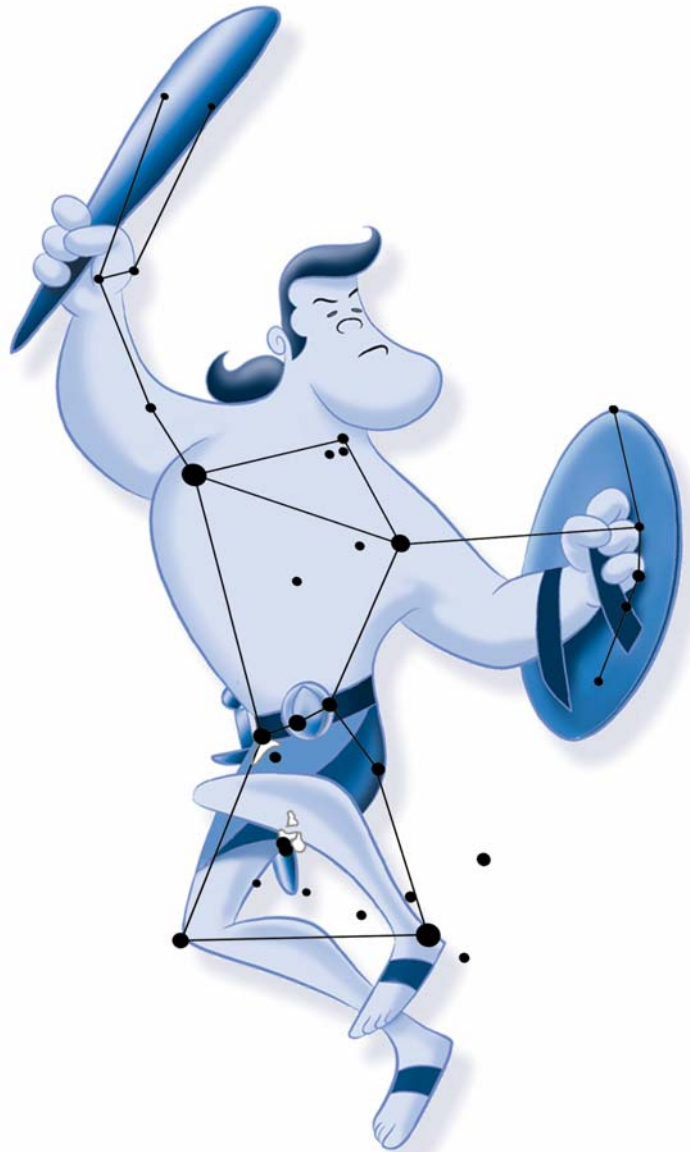


Legends of the Night Sky

Orion



Educator's Guide **Grades K - 8**

Written By: Dr. Phil Wymer, Ph.D. & Art Klinger

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Introduction

It is our belief that "Legends of the Night sky: Orion" is the best multi-grade (K – 8), multi-disciplinary education package on the market today. It consists of a humorous 24-minute show and educator's package.

The Orion Educator's Guide is designed for Planetarians, Teachers, and parents. The information is researched, organized, and laid out so that the educator need not spend hours coming up with lesson plans or labs. This has already been accomplished by certified educators.

The guide is written to alleviate the fear of space and the night sky (that many elementary and middle school teachers have) when it comes to that section of the science lesson plan. It is an excellent tool that allows the parents to be a part of the learning experience.

The guide is devised in such a way that there are plenty of visuals to assist the educator and student in finding the Winter constellations. It is divided up into different levels based upon the students grade (K – 8). The multi-disciplined approach (science, math, english, geography, and history) makes it an excellent tool.

The information is presented in a segmented outline form. This is to allow, not only the educator, but the student to comprehend each piece of information. The outline form also makes it easier for the educator to make "overheads" for the lesson.

The lesson plans and labs are presented in a format that states the objective, purpose, required material, procedures and forms of assessment. A listing of all the National Educational Standards, that this manual complies with, are found in the appendix. The appendix, also has a section where the educator and student may make their own Winter Constellation Locator, overall Star / Constellation Locator and even Constellations Flash Cards. These can be used in conjunction with the lesson plans and labs.

What Are Constellations?

The original farmers throughout different civilizations knew, that for most crops, you had to plant in the Spring and harvest in the Fall.

In regions near the Equator:

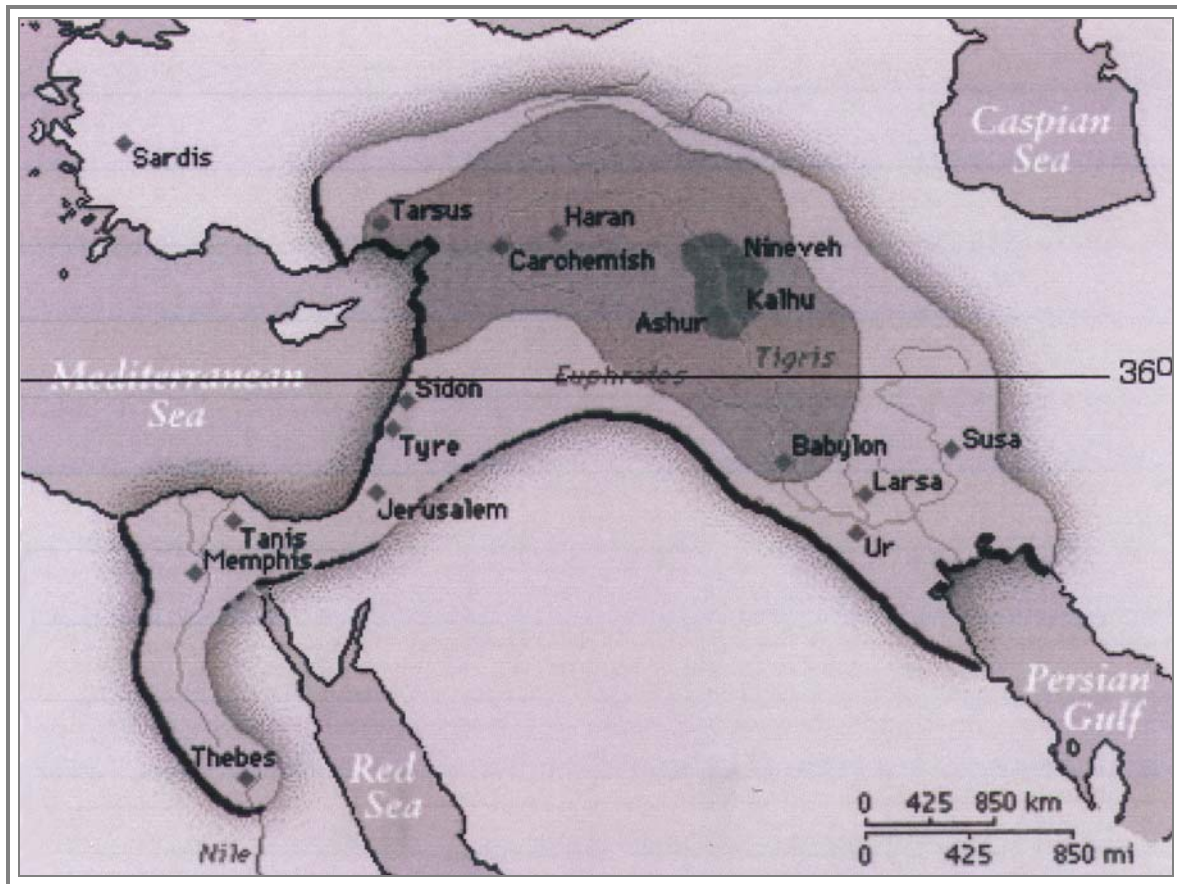
- There is not much difference between seasons.
- The only way to know how to plant and to harvest in those ancient locations was to look to the skies at the constellations.
- Different constellations are visible at different times of the year and are always consistent with the seasons.
- This is how the ancients were able to tell what month it was.
- The dependence upon the sky became a strong part of many civilizations very existence; from their farming to their religious worship.

Origin of Constellation System:

The constellation system that we have today came from the ancient Greeks. The stories, legends and reasons why they came to be in the sky originated the very first moment that man walked this Earth.

- The constellations were totally imaginary creatures, beings, and objects that farmers, poets, and astronomers made up in order to help predict seasons and even save their very lives.
- This occurred over the past 6,000 plus years.
- The oldest description of the constellations was written by the Greek Poet Aratus in 270 B.C.
 - In his poem *Phaenomena*, he mentioned that the constellations named had originated long before 300 B.C.
 - The constellations named were known to the Greeks and did not include those around the South Pole.
 - This can be explained, due to the fact, that the ancient Greeks and Egyptians could not see the Southern Polar constellations, for they fell below the horizon.
 - In Aratus' poem, we are able to deduce that most people responsible for the original constellations lived near a latitude of approximately 36 degrees North. (Latitudes are lines that run parallel to the equator and are used to determine your placement North or South of it).
 - This places the origin in latitudes below the south of Greece and yet north of Egypt.
 - This basic area of latitudes is very similar to the latitudes of ancient Bablyon and Sumeria.

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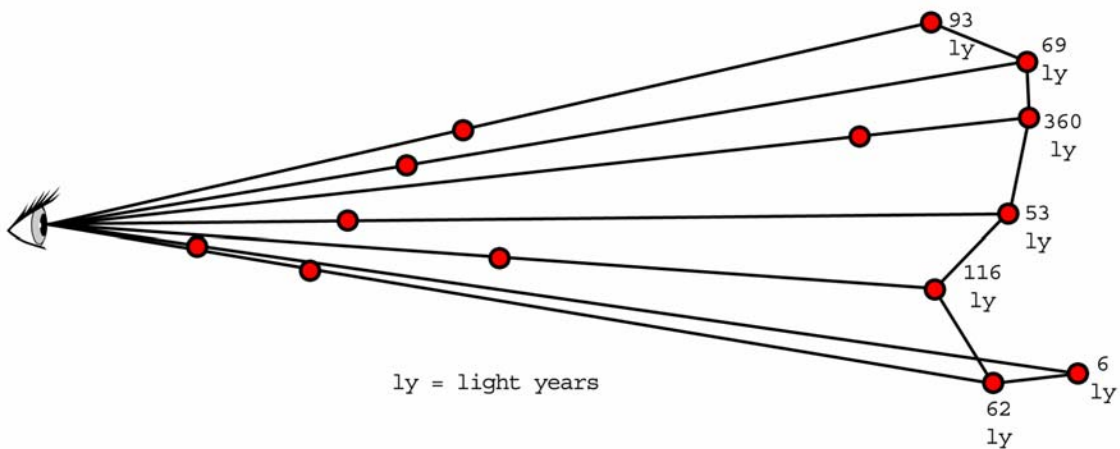
- Around the year 2,000 B.C., the uncharted area (the area where no constellations are mentioned in Aratus' poem) is centered on a place in the sky where the South Celestial Pole would have been located.
 - This coincides with the time of the Sumerians and the Babylonians.
 - It is highly likely that the Sumerians and the Babylonians originated the idea of the constellations and even the myths of how they came to be.
- It is quite possible, because of the nomadic nature of humans, the knowledge of the constellations made its way to Crete and to the Minoans.
 - One of the results of the trade between Crete and Egypt was that the knowledge of the constellations found its way into Egyptian Culture.
- It was in Egypt where the Early Greek astronomers first heard about the constellations and wrote about them.

What Really Makes up Constellations?

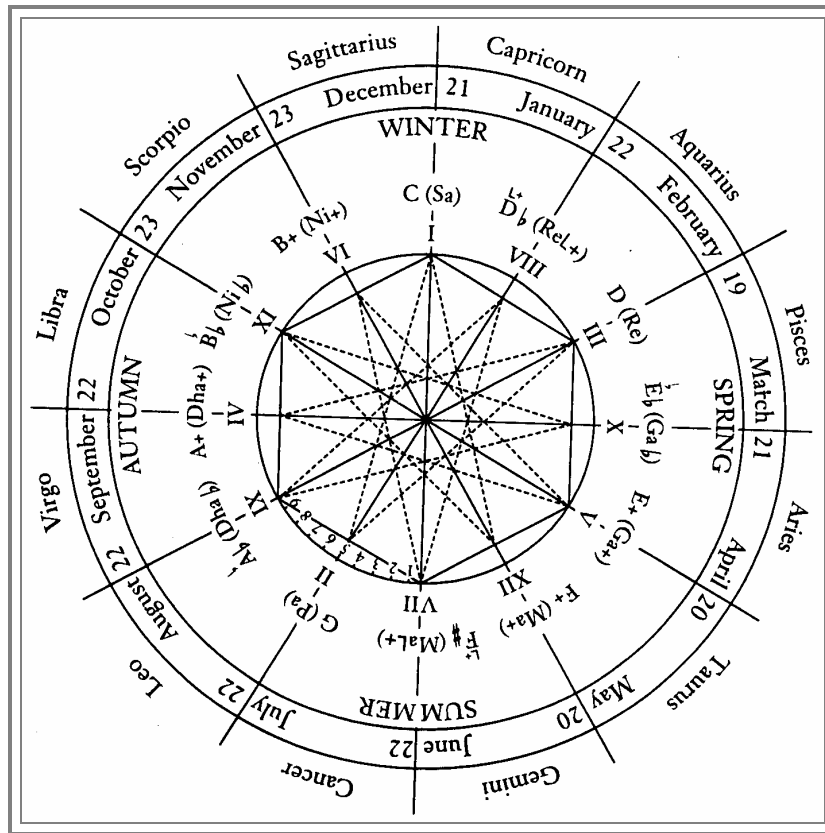
The apparent groupings of stars into the constellations that we see in the sky are not physical groupings.

- The constellations are optical projections on the celestial sphere.
- The distances between the Earth and all the stars that make up the constellations are not the same.
 - Most distances are very different
- The stars appear to be grouped because they lie in approximately the same direction or region of the sky.

- The stars that make up the constellation, The Big Dipper, are a very good example of the aforementioned explanation:



Astrological Constellations (Rubbish?!?):



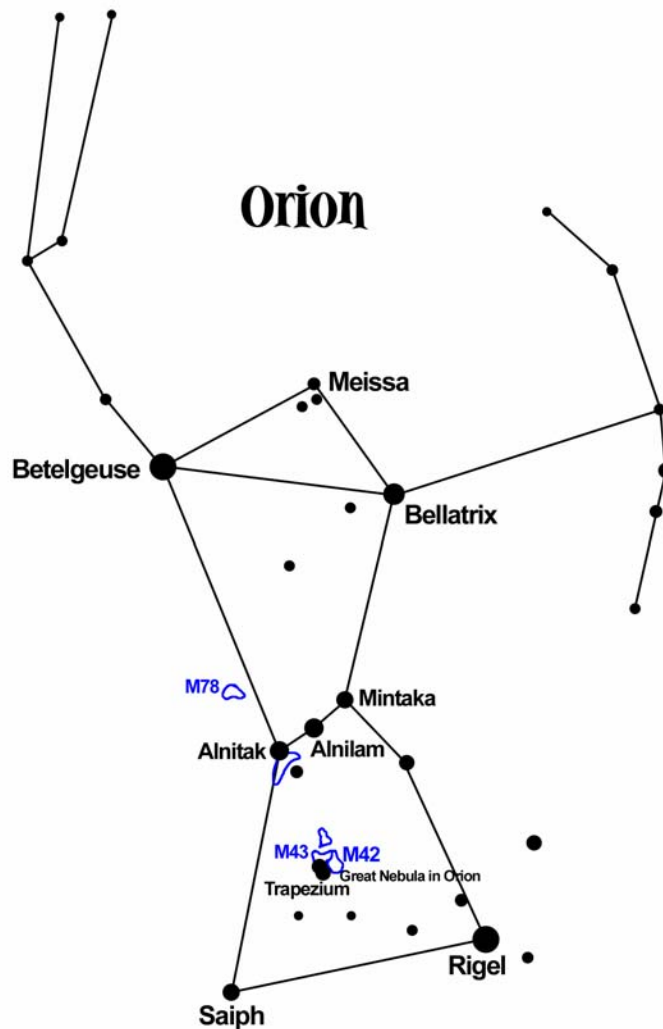
There are 12 constellations that fall in an area we call the Zodiac. The Zodiac is an imaginary band that is 18 degrees wide and is centered on the Ecliptic.

- The Ecliptic is a great circle that is a projection of the path in which the Sun takes through the stars in its annual motion.
 - It is tilted by 23.5 degrees with respect to the Celestial Equator.
- The constellations of the Zodiac were at one time thought to have great mystical and astrological significance.
 - Astrology today is classified as a New Age mystical way to predict your future and is usually considered nonsense.
- The constellations of the Zodiac are still important because, the planets, Sun and Moon are all on or near the ecliptic at any given time.

Why Use Constellations in Today's World?

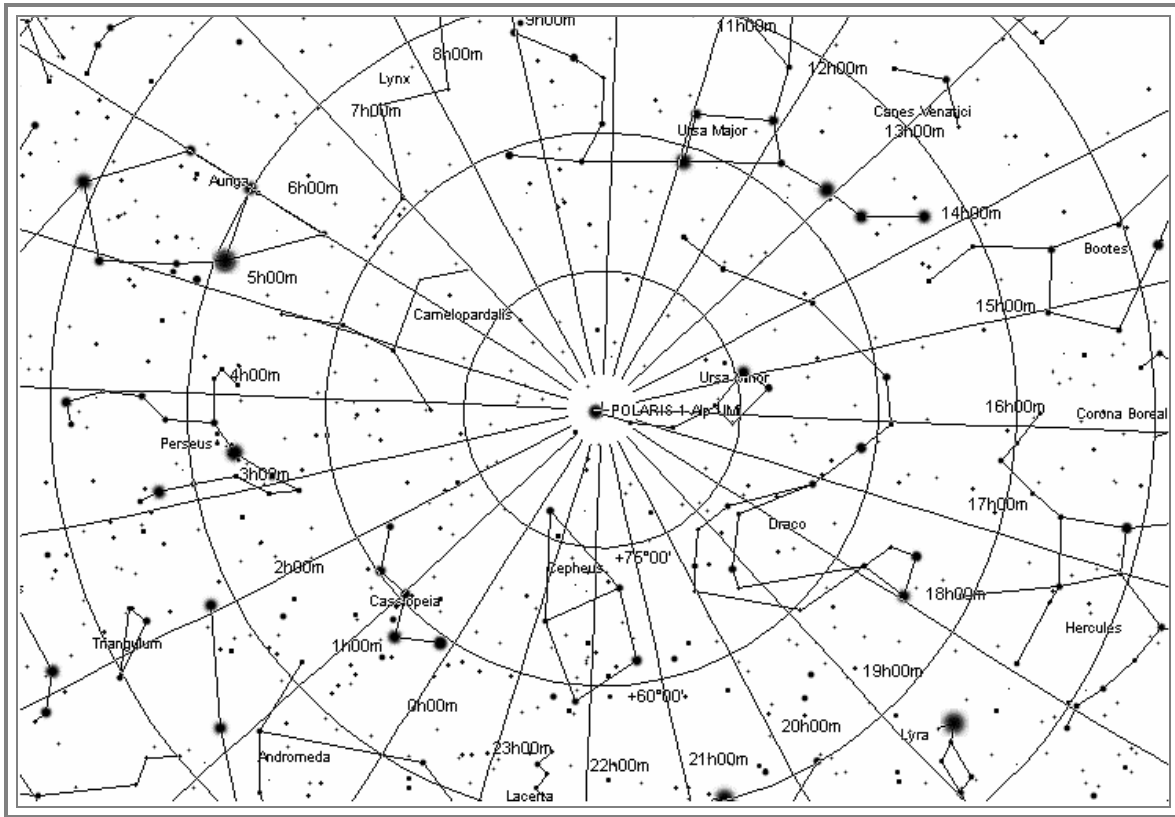
In today's world, constellations define imaginary regions of the sky.

- Constellations are a significant geographical region in the sky.
 - It is as if the individual countries of the world are defined as imaginary regions on the face of this Earth.
 - Constellations are no longer mythologically important.
- When we say that the M78 is in the constellation Orion, it is like saying that France lies in Europe.



- Modern constellation boundaries are irregular and have been agreed upon by various astronomical societies based upon various reasons.

Finding Constellations in the Night Sky



Circumpolar Constellations:

- Constellations that circle close around the north pole, which can be seen every night of the year.

