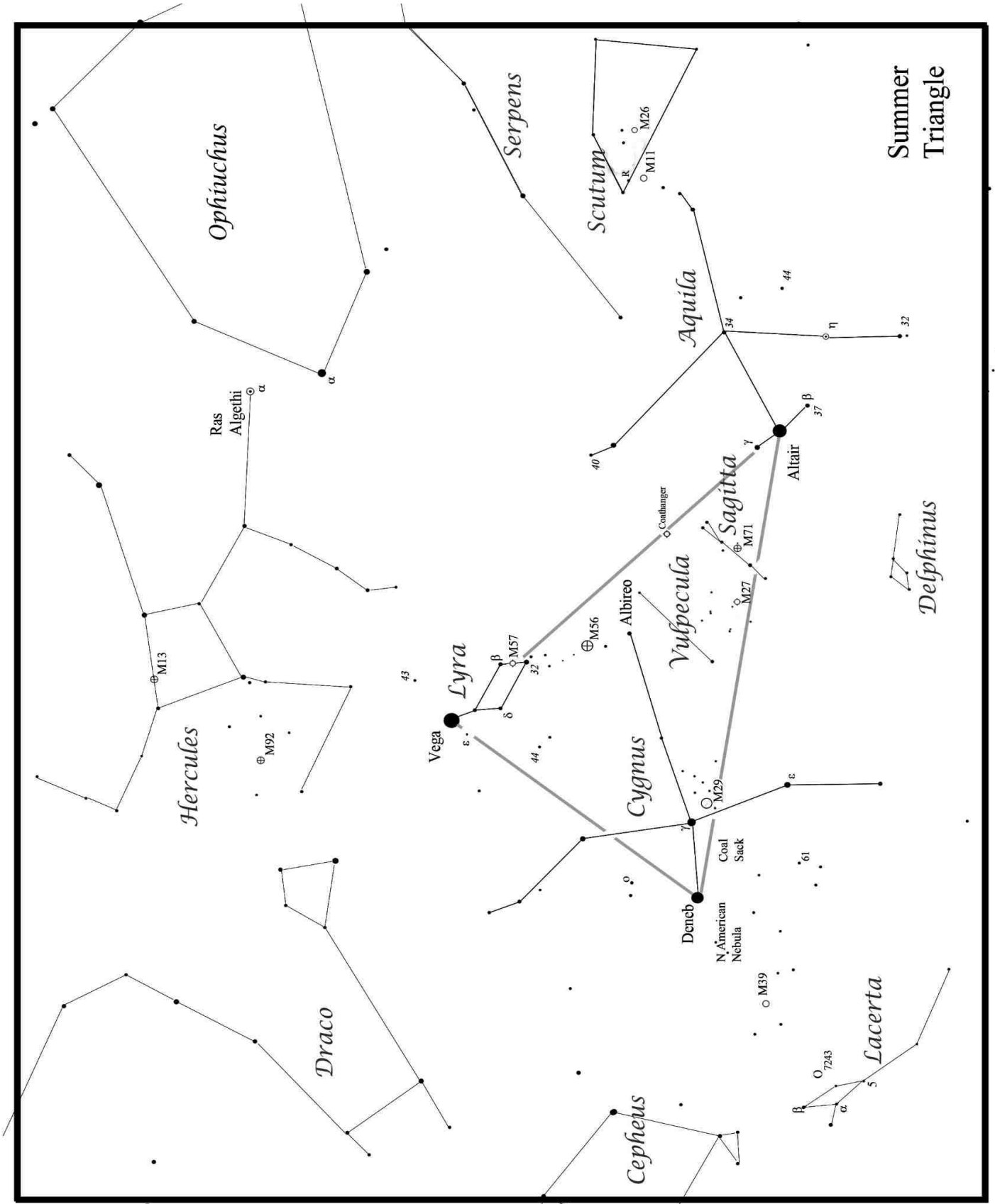
4th Week Activities:

- It is still dark; knock off as many of the observing tasks as you can. Try to finish them all by the end of the program.
- Use Globe at Night to determine and report how dark your favorite observing site is, and use the link above to certify your home as Dark-Sky Friendly, which by now you should appreciate a naturally dark sky.

