

# The Zodiac:

Stellar Stories

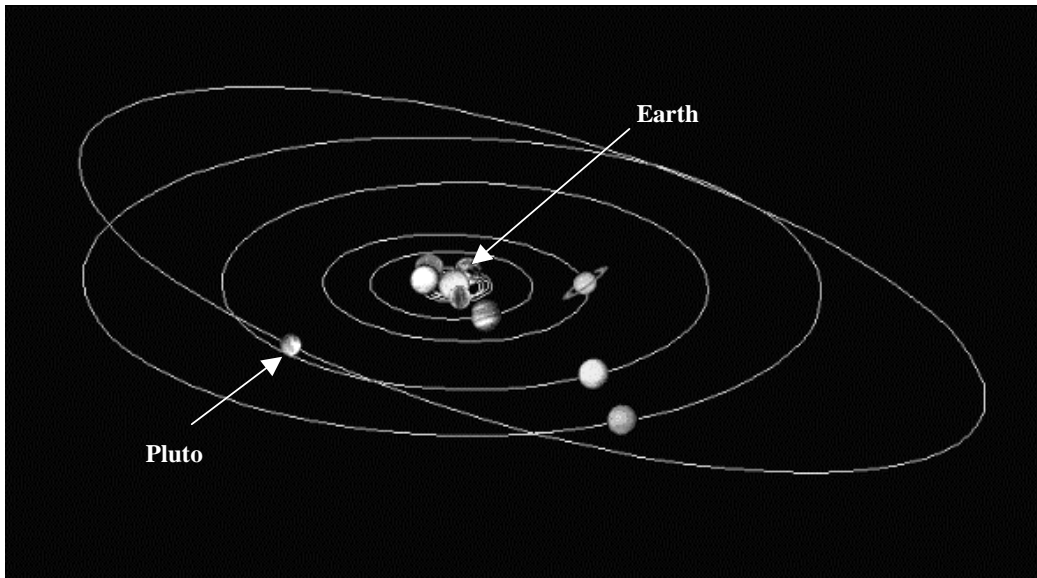
**Presented by the Rhodes University  
Astronomy Society**

Compiled by Richard Johnson and Gregory van Berkel

## **Introduction:**

Our earth is a ball of rock and water floating in the void of space. We orbit the sun about 150 million kilometers out, inclined at 23.45 degrees to the plane of our orbit.

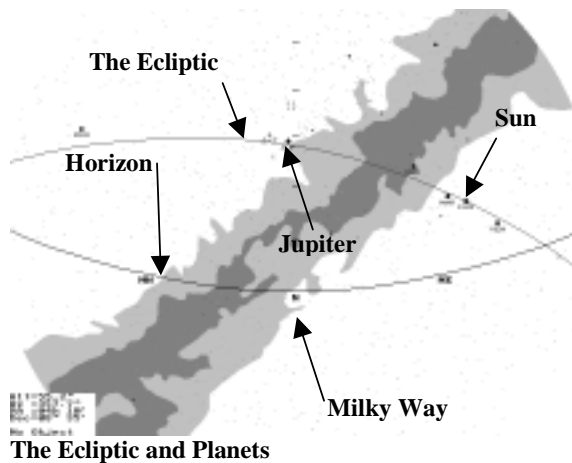
It's easier to see in pictures:



**The orbits of the planets**

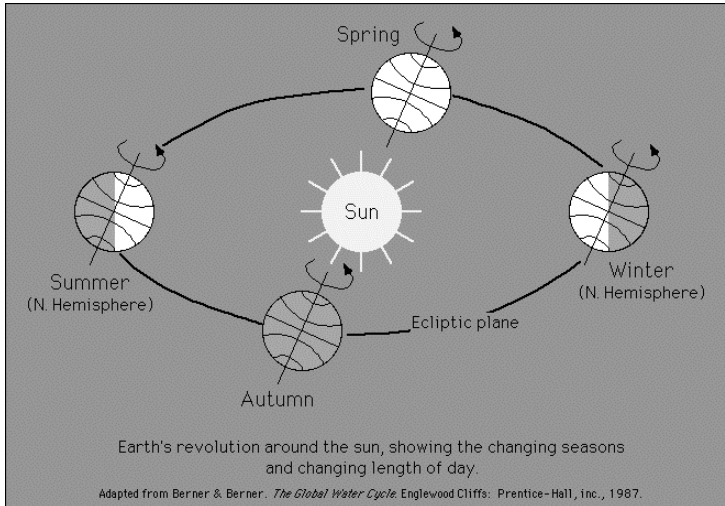
The inner planets (Mercury, Venus, Earth and Mars) appear very close to the sun on this scale. Note how almost all the planets (with the exception of Pluto) lie on a single plane. The moon of the earth lies along the plane too, orbiting the earth.

Because they lie on a single plane, the planets, the sun and the moon appear to travel through the night sky along a single line. This line we call the ecliptic.



**The Ecliptic and Planets**

This tilt on our axis creates the different seasons – when the Southern Hemisphere is closest to the sun, it is summer in the Southern Hemisphere. When it is farthest, it is winter.