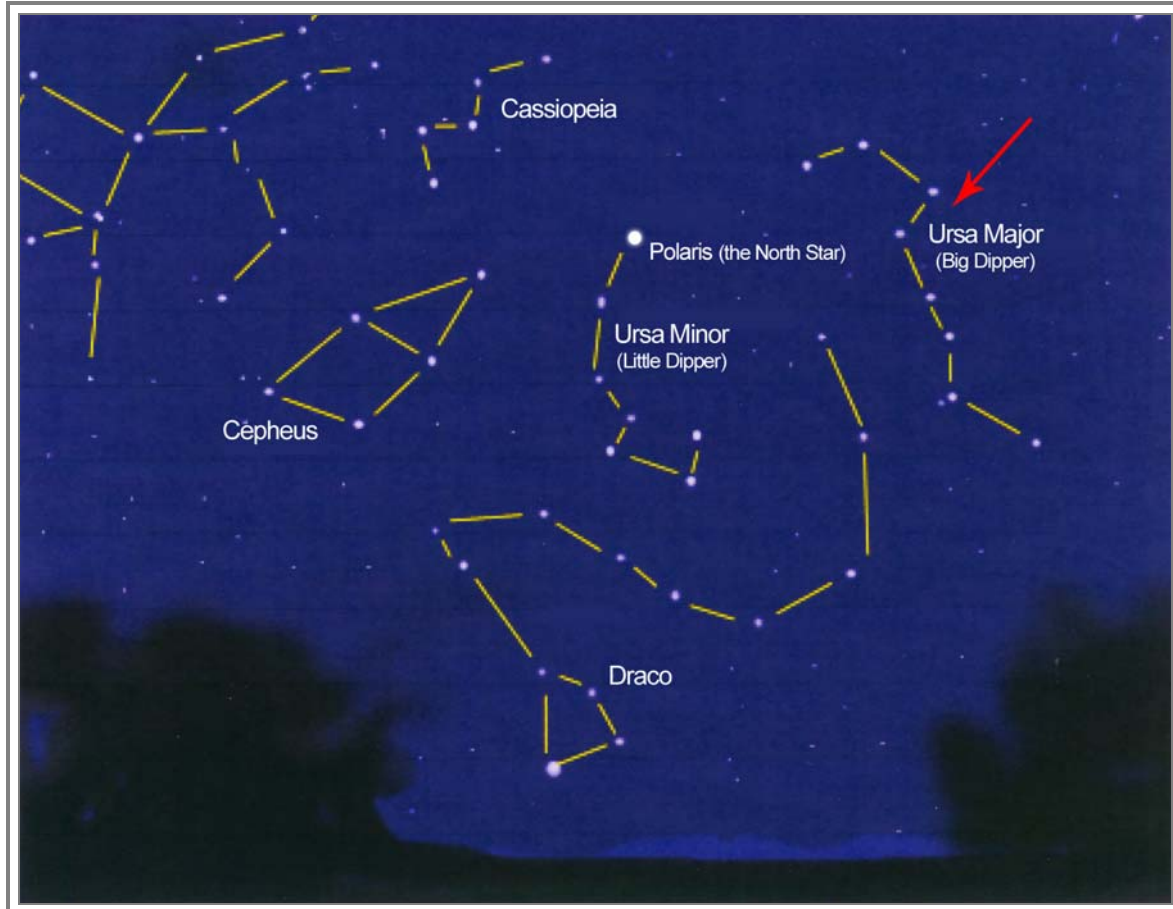
Five Major Circumpolar Constellations:

- Ursa Major (the Big Dipper), Ursa Minor (the Little Dipper), Cassiopeia, Cepheus, and Draco.

- These are visible year-round in the north; therefore, they are some of our most recognizable constellations.

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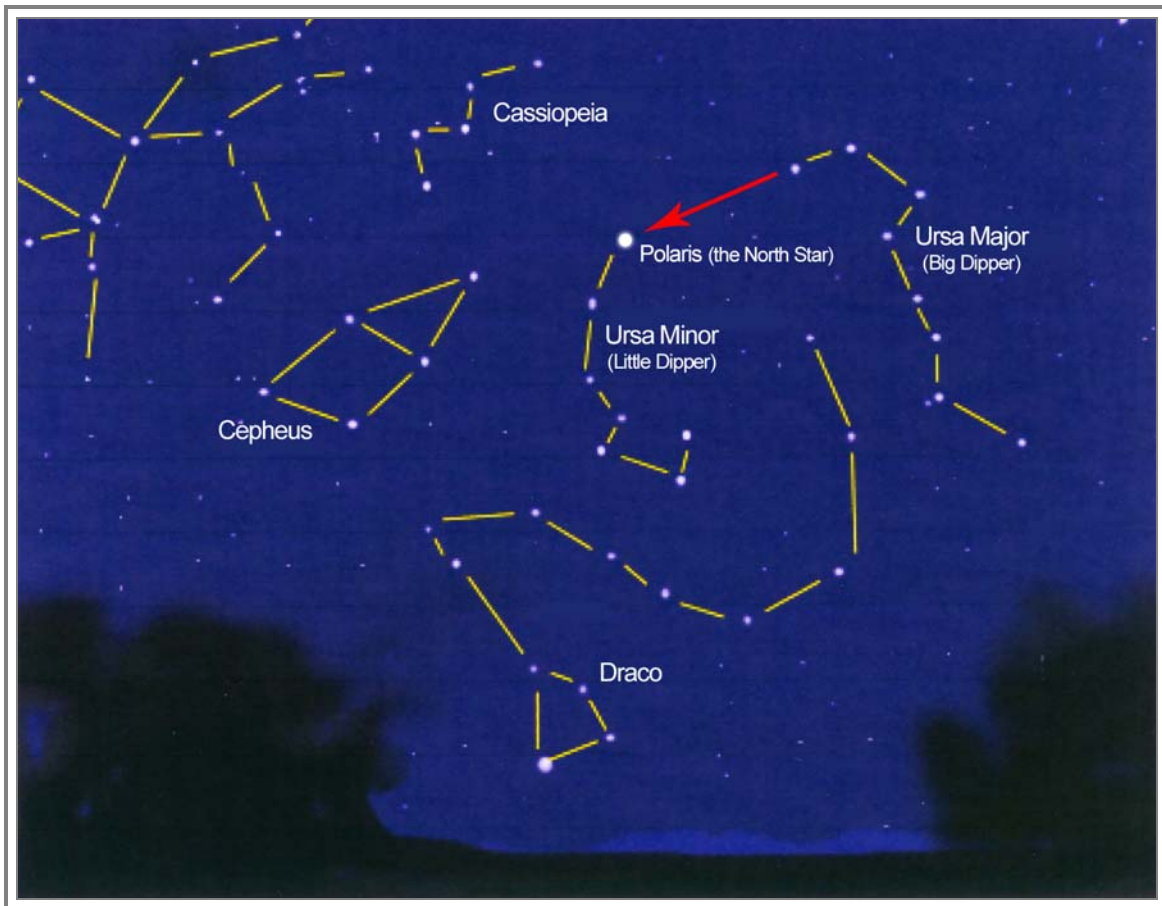
- Hopefully you've found **Ursa Major** (the Big Dipper) in the north. This is the one constellation that everyone seems to know quite well.



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To find **Ursa Minor** (the Little Dipper) using **Ursa Major** (the Big Dipper) as your guide.):

- Follow the two stars at the end of the bowl in a straight line for approximately 30 degrees (or three fists held at arm's length) and you will end up on the north star.
 - **Polaris**, the **North Star**, is the star closest to true north.
- For this reason, it has long been used for navigation.
- It is also the end of the handle of the Little Dipper



- The Little Dipper is made up of rather faint stars, so Polaris might be about all you can see.
- On a clear night you should be able to make out the two stars at the end of the bowl of the dipper.
- Notice the handle of the Little Dipper bends the opposite way to the Big Dipper.

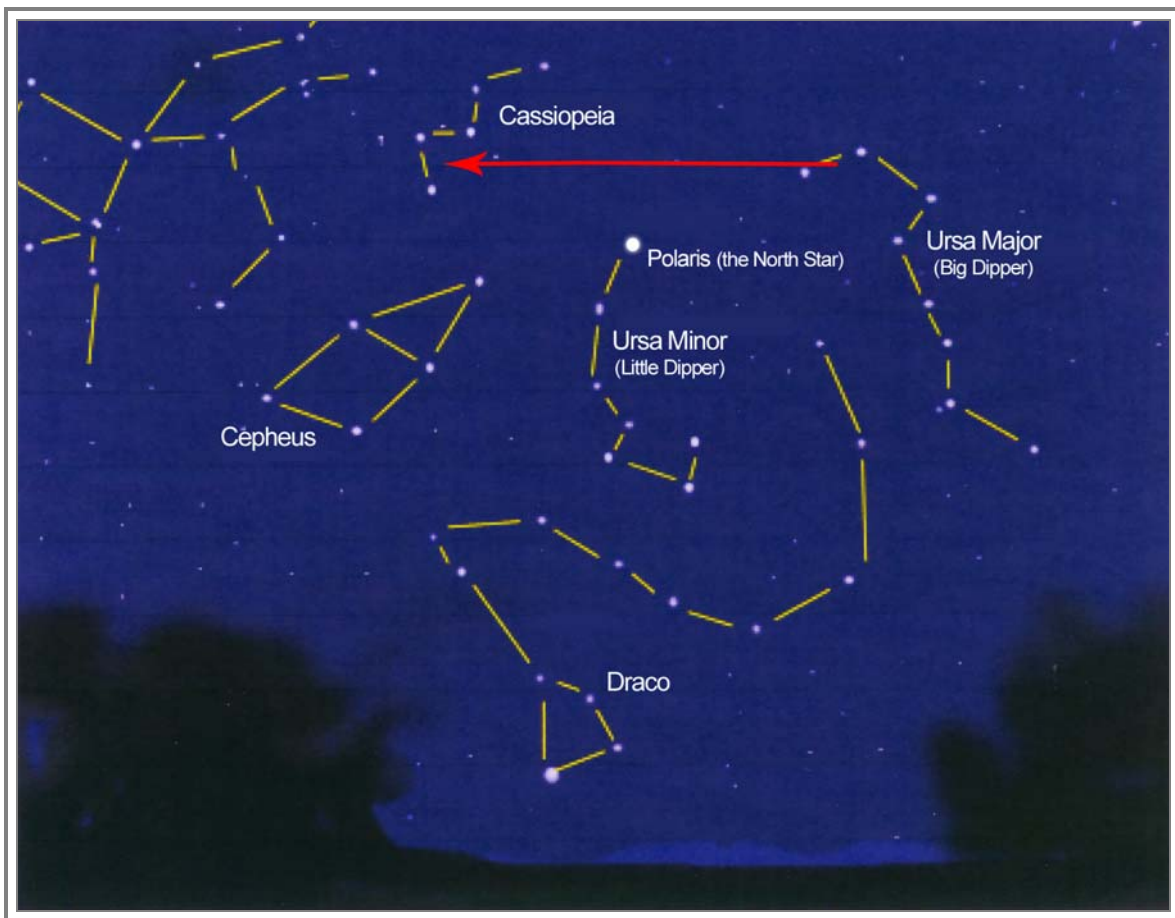
The Big and Little Dippers are linked in their proper constellation names too.

- They are the big and little bears, Ursa Major and Ursa Minor.

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The constellation **Cassiopeia**; According to legend, queen of a powerful land:

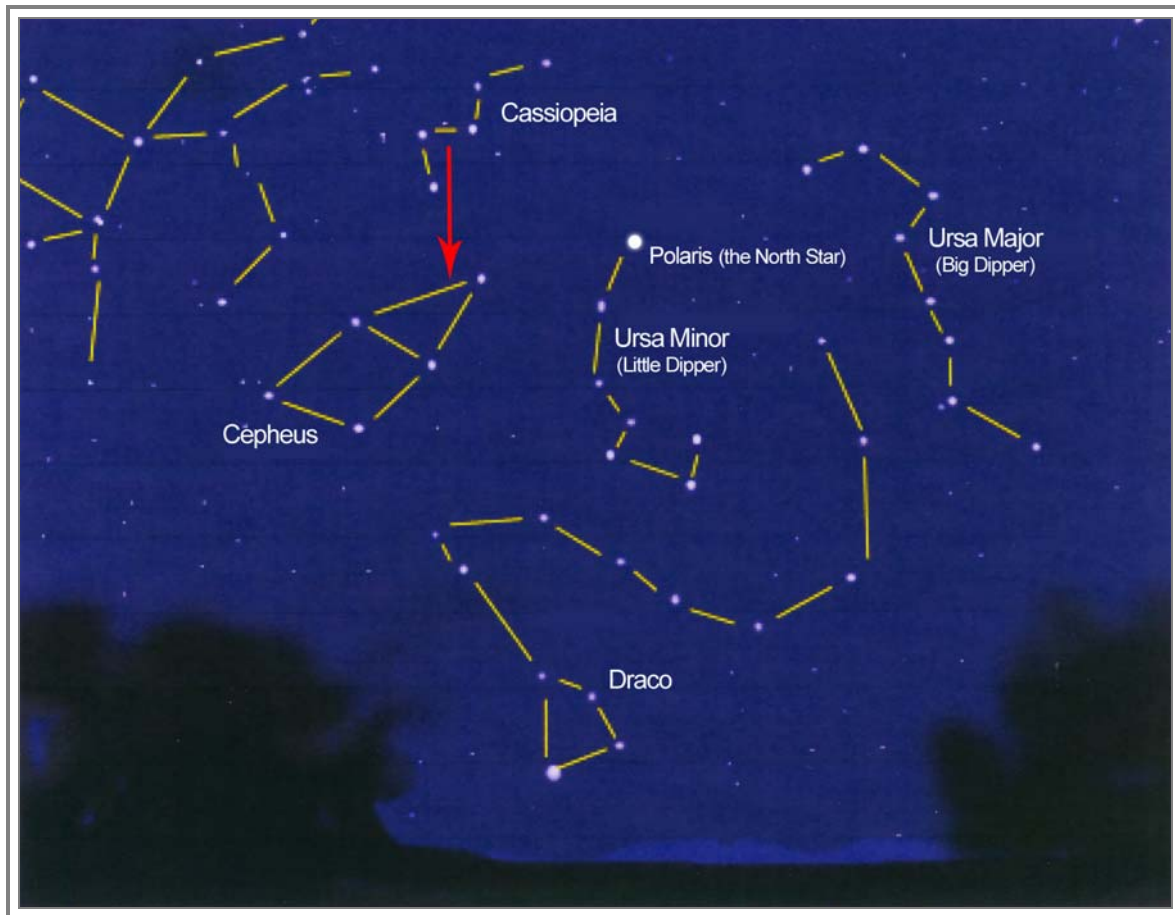
- Cassiopeia looks like a "W" or an "M", depending on the time of year.
- The "W" is Cassiopeia's throne.
- All of her stars are bright, so this is another easy one to see.
- Find Cassiopeia by following the same two stars in the bowl of the Big Dipper past the north star and keep going another 30 degrees or so, to the "W" of stars.



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The constellation **Cepheus**: the King to Cassiopeia's queen

- Constellation stars are a bit fainter, but still visible.
- Cepheus, looks like a tall skinny house or a square with a triangle on top.
- You can find Cepheus by imagining Cassiopeia sitting on her throne (inside the "W") looking at Cepheus.
- The roof-top of the house sits between the north star and Cassiopeia.



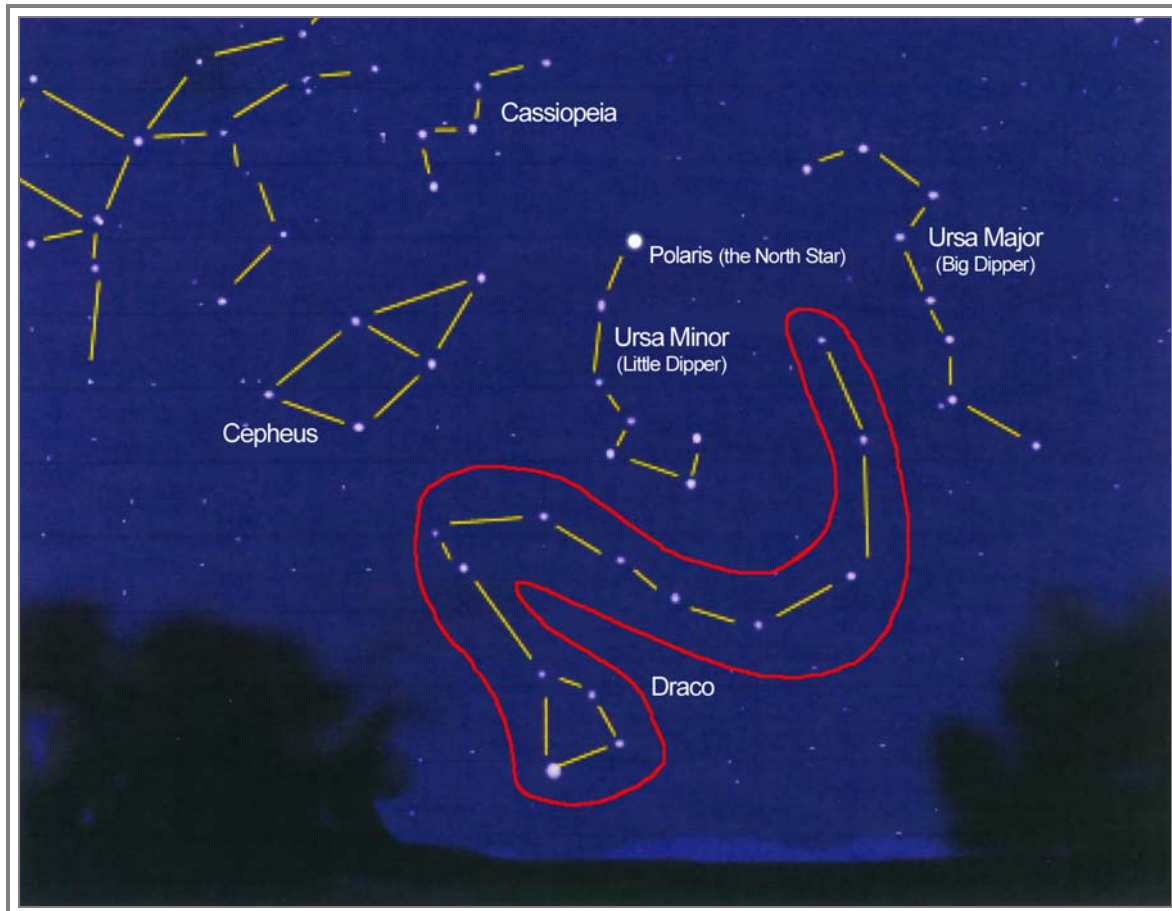
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The constellation **Draco**, the dragon:

- Winds between the Big and Little Dippers.
- Generally takes up all of the remaining bright stars between those two constellations.
- Draco's head hangs down near Cepheus.
- Draco is probably the toughest circumpolar constellation to find,
- If you can find it, you could tell the '*dragon heaven*' story from the movie Dragonheart.

All other constellations are far enough south that as the earth rotates:

- These stars rise and set.
- Different constellations are visible at different times of night.
 - Since the stars rise 4 minutes earlier each night, different constellations are also visible in different seasons (at any particular time of night).