Circumpolar Region



Seasonal Asterism Charts



Summer Triangle

Delphinus

Lacerta

Cepheus

Draco

Hercules

Ophiuchus

Lyra

Cygnus

Vulpecula

Sagitta

Aquila

Scutum

Serpens

Deneb

Vega

Altair

Ras Algethi

Coal Sack

N. American Nebula

Coathanger

M71

M29

M27

M56

M57

M11

M26

M39

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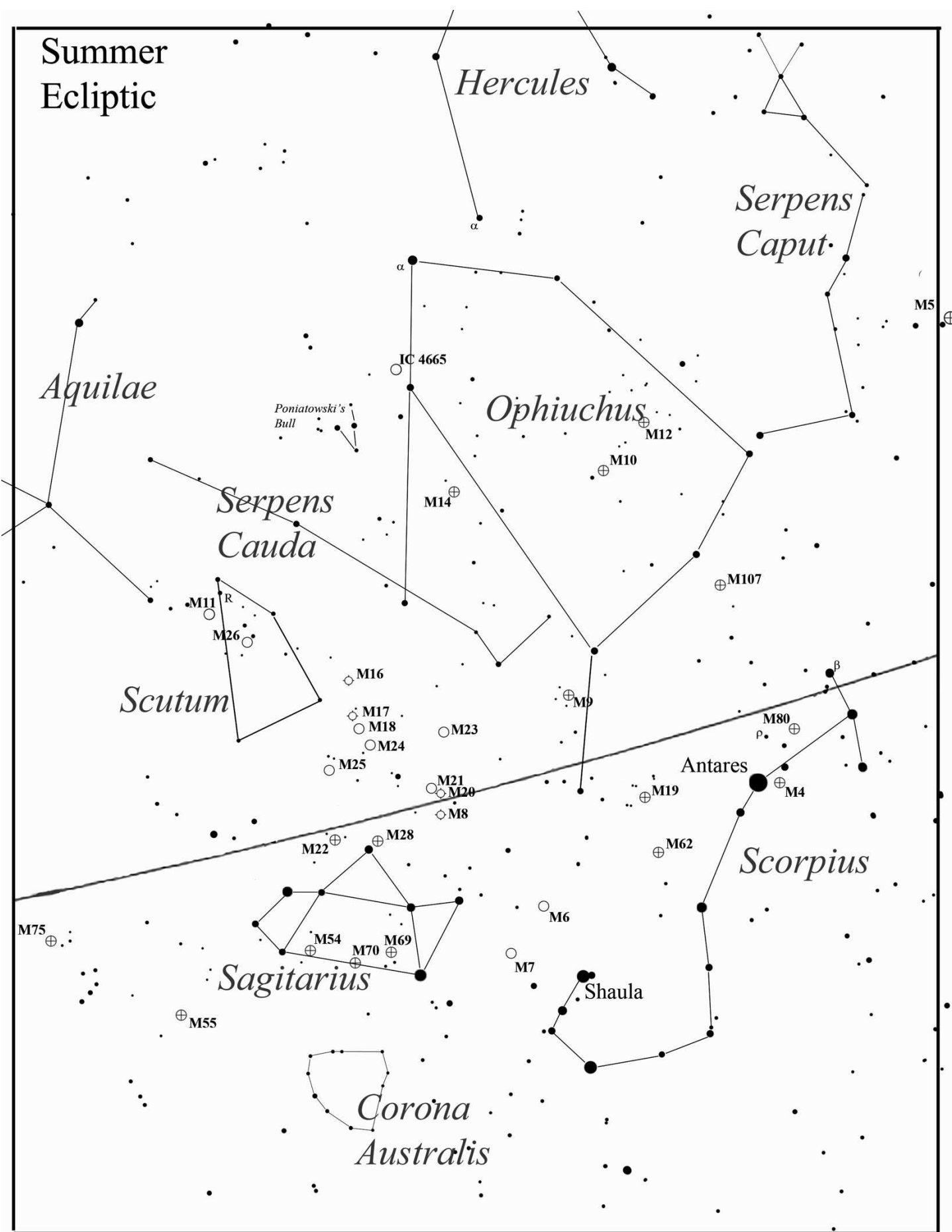
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Winter
Hexagon