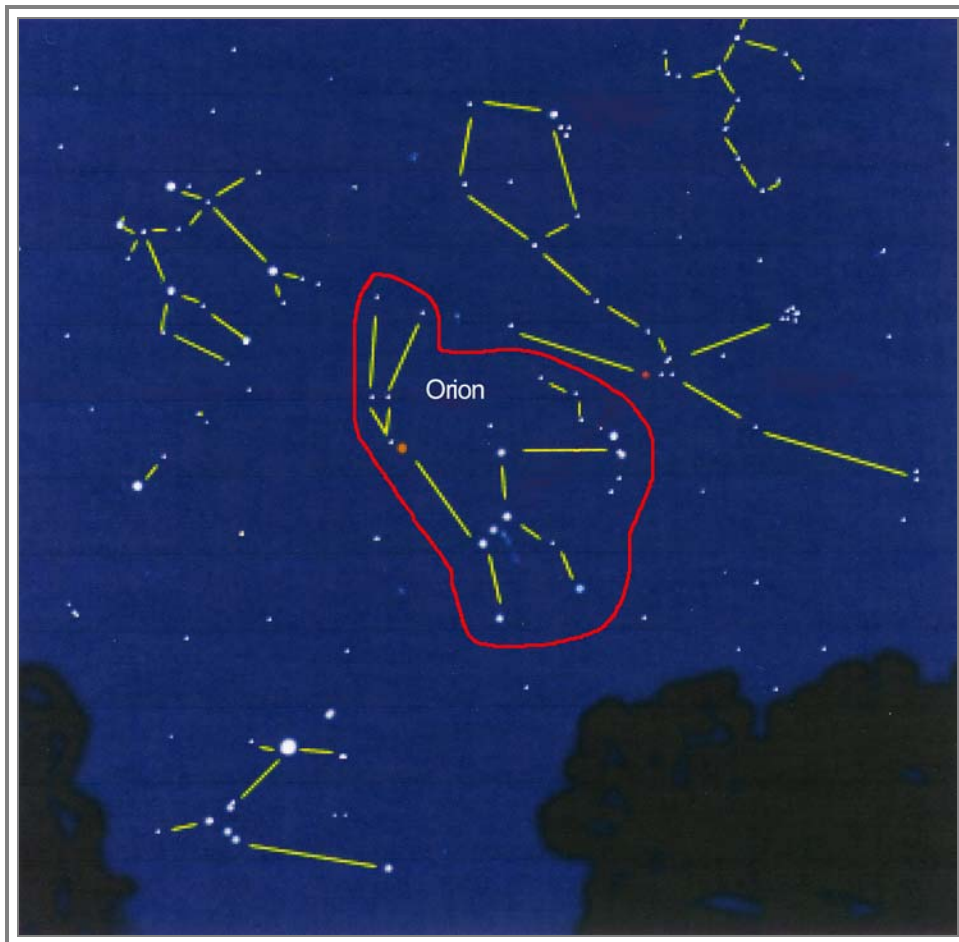


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Winter: The season of Orion:

The constellation, **Orion**; the hunter:

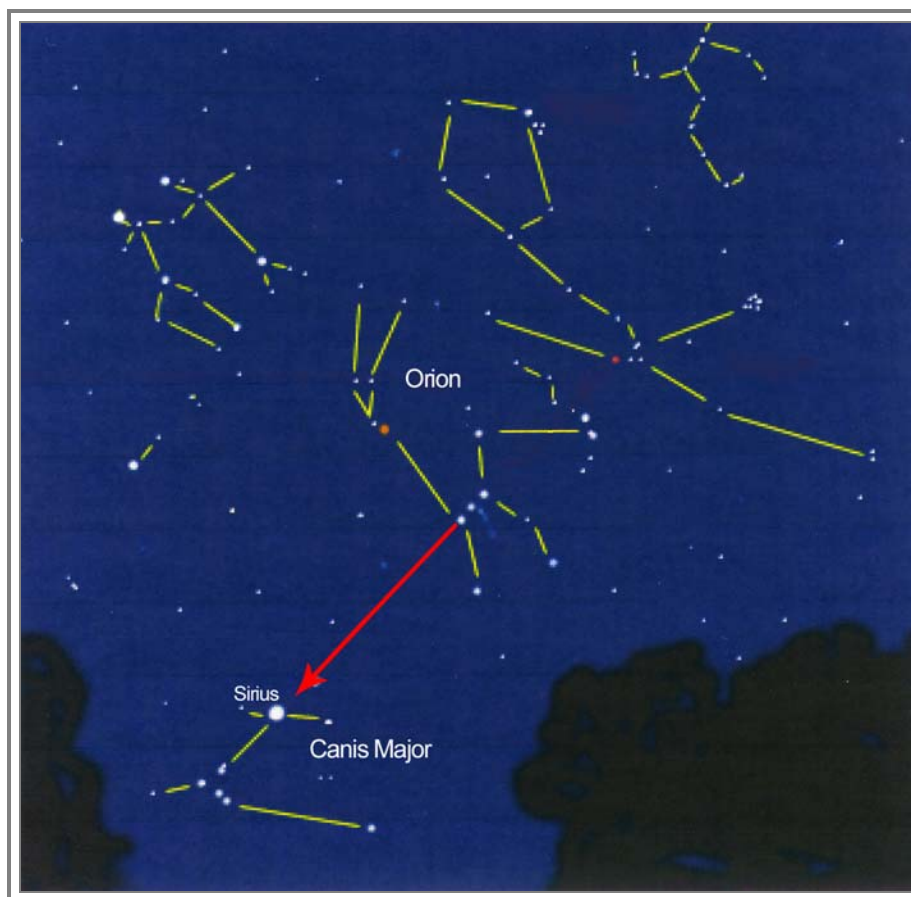
- You can find Orion by looking for three closely set stars in his belt a little further south than overhead. (Once you have seen these a couple of times you will be able to recognize them anywhere.)
- Orion's shoulders (the two bright stars above his belt, to the north).
- Two feet (the two bright stars further south).
- A scabbard hanging from his belt (which may be a little faint to see here).
- Orion is the key to the winter constellations;
 - You can find the other winter constellations by using reference points on Orion.



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The constellation, **Canis Major**; the big dog:

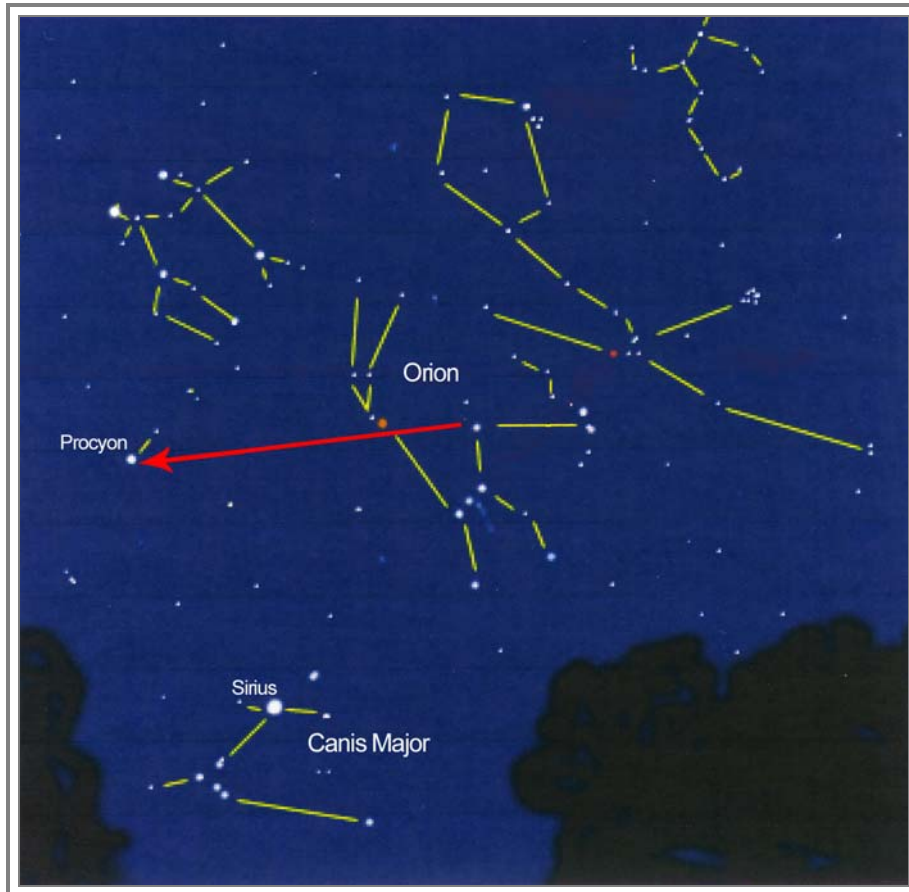
- **Sirius**; the dog star:
 - Find Orion's belt, and follow an imaginary line through it until you come to a very bright star.
 - It is the brightest star in the night sky.
 - There are many stories involving Sirius.
 - In ancient Egypt it was called the "Nile Star" or the "Star of Isis"
 - Its annual appearance, preceding sunrise on the day of the summer solstice, marked the ensuing rise of the Nile River.
 - In medieval Europe it was associated with the "dog days of summer"
 - It was thought that the summer heat resulted from the mixing of the Sirius's light with that of the Sun.
 - Its appearance was regarded as an evil omen.
 - The rest of the body of the dog is closer to the horizon and fainter, but does follow a stick figure of a dog.



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The constellation, **Canis Minor**; another dog that is not so lucky:

- The little dog is indeed 'little', only two stars.
- The brighter one of these is **Procyon**.
- It can be found by following an imaginary line through Orion's shoulders and approximately straight up from Sirius.

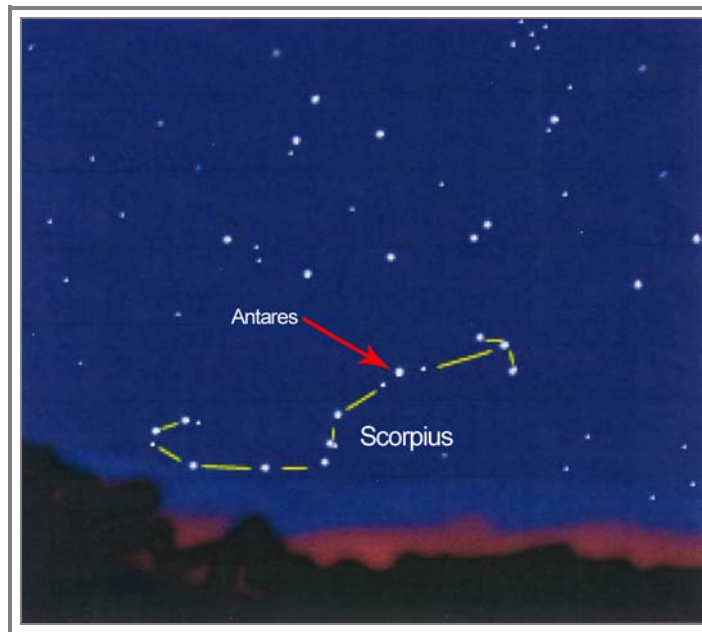


Canis Minor and Canis Major are the two hunting dogs of Orion, following at his heels through the sky.

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The constellation, **Scorpius**; the scorpion:

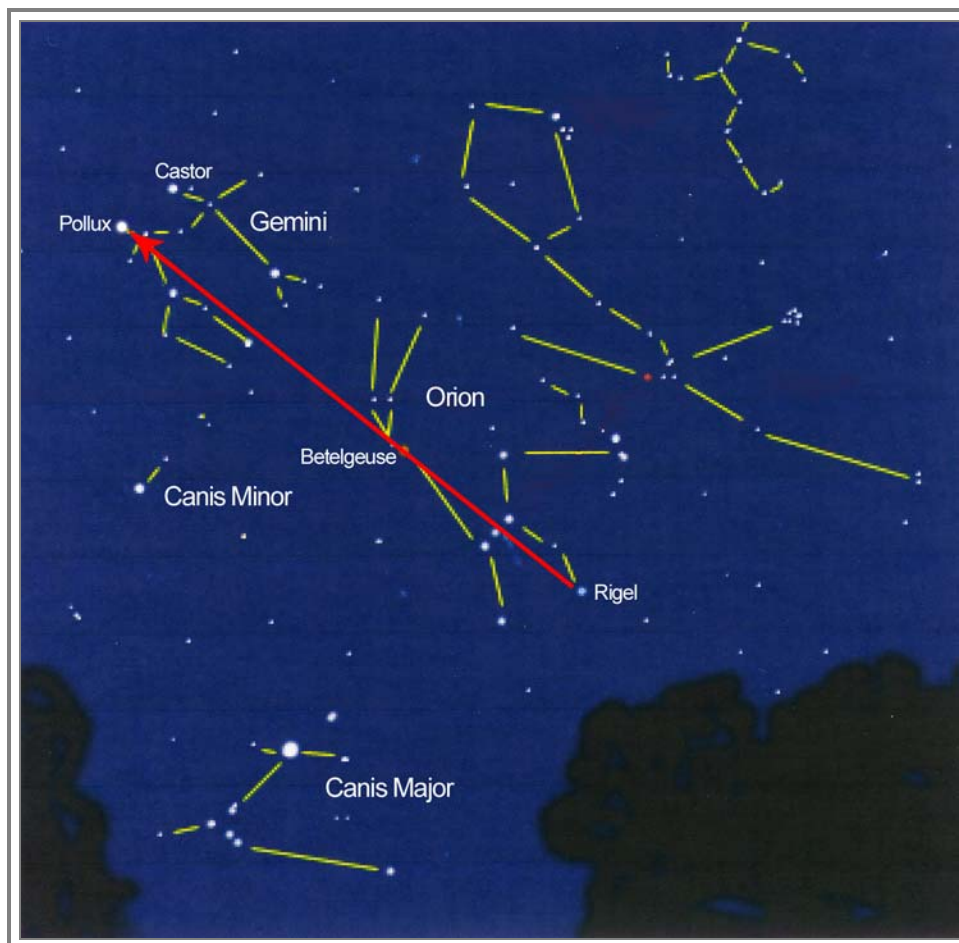
- You can find Scorpius in the early morning. Just as Orion is setting in the northwest; look to the south east.
- On the horizon, you will find the star Antares, which lies in the body of Scorpius.
- Orion and Scorpius were given honored places in the sky.
- They were placed at the opposite ends of the sky, so that they would never engage in battle again.



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The constellation, **Gemini**; the twins:

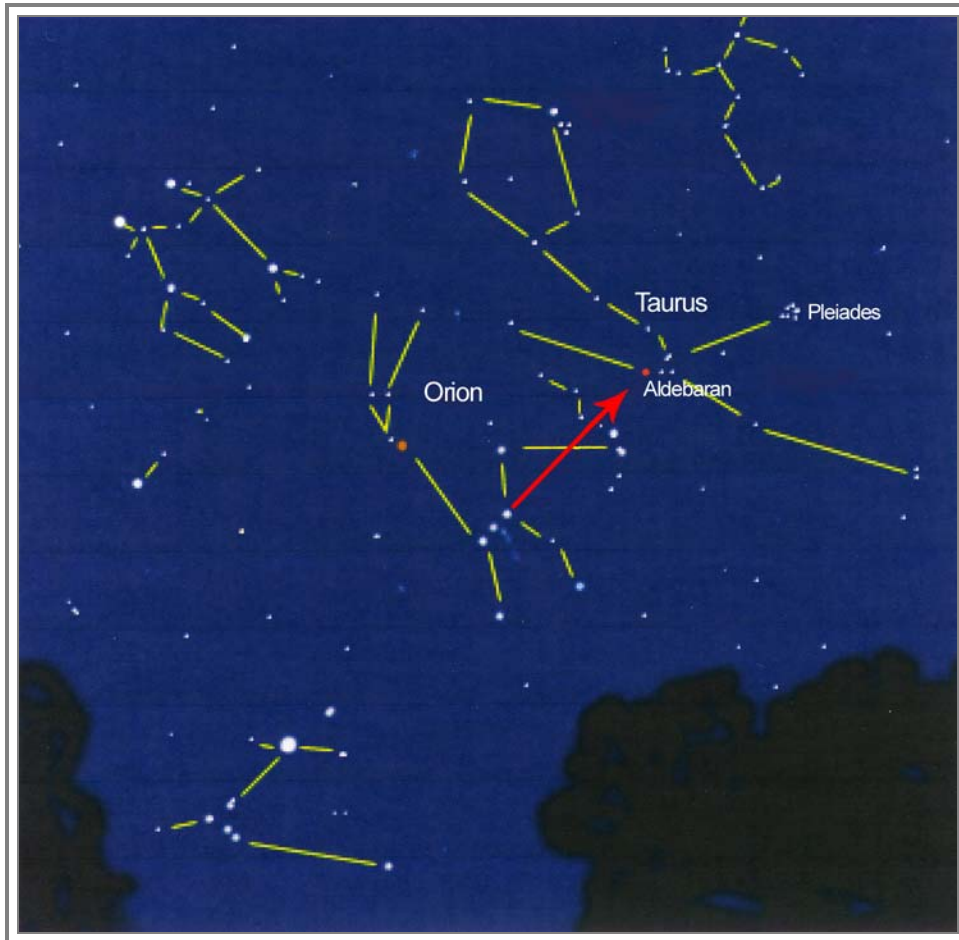
- An imaginary line through **Rigel**, Orion's right foot, and up through **Betelgeuse**, Orion's left shoulder, points toward **Pollux**; the brightest star in Gemini.
- Gemini has a kind of box like shape.
- It is best recognized by its "twin stars".
- **Castor** and **Pollux** appear very similar,
- They are separated by only 4.5 degrees.
- Castor and Pollux are each the head of one twin.
- Stick figures descend from these heads towards Orion, making up the rest of the constellation.



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The constellation, **Taurus**; the bull:

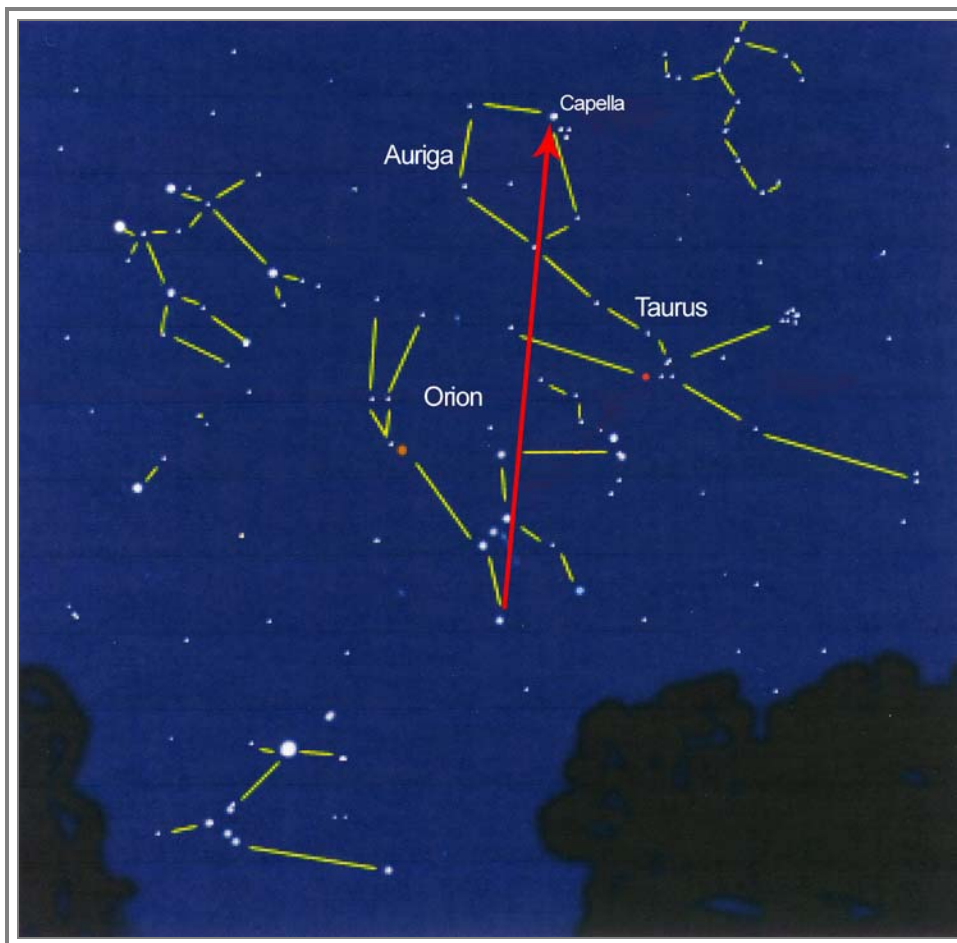
- Taurus is a large constellation in the winter sky.
- It carries the **Pleiades** on his back.
- Follow Orion's belt in roughly a straight line in the opposite direction of Sirius. (so follow it to the west).
- You will find yourself near a big "V" in the sky.
 - This V is Taurus's face and it contains the bright star **Aldebaran**.
- The rest of Taurus is made up of a body somewhere in the stars nearby;
- Faintly, you can see two front legs.
- If you follow the two branches of the "V" upward, you find the tip of Taurus's horns.



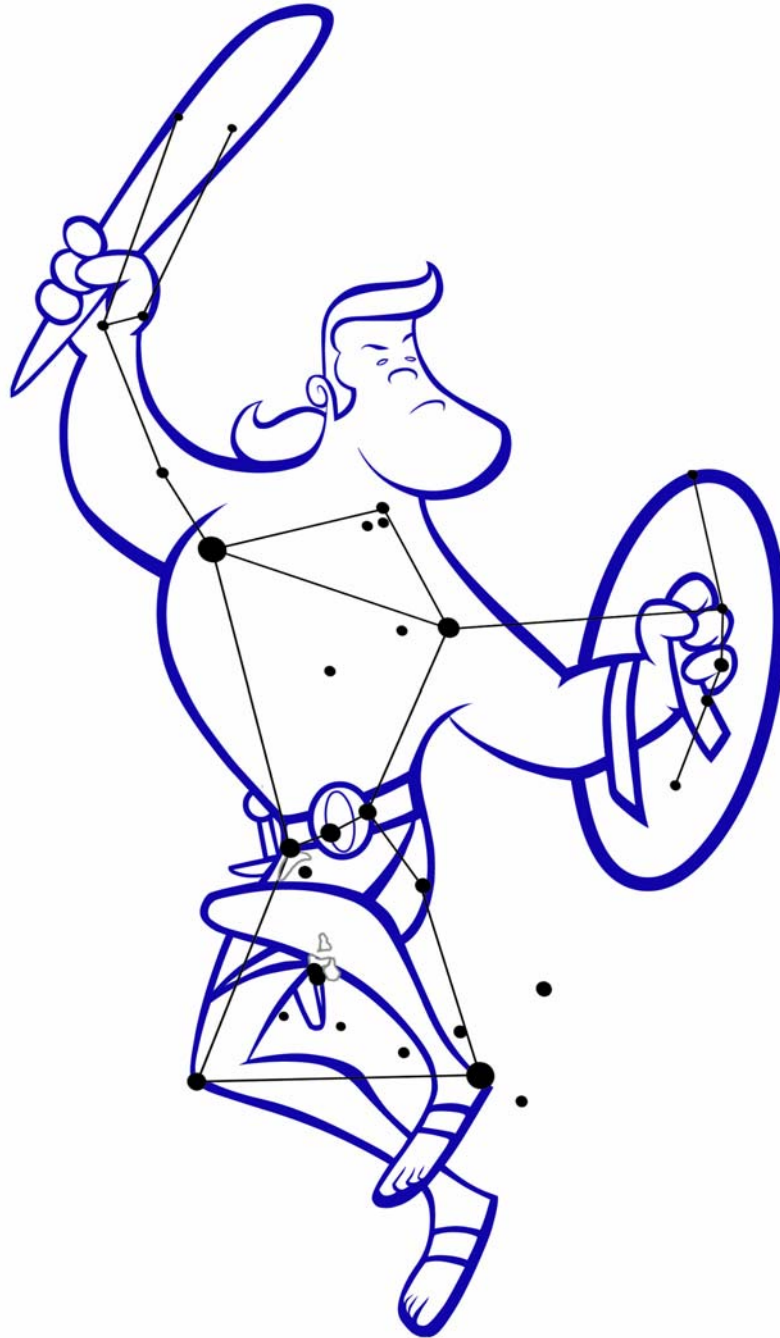
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The constellation, **Auriga**; the goat herder:

- It is perhaps easiest to find by following Taurus's horns to **Capella**.
 - Capella is one arm of a stick figure, that holds three goats under it.
 - The three goats look like a tiny triangle of stars.
 - Auriga is also called the charioteer.
 - You can make the same stars into something that looks like a chariot driver sitting down, holding the reins.
 - Several open star clusters are located in Auriga.
 - Each contain about one hundred stars.
 - If you find a dark location, these would appear as fussy knots in binoculars.



Orion



The Constellation Orion:

- Orion is the master of the winter skies.
- Orion can be found in the heavens from late fall to early spring.

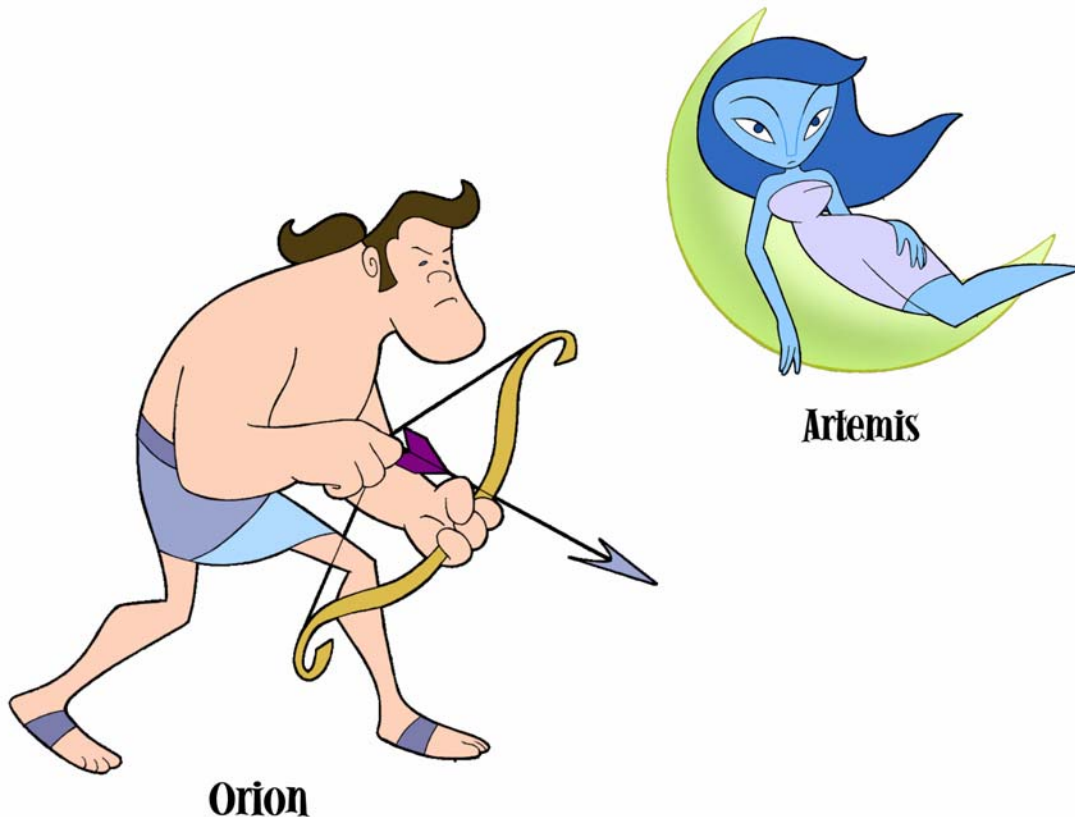


-The mythic tales of Orion:

- They go as far back as the Hittites.
 - The Hittites flourished from the Second Millennium BC to around 1200 BC.
- One story from this culture gives an interesting account of Orion's death:

“In it he is called Aqhat, and was a handsome and famous hunter. The Battle Goddess Anat feel in love with Aqhat, but when he refused to lend her his bow, she sent another man to steal it. This man bungled the job, and wound up killing Aqhat and dropping the bow into the sea. This is said to explain the astronomical fact that Orion and the Bow (an older version of the constellation) drops below the horizon for two months every spring.

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- The animated video that comes with this package tells the basic Greek mythology of how Orion came to be in the sky.
- Like all myths borrowed from several sources over a great length of time, the Greek stories offer many variations.
 - Orion was famous for his prowess both as a hunter and as a lover. He fell in love with the moon goddess, Artemis.
 - He also boasted that he would eventually rid the earth of all the wild animals (this sealed his fate).
 - Apollo was concerned that his sister, Artemis, was forgetting to bring the moon out every night.
 - Apollo told Gaia, the Earth Goddess, of Orion's boast.
 - Gaia then sent a deadly scorpion to destroy Orion.
 - Orion then engaged the scorpion in battle.
 - Orion and the scorpion did not survive the battle.
 - Artemis implored Zeus to restore his life, but Zeus could not.
 - She used her bow and arrow to move the stars in the heavens to create Orion's image.



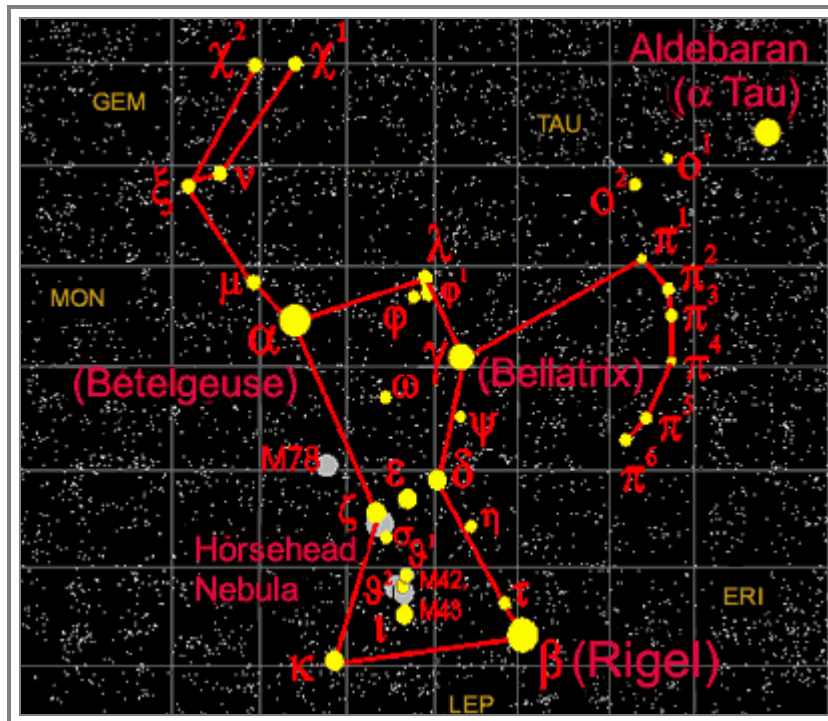
Apollo & Gaia

- In Orion's eternal hunting:
 - He is careful to keep well ahead of the scorpion.
 - As Scorpius rises in the east;
 - Orion is disappearing in the west.



Scorpius

The Stars of Orion



Betelgeuse, alpha Orionis:

- It is found above the belt and slightly to the left.
- Betelgeuse glows with a dull red.
- It is labeled alpha Orionis, even if it is less bright than beta Orionis (Rigel).
- It is much larger than Rigel.
- It is estimated at around 250 Suns.
 - If it were our Sun, its size would completely engulf the Earth and extend as far as Mars.

Rigel; beta Orionis:

- It is the brightest star in Orion.
- Rigel ranks as the seventh brightest star in the night sky.
- It is a visual binary;
 - Its companion is much fainter.

Bellatrix; gamma Orionis:

- It is one of the other corners of the constellation.
- It was once thought that all women born under the sign of Bellatrix would be fortunate and have the gift of speech.
- The star's name is often translated as Female Warrior of Amazon, and another name is "Amazon Star".

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Saiph (kappa Orionis).

- The other corner of the constellation are formed by it.

The constellation's main features are the three stars which form the "belt" across the middle of Orion.

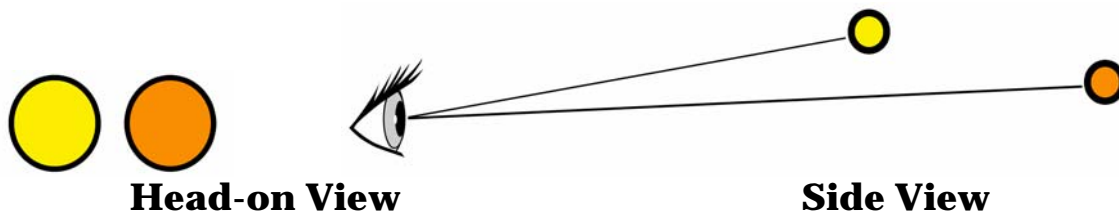
- The three stars that form Orion's belt are; Mintaka, Alnilam, and Alnitak.
- The Bible makes references to this famous group. God, while pointing out how all-powerful he was, is purported to have asked Job if he (Job) was able to "loose the bands of Orion" (Job 38.31).
- Alnitak; zeta Orionis:
 - It is a well known triple star system.
 - The primary star is a blue white star.
 - Its companion is a dull red.
 - Close by is the Horsehead Nebula.
 - It is a so-called dark nebula that is not visible except in extremely long time exposure photographs.

Binary stars in Orion:

There are many double stars in this constellation that are visible in small telescopes.

Binary Stars:

- Optical Binaries: Two stars appear to be close together from the observer's viewpoint when they are actually distant from each other.
- This occurs rarely.



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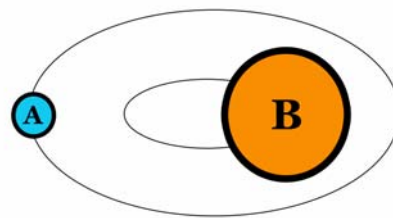
- **Visual Binaries:** Two stars lie in each other's gravitational field and are visible as "doubles" in a telescope.

- stars in a true binary system are so close that they cannot be resolved (separated) by a telescope.
- These are usually identified by their spectra.
- Binary stars mutually revolve around their barycenter (the focus point of gravitation where the gravitational pull of each is equal in strength).

- **The following diagrams illustrate what occurs with visual binaries:**



Head-on View

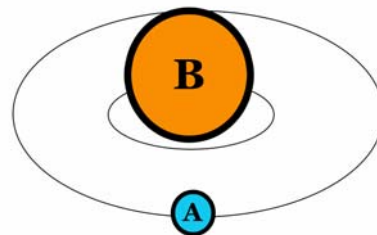


Side View

- Star "A" appears to be moving towards us.
- Star "B" appears to be moving away from us.



Head-on View



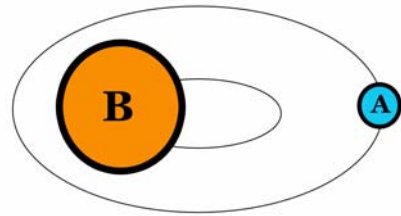
Side View

- Star "A" (the hotter and brighter star) passes in front of star "B" (the cooler & not so bright star), thus just barely decreasing the brightness seen by astronomers.

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Head-on View

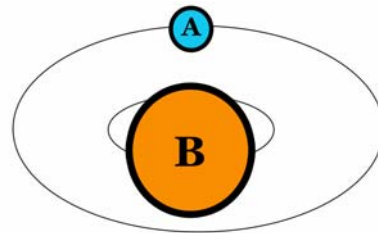


Side View

- Star "B" appears to be moving towards us.
- Star "A" appears to be moving away from us.



Head-on View



Side View

- Star "A" (the hotter & brighter star) passes in behind star "B" (the cooler & not so bright star), thus, greatly decreasing the brightness seen by astronomers.

The Binaries of Orion:

Rigel; beta Orionis:

- It has a 10.4 visual magnitude companion.
- They are separated by a wide 9.5".
- This is a fixed system.

Lambda Orionis:

- It is found between Betelgeuse and Bellatrix.
- It is another fixed binary.
- It has a 5.5 visual magnitude companion.
- They are separated by 4.4"

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Theta 1:

- Is a complex system of fixed stars.
- The four brightest form The Trapezium.
 - It is an outstanding multiple system for small telescopes.
 - A B is at a position angle of 32° and separation of $8.8''$ from A.
 - A C is at a position angle of 132° and separation of $12.7''$ from A.
 - A D is at a position angle of 96° and separation of $21.5''$ from A.

Theta 2:

- Is also a fine binary.
- It is also a triple system to the southeast of The Trapezium.
- Component B is a binocular object:
 - It has a visual magnitude of 6.4.
 - It has a separation of $52.5''$ from component A.
- Component C:
 - It has a visual magnitude of 8.
 - Its has a separation of $52.5''$ from component A.

Sigma Orionis:

- It is one of the few orbiting binaries found in Orion.
- Component B has an orbit of 158 years.
- It is one of the few components that traces a not quite perfect circle.
 - We are able to see it nearly face on.
 - Its separation never changes much from its current distance of only $0.2''$.

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Sigma Orionis (cont'd):

- Component E is much easier to resolve.
- It has a visual magnitude of 6.7.
- It is a binocular object.
- There is a separation of 42" from component A.

Zeta Orionis:

- Component A has a visual magnitude of 1.9.
- Component B has a visual magnitude of 4.0.
- It has a very slow orbit of 1509 years.
- The two components have a 2.3" separation.

Variable stars in Orion:

A dozen stars in this constellation are visible in small scope. Most of them are of the EA type of eclipsing binaries, which change very little.

- These include two stars of the Trapezium (theta 1A and 1B).

EA variables:

- They are old stars which are nearing the end of their evolutionary process.
- Their companions have grown to the size of a sub giant star.
 - It is believed equal in size to its primary.
 - Their luminosity's are quite different;
 - As the dimmer companion revolves around its primary, variations in the brightness occur.
 - The maximum brightness occurs of course when the two are not eclipsed.
 - Each one adds its luminosity to the total output.
 - Two minima also occur:
 - The principal minimum occurs when the companion blocks out the primary.
 - The secondary minimum occurs when the companion is eclipsed by the primary.

U Orionis:

- It is a Mira-type regular variable.
- It usually has a brightness of 4.8.
- Every 368.3 days it drops down to 13.

Deep Sky Objects in Orion:

M42; The Orion Nebula:



- It is one of the most photographed deep sky objects.
- It is a vast nebula of gas and dust exquisitely lit by surrounding stars.
- It is a celestial nursery.
- It is believed that in several hundred million years, young stars will appear from this wealth of cosmic matter.
- Inside is a fascinating four star system known as The Trapezium:
 - Their names are; theta 1A, 1B, 1C, and 1D.
 - These four stars are held together by common gravity.
 - There are two other stars believed to be part of this complex system.
 - They are visible in medium sized telescopes.
 - It is believed that they actually light up the nebula.

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M43; (NGC 1982):



- It is a detached part of the Orion Nebula.
- It has a ninth magnitude central star.
- A dark lane of gas separates M43 from M42.
- The two are actually part of the same vast cloud.

M78; (NGC 2068):



- It is a faint reflection nebula NE of Alnitak (zeta Ori).
- It looks best in long exposure photographs.

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Barnard's Loop; (Sh2-276):



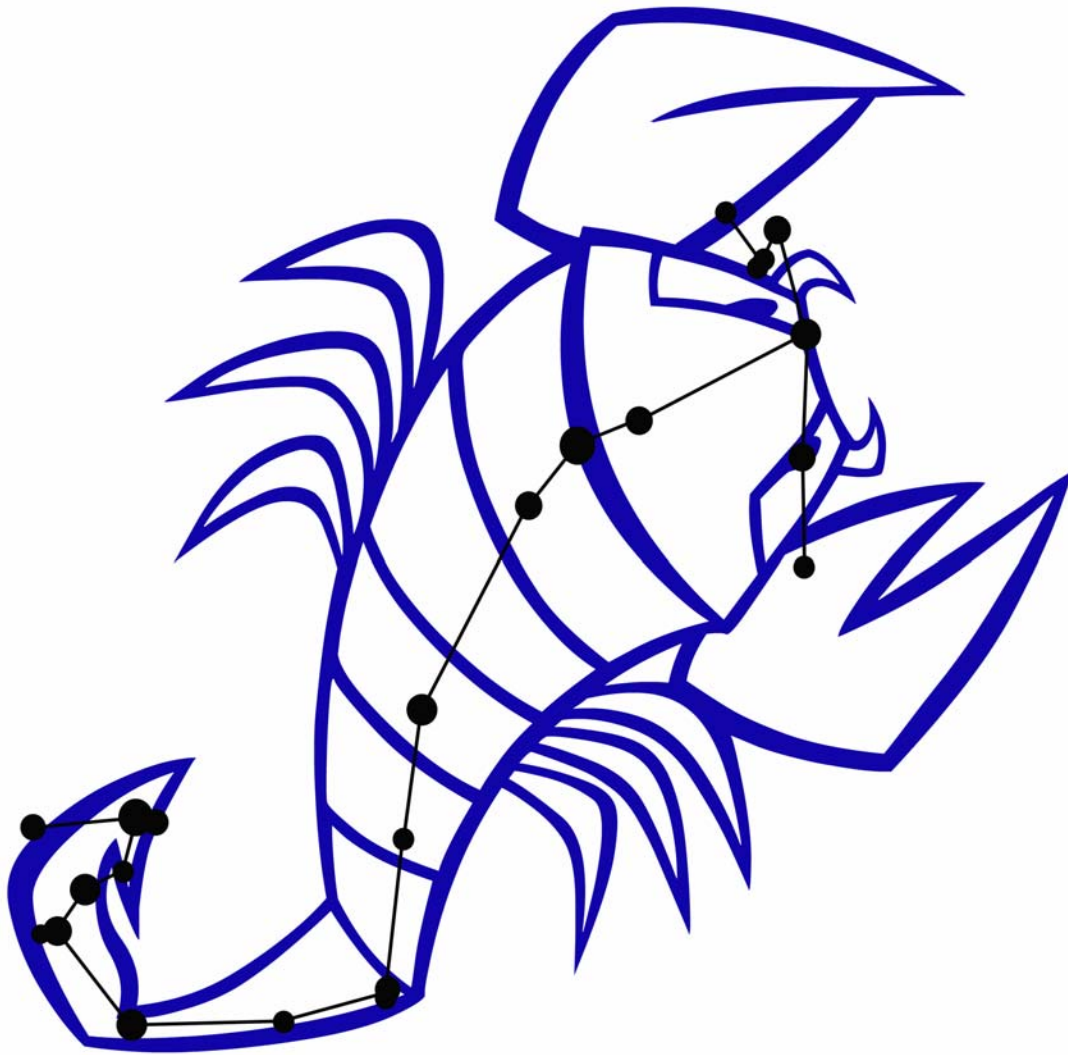
- It surrounds the southern region of Orion.
- The Loop has a real size of 440 by 280 light years in ellipse.
- Barnard's Loop is bright in the northern region and can be seen clearer than the southern part.
- The extraordinary dimmed gaseous matter is distributed between the Great Orion Nebula (M42) and the outer shell of the Loop in the southern region.

The Horsehead Nebula:

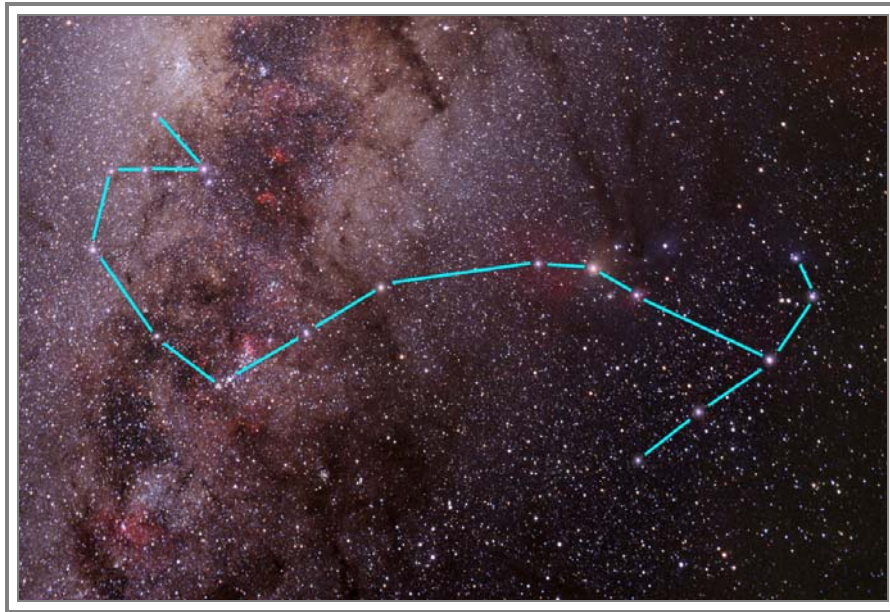


- It is a dark nebula that is in front of an emission nebula.
 - This makes it very intriguing.
- It can be found just between zeta Orionis and sigma Orionis.
 - It is difficult to find.
- It is visible in medium to large telescopes, given the right sky conditions.
 - An H-Beta filter is also helpful to photograph.

Scorpius



Scorpius; (The Scorpion):



- Scorpius is one of the oldest constellations known.
 - It could be one of the original six signs of the zodiac.
 - The stars of the constellation were seen as a scorpion by the earliest mesopotamian civilizations 5000 years ago.

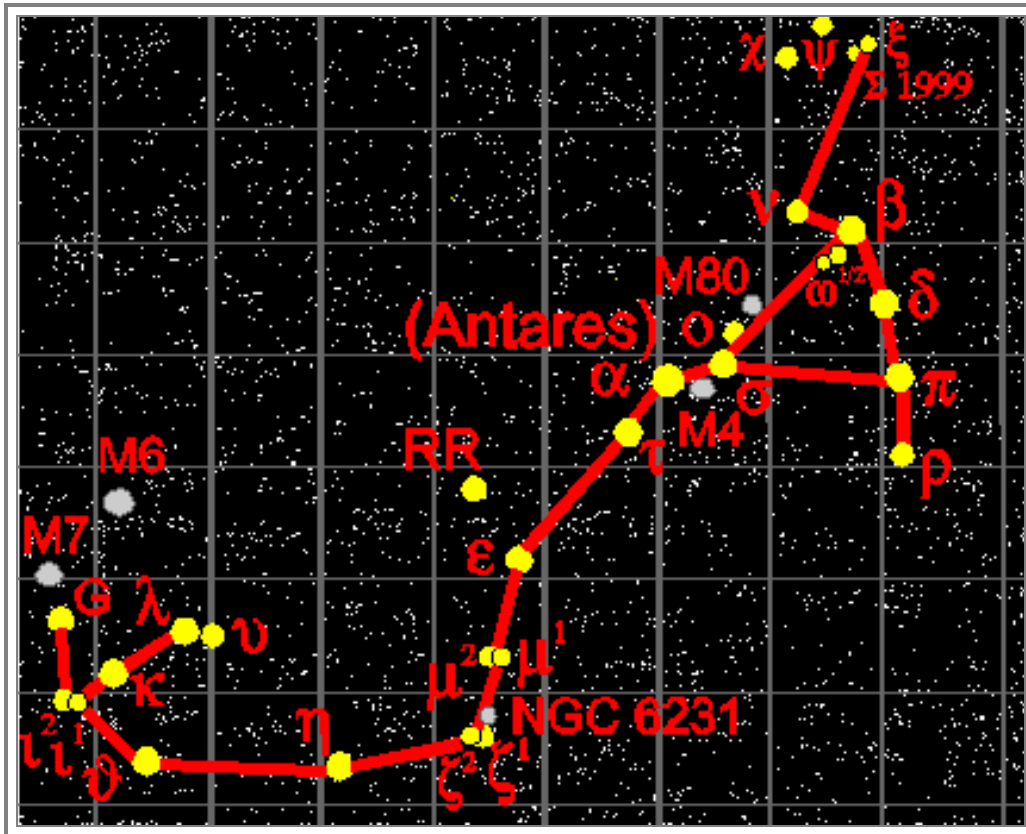
- The sun still traverses Scorpius.
 - It only takes nine days to travel through Scorpius.
 - Most of the time is spent in neighboring constellation Ophiuchus.

- The gigantic skewed "S" was seen in many ancient cultures as a scorpion.
 - This was possibly handed down by cultural conquest or influence.

- The constellation was once much larger, but the western portion representing the claws of the scorpion were given to Libra.

- The constellation is one of the brightest of the larger constellations.

The Stars of Scorpius:



lambda Scorpii and epsilon Scorpii:

- Both stars are called "The Sting" in Arabic.
- Traditionally they form the stinger.

Double stars in Scorpius:

Antares ("Rival of Mars") ;Alpha Scorpii:

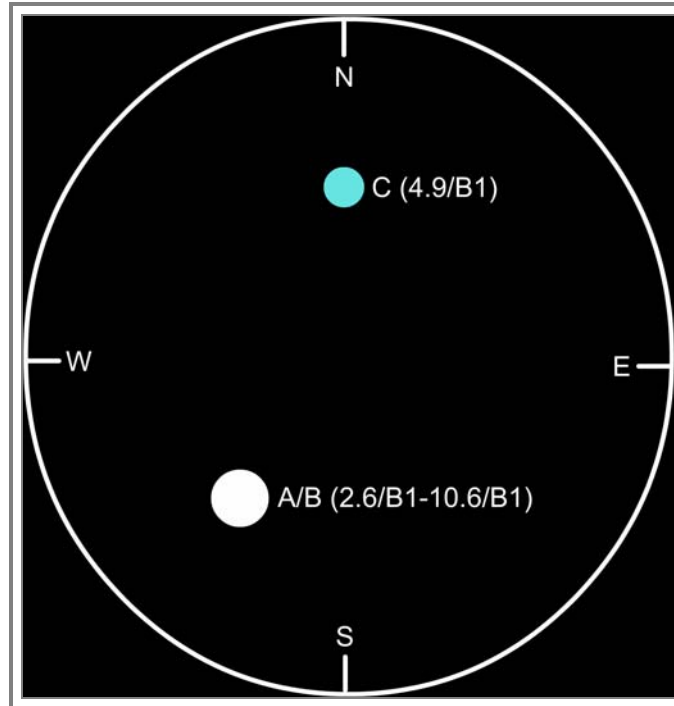


- It has a visual binary.
- The effective temperature is about 3100 K.
 - The star is approximately 10,000 times as luminous as the sun.
- The star is estimated to have a mass of 15.5 times that of the sun.
- Antares A would have a mass of 15.5 times that of the sun.
- This huge star has a radius that is probably almost 4 AU.
 - If the sun were replaced by Antares A at the center of the solar system, the earth would be engulfed, as would be Mars and the Asteroid Belt.
- It is also estimated to be about 600 years away.
- Antares companion is usually described as green in color.
 - It is probably a visual effect, created by the red glow of Antares.
 - The companion star is estimated to orbit its primary every 900 years.

Antares B:

- The companion star is a hot blue main sequence star.
- The spectral type implies an effective temperature of 18,000 K.
- Antares B has a diameter about 4 times that of the sun.
- This star could be about 1900 times as luminous as the sun.

Graffias; Beta Scorpii:



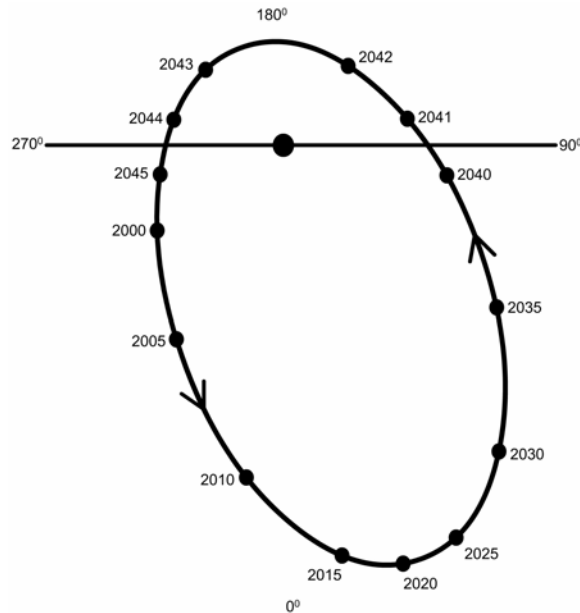
- The primary is white in color.
 - Its apparent visual magnitude is 2.6.
- The secondary is bluish green in color.
 - Its apparent visual magnitude is 4.9.

Nu Scorpii:

- Nu Scorpii is a multiple binary system.
 - It is a “double-double”.
 - That means that each of the visible components (AC) is also a primary of a closer component.
 - These are termed AB and CD.
 - Component AC:
 - Its primary has a visual magnitude of 4.4.
 - Its secondary has a visual magnitude of 6.4.
 - Component AB:
 - Its primary has a visual magnitude of 4.4.
 - Its secondary has a visual magnitude of 5.4.

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Xi Scorpii:



- Xi Scorpii is also a multiple system.
 - Components AB form a close binary.
 - Components AB have a period of 45.7 years.
 - The companion is gradually drawing away from the primary.
 - The components have a separation 0.39".

Sigma Scorpii:

- Sigma Scorpii is a double star with a faint companion.
 - Component A has a visual magnitude of 2.9.
 - Component B has a visual magnitude of 8.5.
 - There is a separation 20" between both components.

Struve 1999:

- Struve 1999 is gravitationally attached to the Xi Scorpii system.
 - The gravitational attraction spans a distance of about 7000 AU.
- The binary is found just south of Xi Scorpii.
 - Component A:
 - "A" is yellowish in color.
 - It has a visual magnitude of 7.4.
 - Component B:
 - "B" is yellowish in color.
 - It has a visual magnitude of 8.1.

Variable stars in Scorpius:

RR Scorpii:

- RR Scorpii is the brightest, long period variable in the constellation.
- It has a visual magnitude range of 5.0-12.4 every 281.45 days.

Deep Sky Objects in Scorpius:

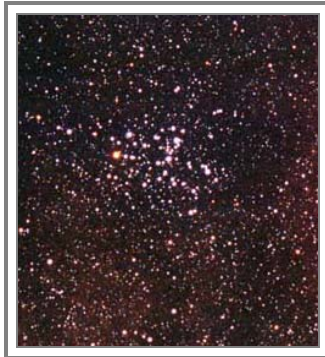
M4 (NGC 6121):



- M4 is a globular cluster.
- It is approximately 6500 light years.
- It is believed to be the closest globular cluster to Earth.
- It will not appear very spectacular without a large telescope.
- It has a visual magnitude of 44,000 suns.
- There may be as many as fifty RR Lyrae variable in the cluster.
- M4 is located just west of Antares, roughly half to sigma Scorpii.

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M6 (NGC 6405):



- M6 is the second-best cluster of the constellation.
- This is an open cluster.
- It sometimes bears the name "The Butterfly Cluster".
- M6 has a luminosity of 8300 suns.
- M6's brightest star is BM Scorpii.
 - It is a sixth magnitude yellow giant.
- The cluster is about 1500-2000 light years away.

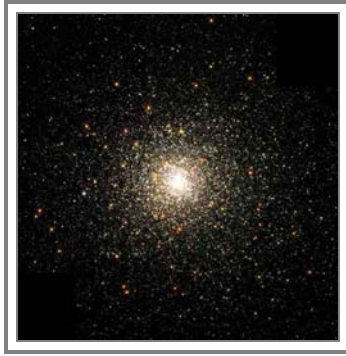
M7 (NGC 6475):



- M7 has no name.
- This is a magnificent open cluster.
- It is extremely large (two full moon diameters).
- It is visible to the naked eye under the right conditions.
- The brightest twenty-two stars range from 5.6 to 9.0 in visual magnitude.
- There are several close visual binaries in the cluster.
- M7 is about 800 light years away.

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M80 (NGC 6093):



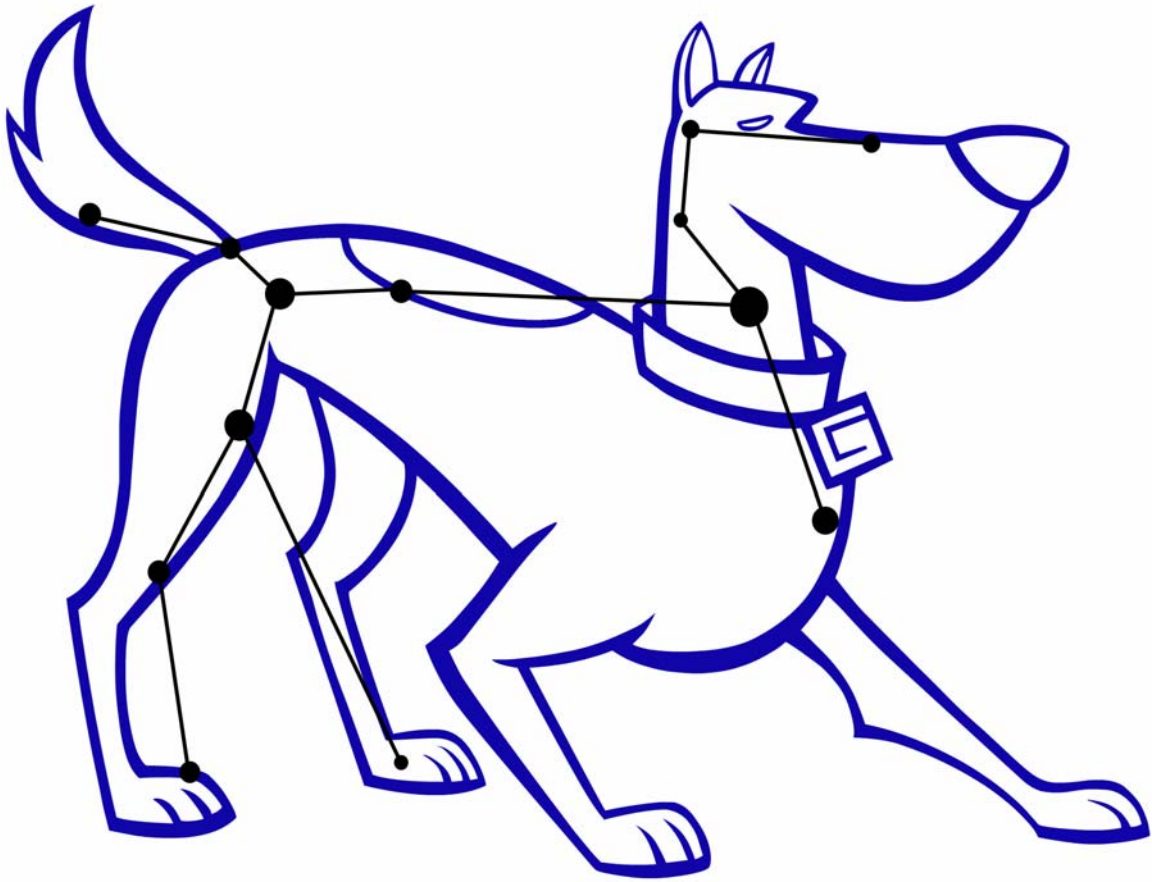
- M80 is a rather faint, very compact, globular cluster.
- Its visual magnitude is 7.3.
- It is found in the vicinity of Antares.
 - It is between Antares and beta Scorpii.
- The cluster is some 36,000 light years away.

NGC 6231:

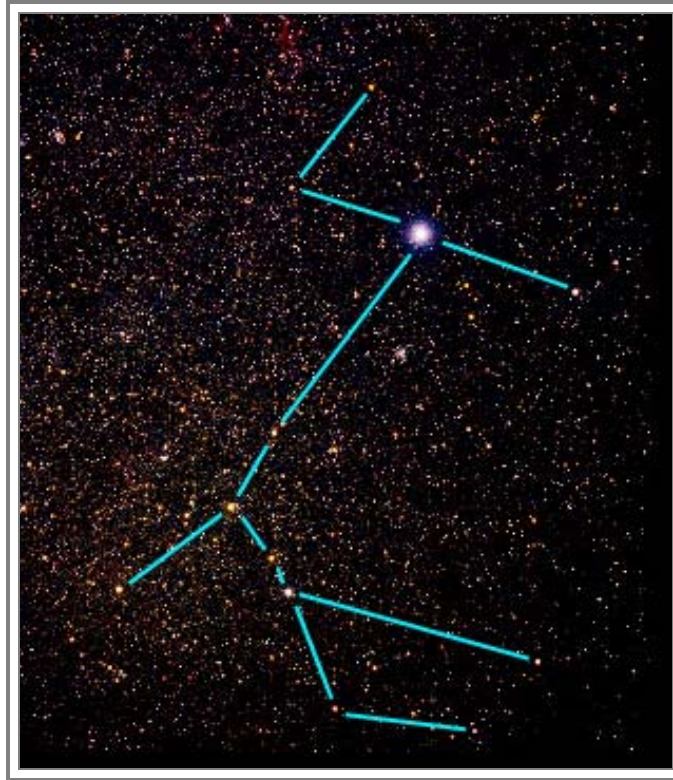


- NGC 6231 is a naked eye open cluster.
- It is found one half degree north of zeta Scorpii
 - zeta Scorpii is a member of this cluster.
- It's about 5500-6000 light years away.
- Its visual magnitude is 2.6.
- The stars that make up the cluster are generally super giants.
- The cluster is only part of a much larger, very scattered, cluster called H 12.
- The stars seen as joining NCG 6231 and H 12 actually form one of the spiral arms of our own galaxy.

Canis Major



Canis Major; (the large dog):

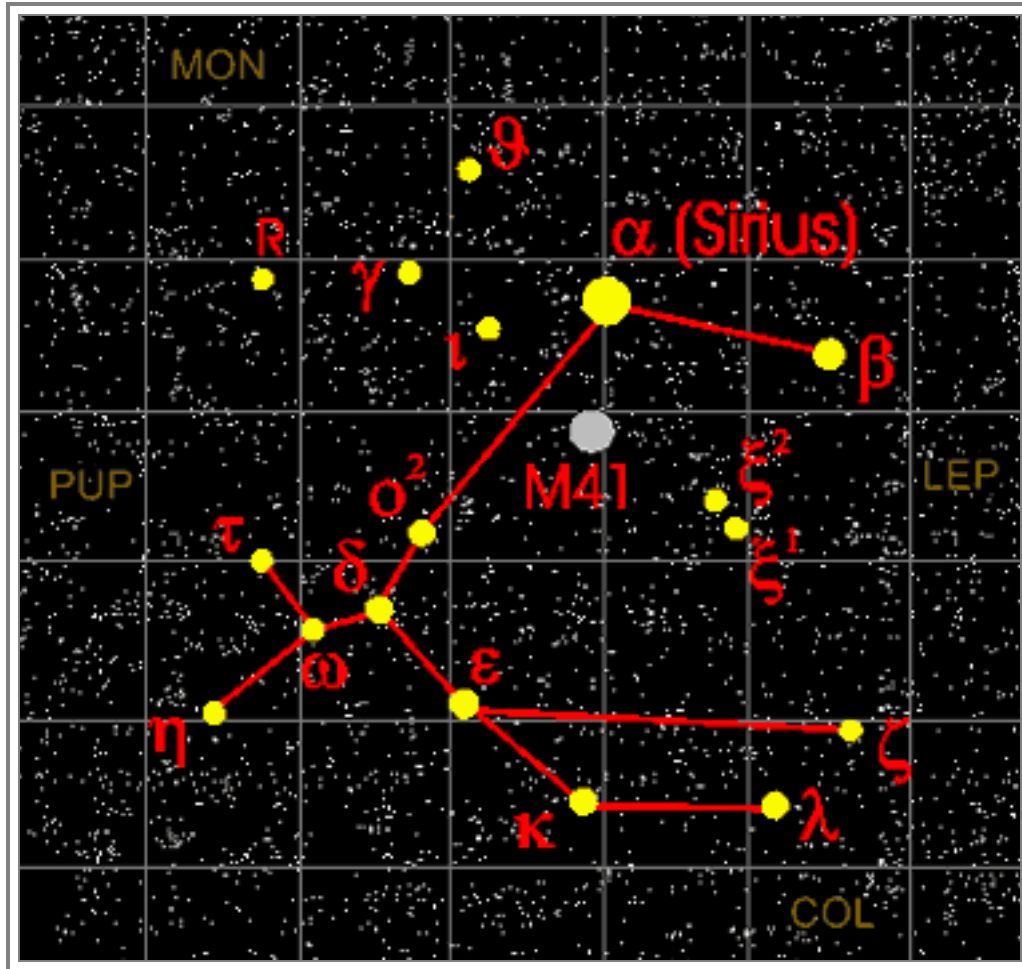


- It is the largest of Orion's two hunting dogs.
- The stories concerning Orion's dogs are not as numerous as Orion's or even other mythical characters.
- The Greeks did have several interesting beliefs concerning Sirius, alpha Canis Majoris.
 - The Athenian New Year began with the appearance of Sirius.
 - He was seen as two-headed, looking back at the past year and forward to the new one.
 - The Dog Star was associated with the Sun, since the Sun enters that part of the sky in the hot summer months.
 - Sirius was said to bring sickness and death.
 - Perhaps this was due to the fact that July and August were habitually the times of drought and disease.
- The name Sirius may come from the Greek meaning "scorching"
- The ancient Egyptians called Sirius the 'dog star', after the god Osirus.
 - Osirus' head in pictograms resembled that of a dog.
- The Egyptians actually believed that the additional light from Sirius was responsible for the summer heat.

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- The origin of the phrase 'the dog days of summer' comes from this ancient belief.
- The star is mostly thought of now as a winter star, accompanying Orion.

The Stars of Canis Major:

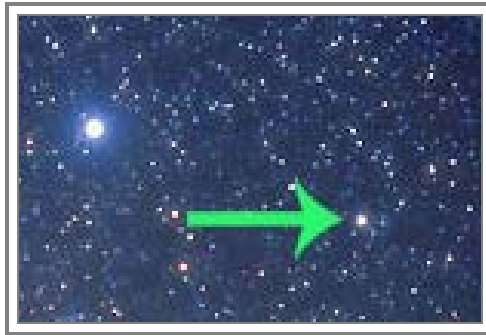


Sirius ; the Dog Star:



- Sirius is the brightest star in the night sky.
- It is similar in size and luminescence as our Sun.
- Sirius is estimated to be about 1.5 Sun diameters.
- Its brightness comes from the fact that it is very close to us.
 - It is approximately 8.56 light years away.
 - It is the sixth closest star to Earth.
- The star is a notable binary.
 - Its companion is very dim and very close.
 - The companion is a white dwarf.
- In 1834 Friedrich Bessel noticed a slight oscillation in Sirius's orbit.
 - He made the calculations and predicted the existence of an unseen companion.
 - It was only in 1862 that verification of Bessel's prediction occurred.

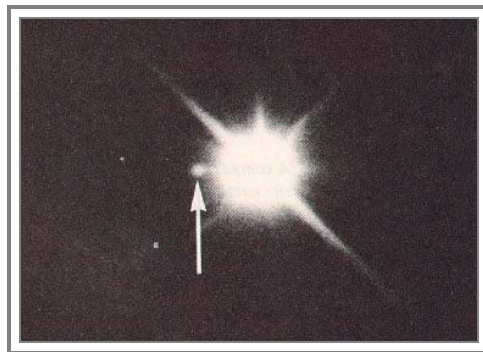
Beta Canis Majoris:



- It is named, "Murzim", which means "The Announcer".
 - Its appearance on the horizon signifies the approach of Sirius.
- This is a pulsating giant that has become the prototype of a class of variable stars called Bayer Stars.
 - The Bayer stars are quite bright.
 - Their brightness ranges from -1.5 to fifth magnitude.
 - There are a dozen stars of third magnitude or better.

Double stars in Canis Major:

Sirius B (the Pup):



- This white dwarf has since been the subject of much study.
- It is an eighth- magnitude star.
- The star's radius is estimated to be only 10,000 km (about twice the size of the earth).
- This companion of Sirius has an orbit of 50.09.
- Its mass is nearly equal to that of our Sun's.
 - The density is so high on Sirius B, that a tablespoon full of its matter would weight over a ton.
- Such a small dense object is the first phase of the collapse of the so-called main-sequence stars.

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Mu Cma:

- Mu Cma is a fixed multiple binary.
- Components "B" is at a fixed spot of 340° , $3''$.
- Components "C" is at a fixed spot of 288° , $88.5''$.
- Components "D" is at a fixed spot of 61° , $101''$.

h3945:

- It is a rather unknown binary.
- It has a gold and blue gaseous hue to it.
- The primary is a fairly bright 5.0.
- The companion has a visual magnitude of 6.1.
It has a separation $26.6''$ from the primary.
- To locate the primary:
 - You must first find tau Cma, which is just to the northeast of delta Cma.
 - Now look north of tau Cma, about 1.75 degrees and very very slightly to the west of due north.
 - You should find the fairly bright primary with no problem.
- Focus carefully and study this star.
 - Its companion should be quite visible, particularly on nights when the skies are clear and dark.

Variable stars in Canis Major:

Beta Cma:

- It is a pulsating giant star;
 - The prototype of a small class of variables.
- Its variations are too slight to be noticed by the naked eye.
 - The visual magnitude changes from only 1.93 to 2.00 every 6h, 2.6s.
- This class of variable is also called the "beta Cepheid type".
 - This particular star was the first in this class to be discovered.

Deep Sky Objects in Canis Major:

M41:



- It is a globular cluster.
- M41 can be located four degrees south of Sirius.
- It is believed that a hundred or so stars make up this bright group.
 - Fifty of them bright enough to be easily seen in binoculars.
- At the center of the group is a red giant.
- M41 is thought to be about 2500 light years away.

Canis Minor

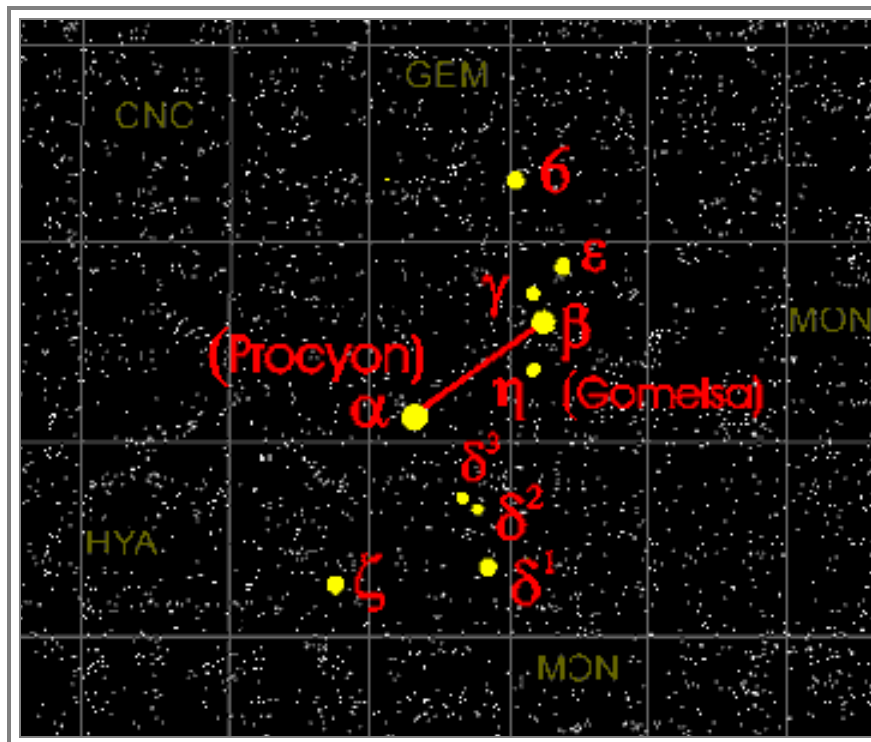


Canis Minor; (the little dog):



- Canis Minor is Orion's second hunting dog.
- It is much smaller than its mate.

The Stars of Canis Minor:



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Gomeisa:

- Gomeisa comes from an Arabic term that means “the little bleary-eyed one.”
- The term was transferred from Canis Minor's Procyon.
- It is a mid third magnitude star.
- Gomeisa is apparently fainter only by its larger distance of 170 light years.
 - It is 15 times Procyon's distance.
- Gomeisa is a blue white class B star with a temperature of 11,500 Kelvin.
- Gomeisa is a main sequence “dwarf” star.
 - It is fusing hydrogen into helium in its core.
- It shows no evidence of any companion star.
- Gomeisa's mass is over three times the Sun's.
 - It radiates far more furiously than our Sun.
 - The star shines with approximately 250 solar luminosity.
 - The star directly measured to be four times larger (remember that size and mass are two different things) than the Sun.
- Gomeisa is a fast rotator.
 - Its equatorial speed is at least 250 kilometers per second.
 - It is 125 times the rotation speed of our Sun.
 - This gives the star a rotation speed of our Sun.
 - Gomeisia is rotating so quickly that it is surrounded by a disk of matter that emits radiation.
 - The disk's diameter is almost four times larger that the star.
- Gomeisa is also surrounded by a thin cloud of dusty interstellar gas.

There are only nine Bayer stars:

- They range from 0.38 to nearly sixth in magnitude.

Double stars in Canis Minor:

Procyon A and Procyon B:

- Both stars form an extremely difficult binary.

Procyon A:

- The name means “Before the Dog”.
- Thus refers to the fact that this star rises just before Sirius (alpha Cma)
- It is 11.4 light years away.

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- Procyon is nearly as close to us as Sirius (8.65 ly).
- Procyon is the eastern anchor of the Winter Triangle.
- Procyon is the eighth brightest star we see in the sky.
- It is a feeble radiator even if it is still 7 times intrinsically more luminous than the Sun.

- The star is an example of a "sub giant," one that is just beginning its death process.
 - Its internal core of hydrogen has almost burned away helium.
 - Recent Hubble Space Telescope observations show that Procyon A has a temperature 6500 degrees above absolute zero.

Procyon B:

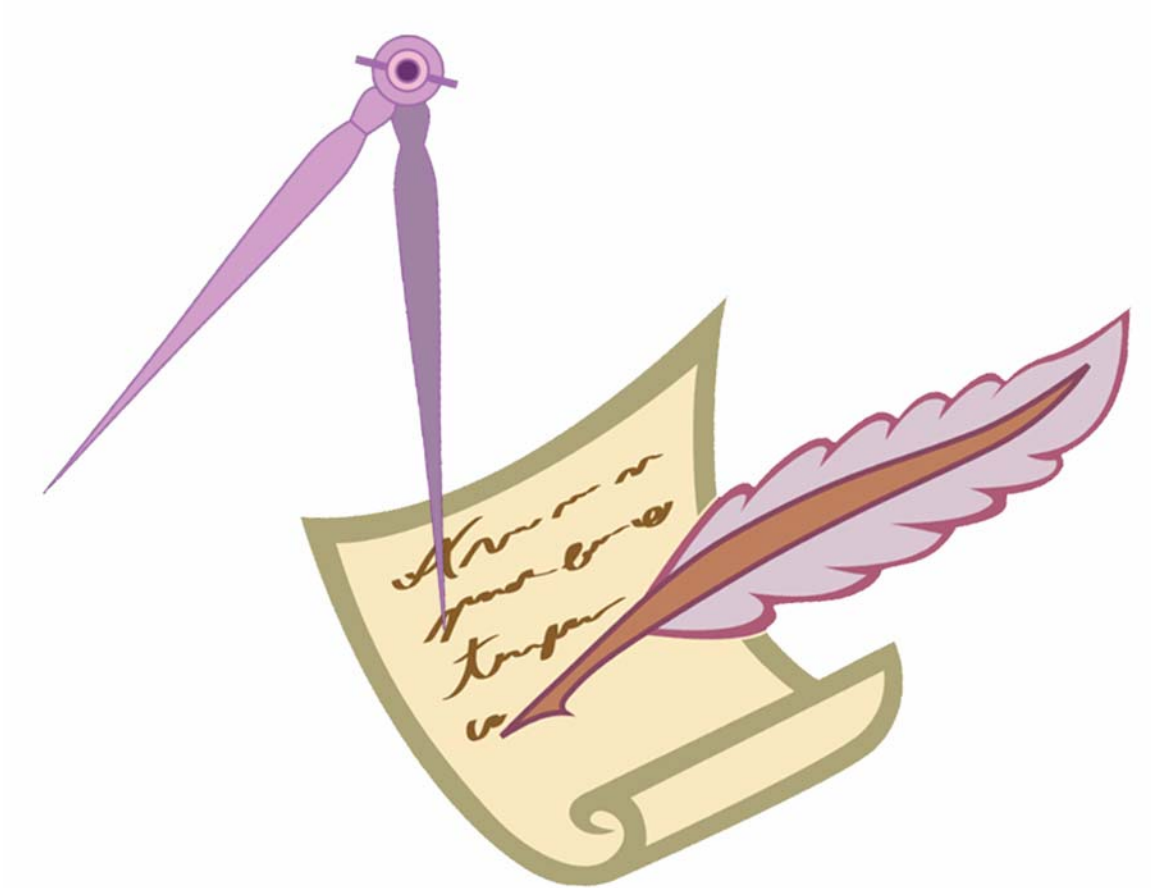
- Procyon B is a white dwarf.
- It has a diameter of only twice that of Earth's.
- The star was first seen only in 1895.
 - Its existence was already known from the wobbles. It exerts on the brightest star, Procyon A.
- Its orbit is nearly circular.
 - The orbit has been calculated to be 40.65 years.
- Recent Hubble Space Telescope observations show that Procyon B has a temperature of 8700 degrees above absolute zero.
- Procyon B is a dead star that has gone through the entire cycle of stellar evolution.
 - It now consists of highly compressed gas that is just cooling off.

Variable stars in Canis Minor:

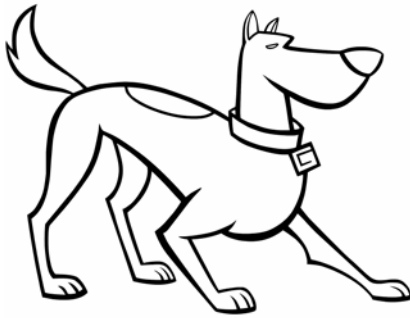
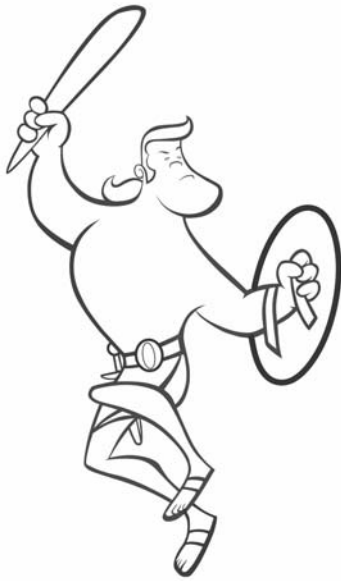
Beta Cmi:

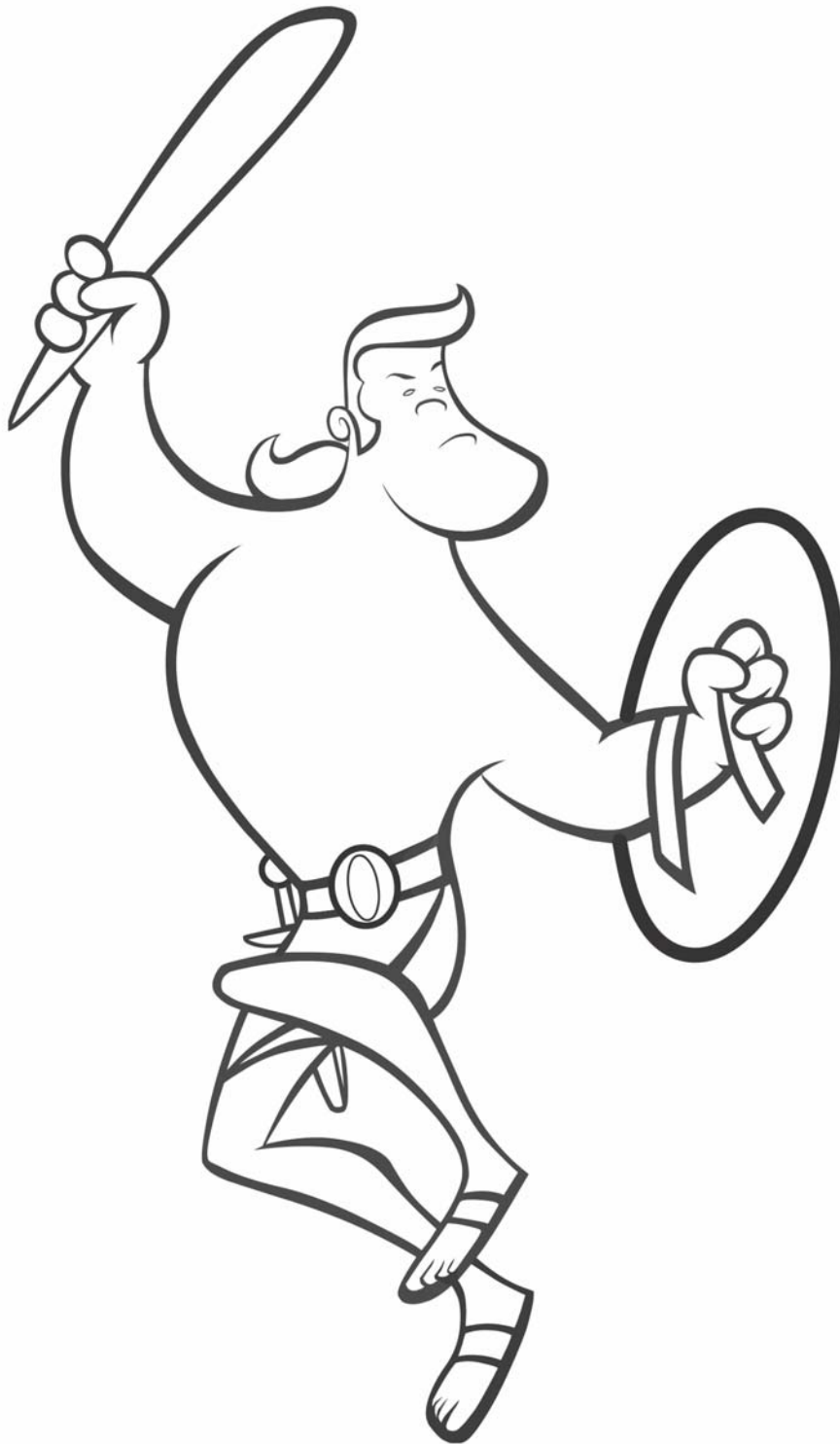
- It is a gamma Cas type variable star.
 - **Variable star:** is a star that exhibits changes in its luminosity and/or its color.
 - It appears to be pulsating.
- It fluctuates from 2.84 to 2.92 in visual magnitude.

Lesson Plans

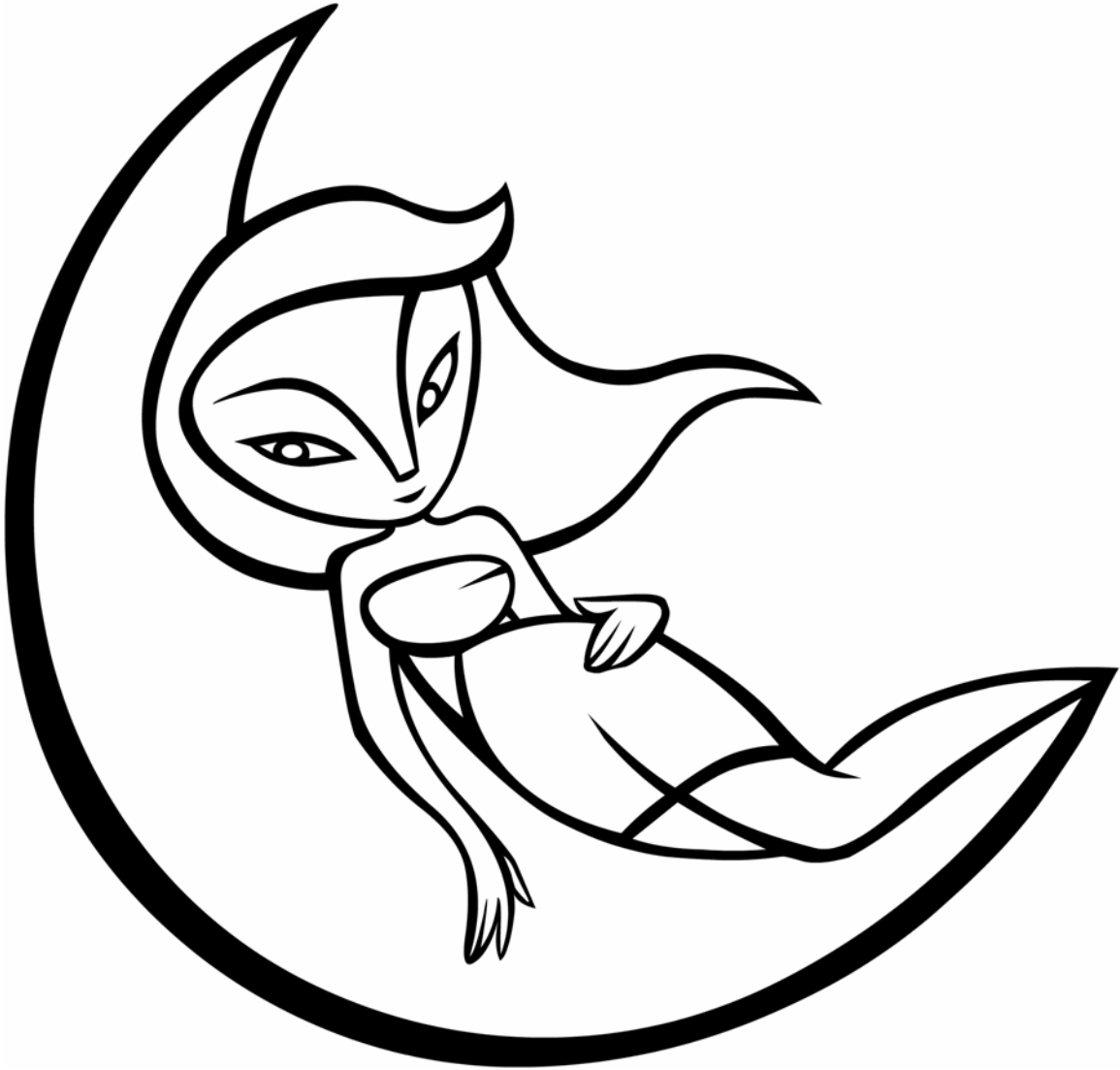


Coloring Book

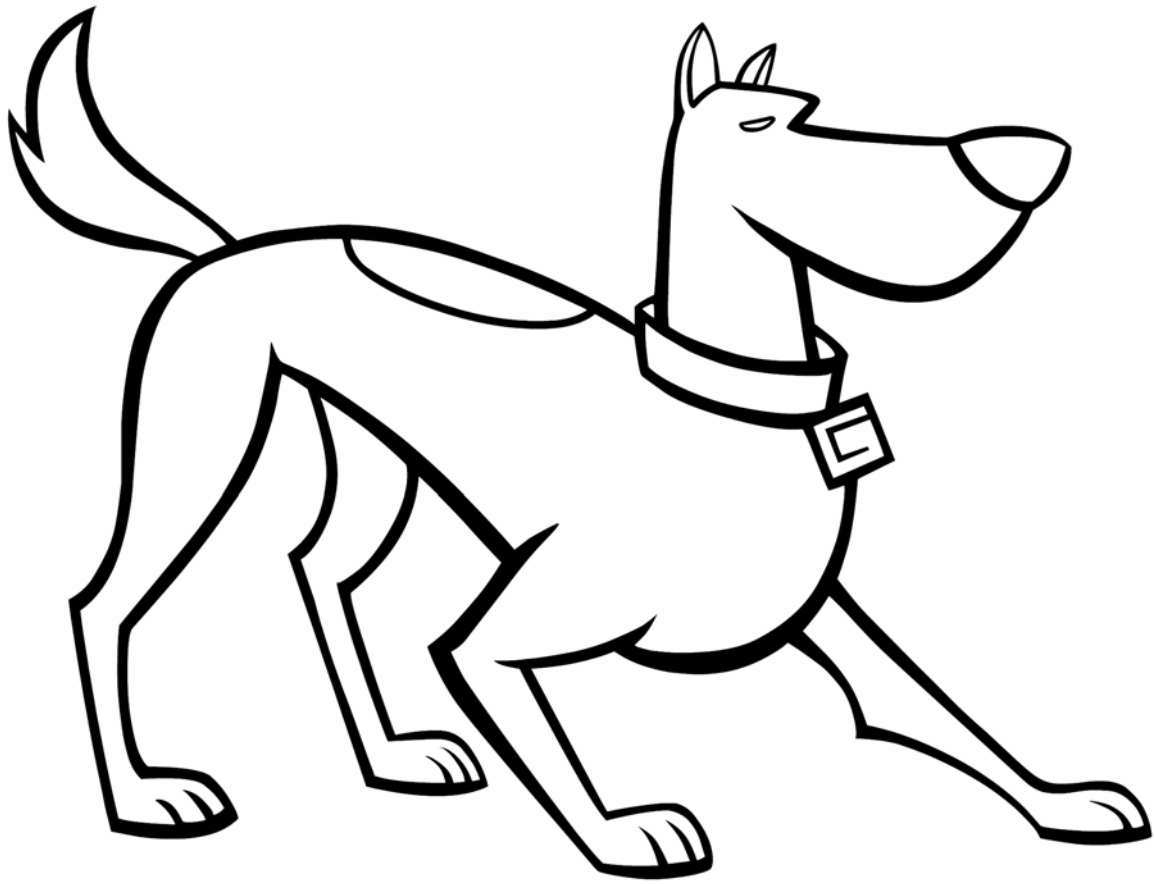




Orion



Artemis



Canis Major
Sirius



Canis Minor
Procyon



Scorpius



Apollo

Hand - Angles Lesson Plans

Legends of the Night Sky: Orion
Educator's Guide

Hand Angles
Teacher Lesson Plans

Objective:

Students will use the astronomical system of degrees to measure objects on the horizon.

Grade Level:

- Elementary School
- Middle School

Materials:

- Copy of the activity sheet
- Horizon with features. (Trees, buildings, or clouds can act as features to be measured)
- A person's hand.

Estimated Time:

- Reading and explaining the activity sheet will take between 15 and 30 minutes.
- Measuring objects on the horizon may take another 20 minutes.

Procedure:

1. Read over the activity sheet. Review any new vocabulary. As you read each paragraph, practice hand measurements. Have kids practice using their hands to measure objects on the ceiling.
2. Review your behavior standards for going outside. You might want to have students work in pairs.
3. Before having the students measure, do the first problem together.
4. Monitor students as they measure. Encourage students to compare answers.
5. While you are still outside, go over the student responses.

Rationale:

Thus exercise will prepare students to locate stars in the sky. It will motivate and prepare students to go out at night on their own.

Name : _____

Date : _____

Hands – Keys to the Universe
(Worksheet)

You can measure the sky with your hands.

Now, you need to get used to a new word. The word is degree.

- When you measure the sky, you say things like 'one degree' or 'ten degrees'.
- In the sky, degree does not mean how warm it is.
- A degree means how far away something is from something else.

This is what scientists do first.

You hold your hand in front of you at an arm's length.

- Hold your pinky finger up high!
- Your pinky finger is the little finger on the end of your hand.



- Your pinky finger is about 1 degree wide.

- Hold up just your three (3) middle fingers together.



- These are about 5 degrees wide.

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- Make a fist and hold it at arms length.



- **Your fist is also about 10 degrees wide.**

- Can you hold up just your pinky finger and your pointer finger?
(This can be tricky.)



- **If you can hold these up, they are about 15 degrees wide.**

- Make your thumb and pinky of one hand go as far apart as they can go.



- **If you are able to do this, they are about 25 degrees.**

Go outside!

A big playground or park is a good place.

- Look at things that are as far away as you can see.
- we call that the horizon.
- Try to answer the following questions.

Legends of the Night Sky: Orion
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Name: _____

Date: _____

Hands – Keys to the Universe
(You may write the words or draw a picture.)

1. What two things on the horizon seem to be one degree apart?

2. What two things on the horizon seem to be five degrees apart?

3. What two things on the horizon seem to be ten degrees apart?

4. What two things on the horizon seem to be 15 degrees apart?

5. What two things on the horizon seem to be two degrees apart?

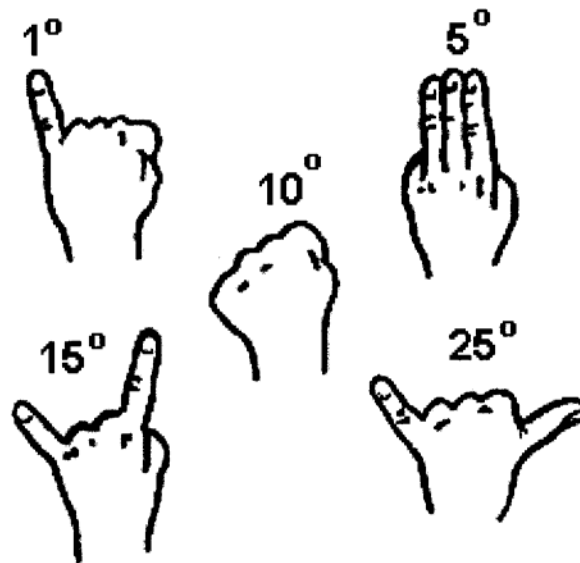
Name : _____

Date : _____

Hands – Keys to the Universe Worksheet

The unit of measure used to describe distances in the sky are degrees.

- The degrees are originally taken from the degrees around a circle.
- It is easy for star watchers to measure degrees with their hands.
 - To use your hand as a measuring tool, you need to hold your hand in front of you at an arm's length.



- Held at arm's length. Your pinky finger is about 1 degree wide.
- Your three middle fingers, held together, are about 5 degrees wide.
- If you hold out your fist, it will measure a 10 degree width of the sky.
- If you hold up just your pointer finger and your pinky finger, it will be about 15 degrees of sky between them.
- If you spread the thumb and pinky of one hand as far apart as they will go, it will be about 25 degrees from the outside edge to outside edge.

Answer the following questions in complete sentences.

Name: _____

Date: _____

Hands – Keys to the Universe
(Answer in complete sentences.)

1. What two objects on the horizon seem to be one degree apart?
2. What two objects on the horizon seem to be five degrees apart?
3. What two objects on the horizon seem to be ten degrees apart?
4. What two objects on the horizon seem to be 15 degrees apart?
5. What two objects on the horizon seem to be 25 degrees apart?
6. Can you find two objects that are 50 degrees apart?
7. Can you find two objects that are 35 degrees apart?
8. Never look directly at the Sun, it will damage your eyes. Without looking at the Sun, can you measure how many degrees high it is in the sky?

Constellation Research Project

Constellation Research Project

Teacher Lesson Plans

Objective:

The student will research and report on a constellation.

Materials:

The students will need copies of the activity sheet (for younger kids or for older kids) and access to constellation information.

Estimated Time:

This project will take at least two class periods, a third to shape everything into final draft form. If you want students to present to each other, that will take yet another period.

Procedure:

1. Discuss and define 'expert'. Ask if any student is already an expert on a subject.
2. Distribute the activity sheet. Be sure to emphasize the components that you want included in the final project by writing them on the board.
3. Let students choose the constellation. Record who chose which constellation. There are so many, do not have more than one student the same constellation.
4. Discuss the fact that the sky looks different depending upon where you are located on the Earth. The stars in the Northern and Southern Hemispheres are very different. The North Star, The Big Dipper and other constellations can only be seen if you live north of the equator. Many people who live in the Northern Hemisphere have never seen the Southern Cross or the Southern Triangle.
5. Direct students to available resources on constellations. Provide them time to complete their research.
6. Monitor students as they work. For older students, edit the rough drafts of their information documents.
7. Have students report back to the class, to small groups, or to you.

Rationale:

This project reinforces research skills, exposes students to an array of constellations, and promotes an appreciation and understanding of some of the mythology.

Name: _____

Date: _____

Constellation Research

You will become an expert on a group of stars called a constellation.

- Pick one of the constellations listed below.
- Look it up.
- Look on the internet.
- Look in a book about stars.

As an expert, you should know about your constellation.

- You should be able to say the name of your constellation and know what it means.
- Draw a picture of the constellation.
- Why does it have that name?
- Where in the sky is your constellation.

Tell your teacher!

Constellations of the Zodiac:

Aquarius (the water bearer)
Aries, the ram
Cancer, the crab
Capricorn, the goat
Gemini, the twins
Leo, the lion

Libra, the scales
Pisces, the fish
Sagittarius, the archer
Scorpius, the scorpion
Taurus, the bull
Virgo, the virgin

Constellations of the Northern Hemisphere:

Andromeda
Antlia, (the pump)
Aquila, (the eagle)
Auriga, (the chariot driver)
Bootes, (the herdsman)
Caelum, (the chisel)
Camelopardalis, (the giraffe)
Canes Venatici, (the hunting dogs)
Canis Major, (the big dog)
Canis Minor, (the little dog)
Cassiopeia, (the queen)
Cepheus, (the king)
Cetus, (the whale)
Columba, (the dove)
Coma Berenices, (Berenice's hair)
Corona Australis, (the southern crown)
Corona Borealis, (the northern crown)
Corvus, (the crow)
Crater, (the cup)
Cygnus, (the swan)
Delphinus, (the dolphin)
Equuleus, (the little horse)
Fornax, (the furnace)
Hercules
Horologium, (the clock)

Hydra, (the water snake)
Lacerta, (the lizard)
Leo (the lion)
Leo Minor, (the little lion)
Lepus, (the rabbit)
Lupus, (the wolf)
Lynx, (the lynx)
Lyra, (the harp)
Microscopium, (the microscope)
Monoceros, (the unicorn)
Ophiuchus
Orion
Pegasus
Perseus
Pisces Austrinus (the southern fish)
Puppis, (the ship's stern)
Pyxis, (the ship's compass)
Sagitta, (the arrow)
Sculptor, (the sculptor)
Scutum, (the shield)
Telescopium, (the telescope)
Triangulum, (the triangle)
Ursa Major, (the big bear)
Ursa Minor, (the little bear)
Vulpecula, (the little fox)

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Constellations of the Southern Hemisphere: warning, these may be more difficult to research.

Apus, (the bird of paradise)

Ara, (the altar)

Carina, (the ship's keel)

Centaurus, (the centaur)

Chamaeleon, (the chameleon)

Circinus, (the compass)

Crux, (the southern cross)

Dorado, (the swordfish)

Eridanus

Grus, (the crane)

Hydros, (the water snake)

Indus, (the Indian)

Musca, (the fly)

Norma, (the surveyor's level)

Octans, (the octant)

Pavo, (the peacock)

Phoenix, (the phoenix)

Pictor, (the easel)

Reticulum, (the net)

Triangulum Australe, (the southern triangle)

Tucana, (the toucan)

Vela, (the ship's sails)

Volans, (the flying fish)

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Name: _____

Date: _____

Constellation Research

You have a chance to become an expert on a group of stars called constellation.

- Select one of the constellations listed below.
- You may do any of the following.
 - Look it up on the internet.
 - Look it up in an astronomy book.
 - Look it up in any book about constellations.

As an expert, you should prepare the following documents about your constellation.

- One document should explain the name of the constellation and any myths or legends about the constellation.
- One document should contain a picture of the constellation as it appears in the sky and as it appears in its legend.
- Another document should explain where in the sky your constellation appears.
- A fourth document should explain why this constellation should be selected as your classroom constellation mascot.

Constellations of the Zodiac:

Aquarius, (the water bearer)
Aries, the ram
Cancer, the crab
Capricorn, the goat
Gemini, the twins
Leo, the lion

Libra, the scales
Pisces, the fish
Sagittarius, the archer
Scorpius, the scorpion
Taurus, the bull
Virgo, the virgin

Constellations of the Northern Hemisphere:

Andromeda
Antlia, (the pump)
Aquila, (the eagle)
Auriga, (the chariot driver)
Bootes, (the herdsman)
Caelum, (the chisel)
Camelopardalis, (the giraffe)
Canes Venatici, (the hunting dogs)
Canis Major, (the big dog)
Canis Minor, (the little dog)
Cassiopeia, (the queen)
Cepheus, (the king)
Cetus, (the whale)
Columba, (the dove)
Coma Berenices, (Berenice's hair)
Corona Australis, (the southern crown)
Corona Borealis, (the northern crown)
Corvus, (the crow)
Crater, (the cup)
Cygnus, (the swan)
Delphinus, (the dolphin)
Equuleus, (the little horse)
Fornax, (the furnace)
Hercules
Horologium, (the clock)

Hydra, (the water snake)
Lacerta, (the lizard)
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Tucana, (the toucan)

Vela, (the ship's sails)

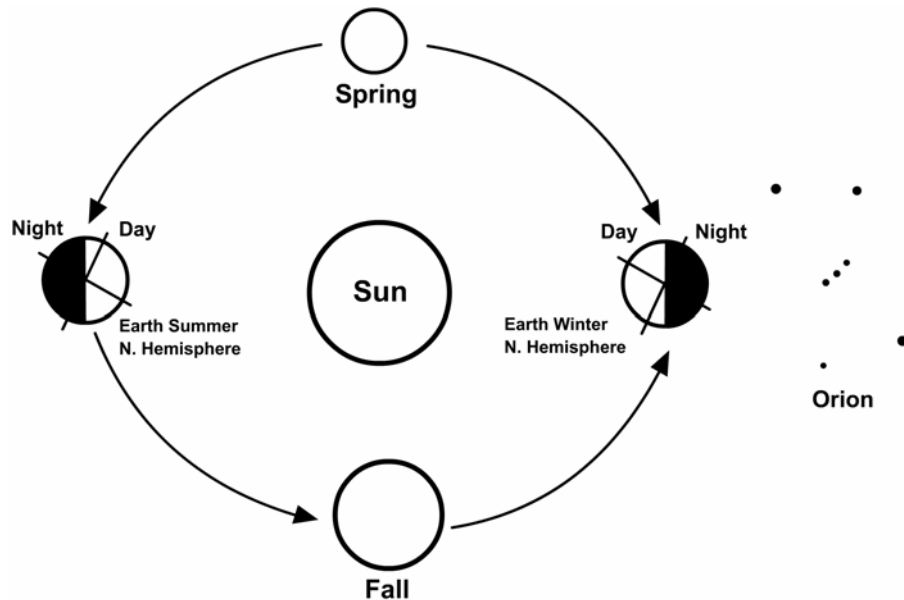
Volans, (the flying fish)

When and Where to View Orion

Information:

Orion the Hunter, Sirius (Canis Major the Big Dog), Procyon (Canis Minor, the Little Dog) and the Winter Triangle for that matter can be viewed at various times during the year.

As you know, Orion can't be viewed when the Sun is shining because the Sun light is so strong it washes out the light from the stars and planets. On a clear day, the only celestial bodies you can see are the Sun and sometimes the Moon, even though the stars are still there.



Interpretation:

- _____ 1. Using the above diagram when do you think Orion can be viewed? Remember, we can see Orion only when the Sun is down. Thus, between sunset and sunrise.
- A. Summer to Fall C. Winter to Spring E. Spring to Fall
B. Fall to Winter D. Spring to Summer F. Fall to Spring

Information: When Orion Can be Viewed

Here in the middle latitude in the N. Hemisphere, Orion the Hunter can be viewed directly south starting:

Morning Hours

October 1 @ 5am, November 1 @ 3am, December 1 @ 1am

Evening Hours

January 1 @ 11pm, February 1 @ 9pm, March 1 @ 7pm

Here in the middle latitudes in the N. Hemisphere, Orion the Hunter can be viewed rising in the eastern sky

Morning Hours

August 5 @ 4am, September 1 @ 2am, October 1 @ midnight

Evening Hours

November 1 @ 10pm, December 1 @ 8pm, January 1 @ 6pm

Angles used For Locating Orion

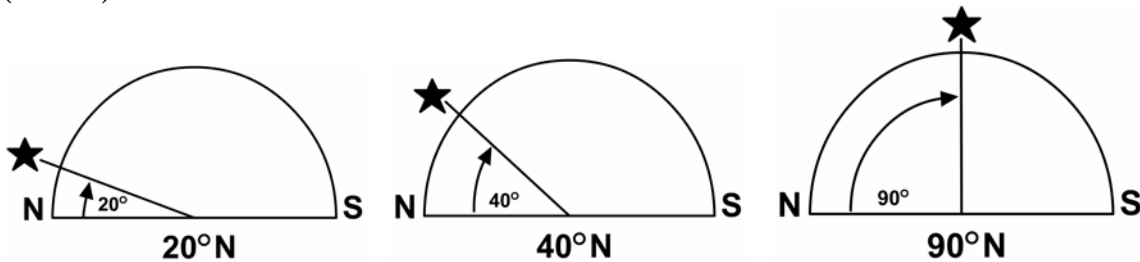
Information: The Hemisphere (Sky)

The sky that we observe represents an upside down bowl or hemisphere. This hemisphere spans 180° from horizon to horizon. The diagrams below represent a view of the sky, standing west and looking east with north on our left and south on our right. The line across represents the horizon.

Information: The angle of the North Star (Polaris) = Your Latitude

In the northern hemisphere the angle of the North Star (Polaris), which is an extension of the Earth's North Pole (called the Celestial North Pole), equals your latitude. Thus, if you are at 20°N latitude the angle of the North Star above the horizon is 20°. Likewise, if you live at 40°N latitude the angle of the North Star above the horizon would be 40°. If you were at the North Pole, the North Star would be directly over your head, which means that the angle would be 90° above the horizon

In the Southern Hemisphere there is no South Pole Star; therefore, trying to measure angles (latitude) is a little more difficult.



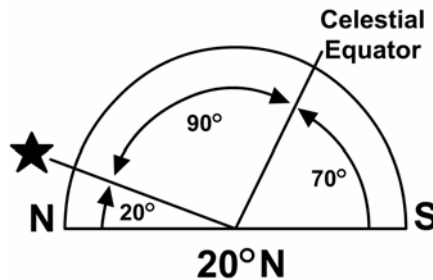
Information: The Angle of the Celestial Equator and Orion's Belt

The Celestial (Sky) Equator is an *imaginary* projection of the Earth's Equator, whereas the North Star is a *visible* projection of the Earth's North Pole. On the Earth the angle of the Equator from the North Pole is 90°, likewise, the Celestial Equator is also 90° from the North Star (Celestial North Pole). The imaginary Celestial Equator runs through the Belt of Orion. Thus, the mid point of Orion is represented by the Celestial Equator.

Information: Calculating the Angle of Orion (Orion's Belt)

If you add up the angle of the North Star plus the angle of the Celestial Equator from the North Star, then subtract it from 180° you will have the angle of the Celestial Equator above the south horizon.

As an example, at 20°N the altitude of Polaris is 20°. The Celestial Equator is 90° from Polaris. Thus, $20^\circ + 90^\circ = 110^\circ$. Subtract 110° from 180° the remaining angle is 70° . Thus, at 20°N the angle of Orion (Orion's Belt) is 70° above the south horizon.



$$20^\circ + 90^\circ = 110^\circ \quad 180^\circ - 110^\circ = 70^\circ$$

70° is the angle of the Celestial Equator above south as well as the angle of Orion (Belt).

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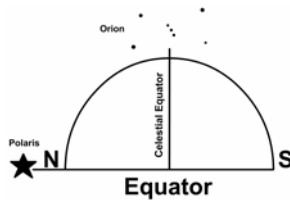
Interpretation: Altitude and Angle above the Horizon are the Same Thing!

What is the altitude of the North Star and Celestial Equator at the following Latitudes?

At any given time you can see from the horizon to your zenith. This angle is 90° . What is the fraction of the sky up from the South Horizon is Cel.Eq (and also Orion)?

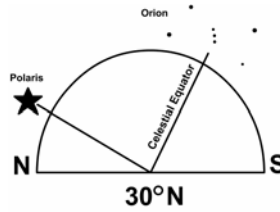


1. @ 0° Polaris _____ Cel Eq. _____



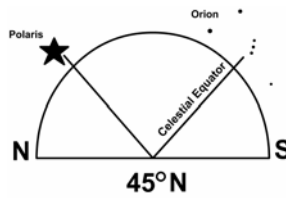
At the Equator, Orion is directly over head.

2. @ 30°N Polaris _____ Cel Eq _____



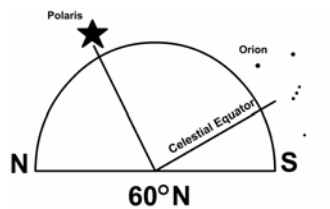
6. Give the fraction of Cel. Eq _____

3. @ 45°N Polaris _____ Cel Eq. _____



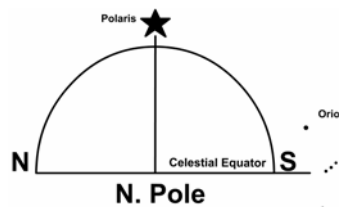
7. Give the fraction of Cel. Eq _____

4. @ 60°N Polaris _____ Cel Eq. _____



8. Give the fraction of Cel. Eq _____

5. @ 90°N Polaris _____ Cel Eq. _____



• At the N. Pole, Orion can be viewed on the horizon.

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- _____ 9. People living in the middle latitudes of the N. Hemisphere can view Orion directly south (January, February, March 11:00pm to 7:00 am) and about:
- A. 1/3 of the way up
 - B. 1/2 of the way up
 - C. 2/3 of the way up
- _____ 10. Can people living in the middle latitudes of the S. Hemisphere (during January, February, March 11:00pm to 7:00 am) view Orion?
- A. Yes
 - B. No
- _____ 11. How would it appear?
- A. Right side up
 - B. Upside down

For Overhead Projector Punch Out of Orion And the Winter Constellations

Information: Time and Direction to View Orion

Generally speaking, in the middle latitudes of the Northern Hemisphere, a good time to view Orion is in the evening skies of January, February, and March. During this time you would face south and look up between the hours of 11:00pm in January , 9:00pm in February, and 7:00pm in early March.

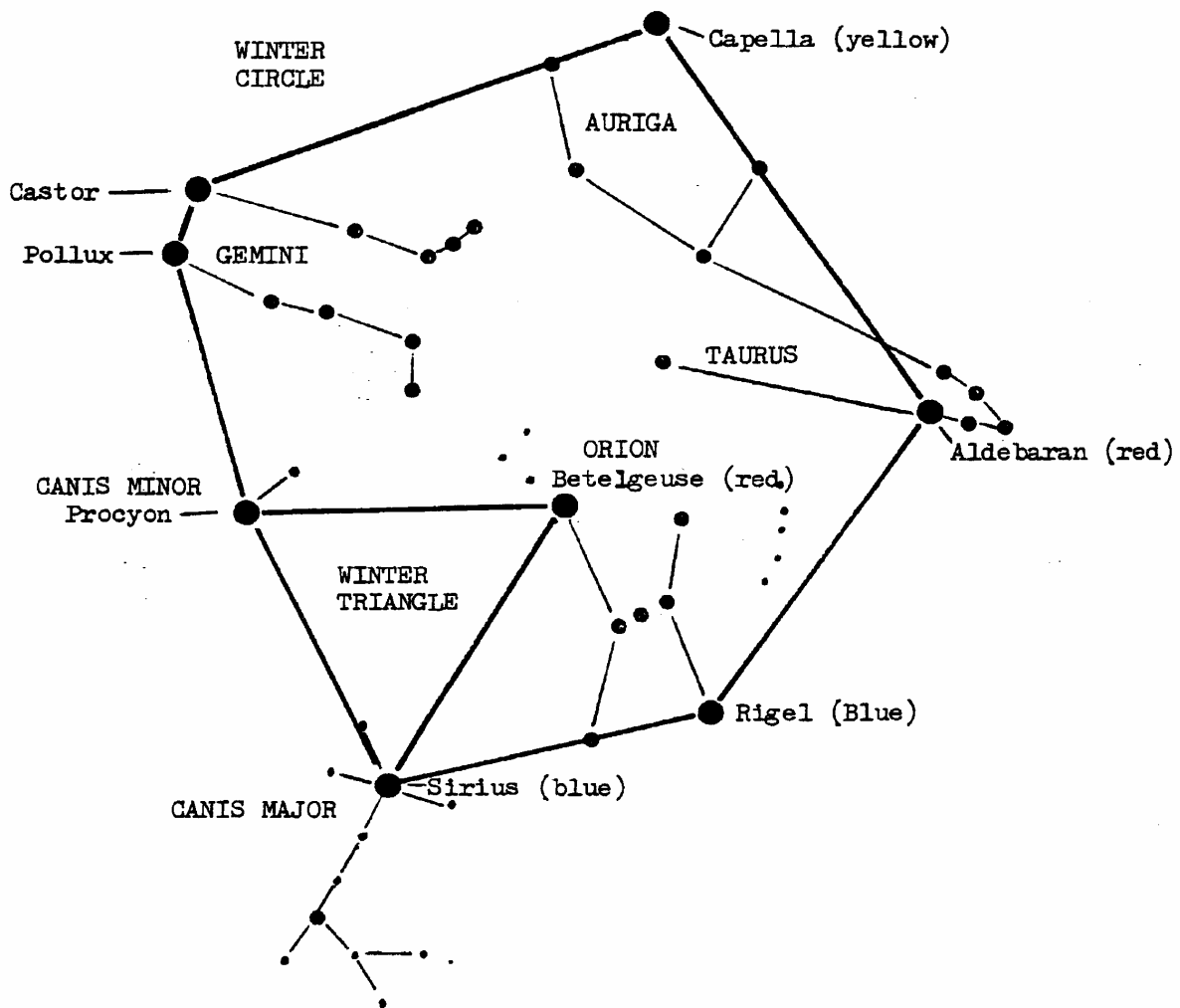
Orion can also be viewed in the early morning hours before sunrise during the months of August, September, October and November. We have included a lesson titled: "When and Where to View Orion."

Procedure:

1. Make several copies of the next page so that you can practice the following steps.
2. Tape or glue the next page on top of an 8"x11" sheet of poster board. Use a straight pin to punch a hole in the center of each dot on this page. DO NOT make the whole punches as big as the dots on this page. Simply push the straight pin in and bring it straight out. For the larger dots, place a pin in the center of these large dots, push through and widen the pin-hole just a little.
3. Most of the stars are white; however, some are colored as you can see. You can take a piece of colored cellophane (blue as an example) and tape it over the dots labeled blue. Do the same for red and yellow.
4. When this is completed lay the punch-out poster board on an overhead projector. Block out all the light leaks from around the poster board, darken the room, aim the overhead at a screen and turn it on. You and your students will be amazed at how much this projection looks like the night sky.
5. If you have a laser pointer you can have your students point out the constellations and bright stars.

The Winter Evening Sky Facing South

Constellation Punch-out for Overhead Projector



Where on Earth is: Thrace, Lemnos, Crete?

Information: Thrace, Lemnos, and Crete

Thrace, Lemnos and Crete are the three locations mentioned in the story.
Thrace represents a region of SE Europe comprising NE Greece, S Bulgaria and W Turkey, bordered by the Black Sea in the northeast and the Aegean Seas in the south.
The island of *Lemnos* is located in the northern part of the Aegean Sea.
The island of *Crete* is located at the very south end of the Aegean Sea.
All three locations are near a county called *Greece*.

Information: Latitude and Longitude

Latitude represents the horizontal lines on a map that are measured in degrees "North" and "South" from the equator. The equator is called 0° latitude
Longitude represents the vertical ("up" and "down") lines on a map measured "East" and "West" of the prime meridian which runs vertically through Greenwich, England.
The prime meridian is called 0° longitude.

Information/Interpretation: *World Map Showing Longitude and Latitude

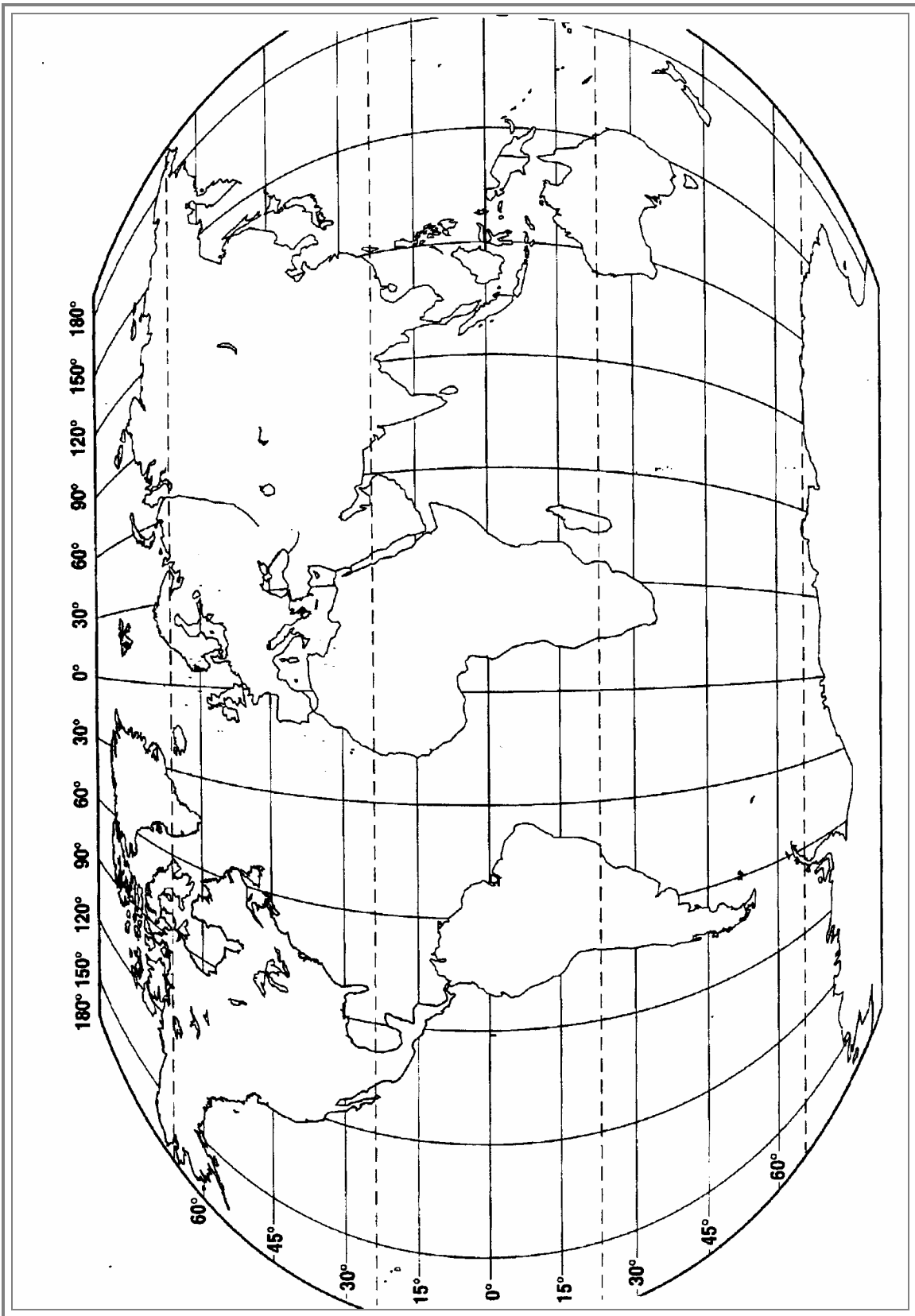
1. Locate the seven continents and place their names in the correct areas.
2. Place an "X" to show the location of Greece.

Information/Interpretation: *Map of Europe Showing Longitude and Latitude

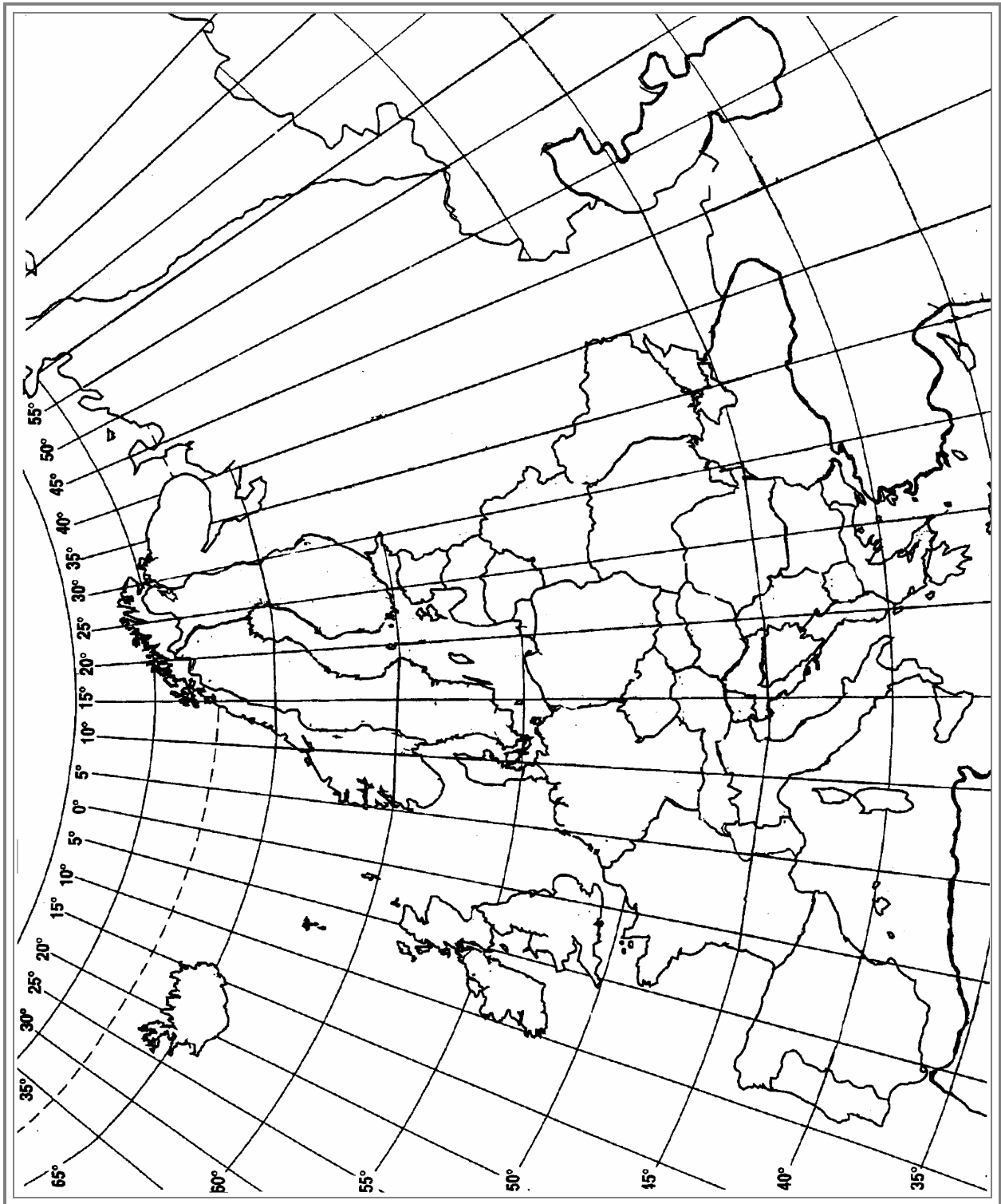
1. On the Map of Europe place a
 - "T" for the location of Thrace 42°N, 23°E
 - "L" for the island of Lemnos 40°N, 25°E
 - "C" for the island of Crete 35°N, 25°E

*Both maps are from Milliken Map Skills 7-9 (reproducible pages) p.1a and 2a
Milliken Publishing Company, 1100 Research Blvd, St. Louis, MO 63132

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Appendix

National Education Standards Encompassed by this Package

(The following National Standards pertain to "Legends of the night sky: Orion", covers grades K through 8.)

Geography:

1. How to use maps and other geographic representations, tools and technologies to acquire, process and report information.
2. How to use mental maps to organize information about people, places and environments.
7. The physical processes that shape the patterns of Earth's surface.

History:

- Standard 1: Chronological thinking.
Era 1: The beginnings of human society

English Literature:

1. Students read a wide range of print and non print texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demand of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
2. Students read a wide range of literature from many periods in many genres to build an understanding of the many dimensions (e.g., philosophical, ethical, aesthetic) of human experience.
3. Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound letter correspondence, sentence structure, content, graphics).
4. Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
5. Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purpose.
6. Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and non print texts.
12. Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information).

Earth & Space Science:

Content Standard D:

As a result of their activities in grades K-4, all students should develop an understanding of:

- Objects in the Sky
- Changes in Earth and sky

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As a result of their activities in grades 5-8, all students should develop an understanding of;

Structure of the Earth System

Earth in the solar system

Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon and eclipses.

The Sun is the major source of the energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents and the water cycle. Seasons result from variations in the amount of the Sun's energy hitting the surface, due to the tilt of the Earth's rotation on its axis and the length of the day.

Math:

In grades Pre-K-2, all students should:

Number and Operations Standard:

- Understand and represent commonly used fractions, such as $\frac{1}{4}$, $\frac{1}{3}$ and $\frac{1}{2}$.

Geometry Standard:

- Find and name locations with simple relationships such as "near to" and on coordinate systems such as maps.
- Recognize and create shapes that have symmetry.
- Recognize geometric shapes and structures in the environment and specify their location.

In grades 3-5, all students should:

Number and Operation Standard:

- Develop understanding of fractions as parts of unit wholes, as a part of a collection, as locations on number lines and as divisions of whole numbers; use models, benchmarks and equivalent forms to judge the size of fractions; recognize and generate equivalent forms of commonly used fractions, decimals and percents.

Geometry Standard:

- Classify two and three dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids. Make and use coordinate systems to specify locations and to describe paths.

In grades 6-8, all students should:

Number and Operation Standard:

- Work flexibly with fractions, decimals and percents to solve problems; compare and order fractions, decimals and percents efficiently and find their approximate locations on a number line.

Geometry Standard:

- Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science and everyday life.

Pronunciation Key

Characters: "Legends of the Night Sky: Orion"

Aesop (ee-sop) the Owl	Cedalion, the guide
Socrates (soc-ruh-tez), the mouse	Heliuss (he-lee-us) the sun god
Hyrieus (hi-ree-us), a poor shepherd	Apollo (a-pa-lo), sun god
Poseidon (po-side-un), god of the sea	Gaia (gay-a), earth goddess
Zeus (zoos), god of all gods	King Oenopion
Merope, King Oenopion's daughter	Orion (oh-rye-un), the Hunter
Artemis (r-tum-us), the moon goddess sister of Apollo	
Procyon (proh-se-on), bright star in Canis Minor, Little Dog	
Sirius (seer-ee-us), bright star in Canis Major, the Big Dog	

Constellations/Stars: "Legends of the Night Sky: Orion"

Orion (oh-rye-un) the Hunter
Canis Major (kay-nis, major), the Big Dog
Sirius (seer-ee-us) bright star in Canis Major
Canis Minor, (kay-nis, minor) the Little Dog
Procyon (proh-si-on) bright star in Canis Minor
Scorpius (skor-pi-us) the Scorpion

Additional Winter Constellations/Stars in Teacher Packet

In the winter sky near Orion, the Hunter one can easily find: Taurus the Bull, Gemini, the twins, Auriga the Chariot Driver, Winter Triangle, and Winter Circle.

Additional bright stars in this area of the sky include:
Capella (ka-pel-a), in Auriga (aw-ry-ga);
Aldebaran (al-deb-a-ran) in Taurus (taw-rus) and,
Castor (kas-tor) and Pollux (pol-uks) in Gemini (jem-i-ny).

Story (Geographical) Locations: "Legend of the Night Sky: Orion"

Thrace: Region of SE Europe comprising NE Greece, S Bulgaria, and European Turkey bordered by the Black Sea in the northeast, and the Sea of Marmara and the Aegean Sea in the south.

Lemnos: An island located in the North-Eastern Aegean Sea; northeast of Athens, Greece.

Crete: An island located southeast of Greece in the E. Mediterranean Sea and marking the southern limit of the Aegean Sea.