### The Seasons and the Inclination of Earth

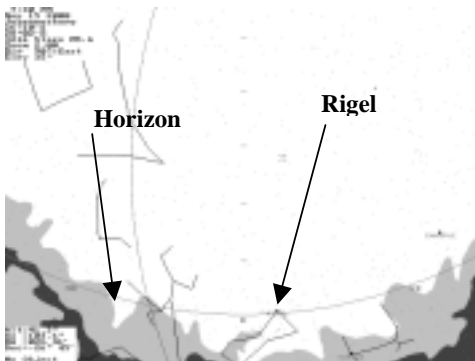
The earth spins around on its axis, like a giant top. This spin creates our day and night.

We are accustomed to thinking of one day as 24 hours long. This is almost right. The earth actually completes one “spin” in 23 hours, 56 minutes and four seconds long (to be exact!)

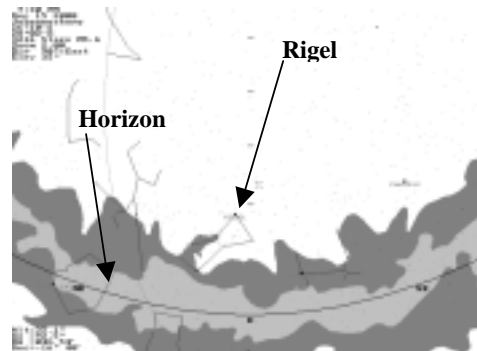
This period is referred to as a sidereal day – a day as measured by the stars. The average solar day (as measured by the sun) is about 24 hours long, changing in apparent length during the year. So we keep in synch with a 24 hour clock – some “days” are longer than 24 hours, some are shorter.

The spin of the Earth causes the apparent motion of the sun and the stars across our sky.

A sidereal day is the time taken for a star to “move” from its position, “travel around the earth,” and get back into position. Thus a star is in exactly the same position, relative to an observer, one sidereal day later. This changes the rise and set times of a star relative to an observer.



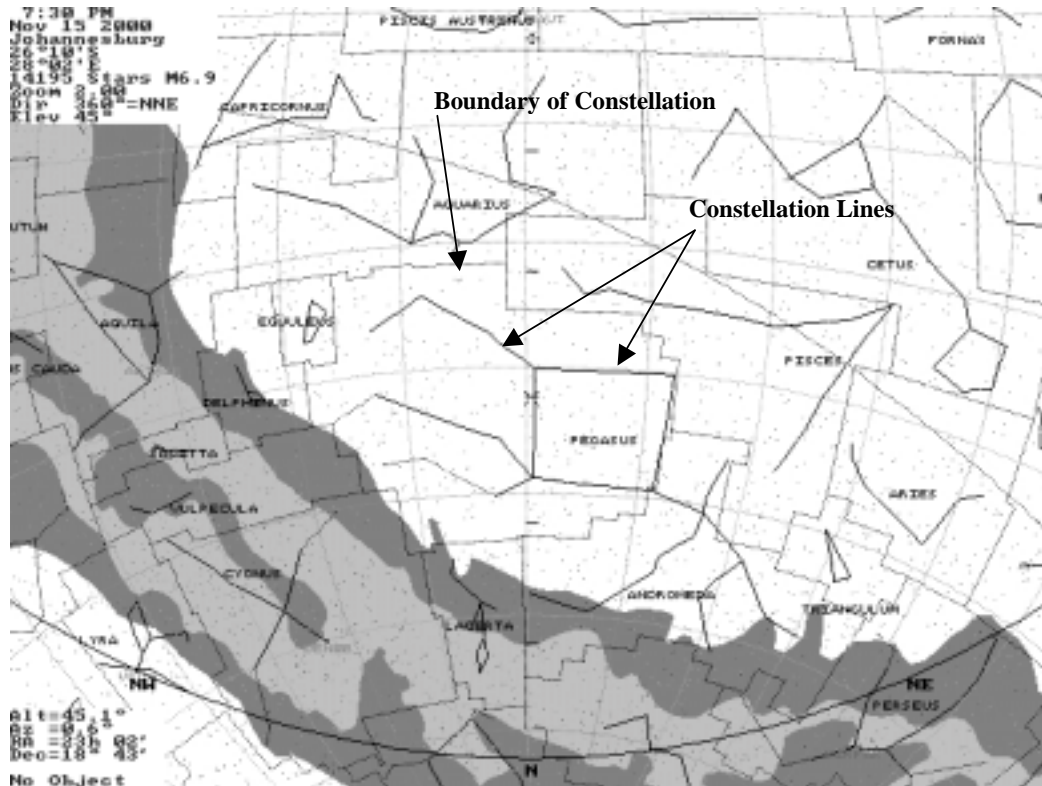
The sky above Johannesburg on Nov 05, 2000. The time is 7:30pm and we are looking east. The brightest star in Orion, Rigel, has not yet risen above the horizon.



The sky above Johannesburg, one month later (Nov 05, 2000, 7:30pm.) Rigel is now above the horizon at this time of the night.

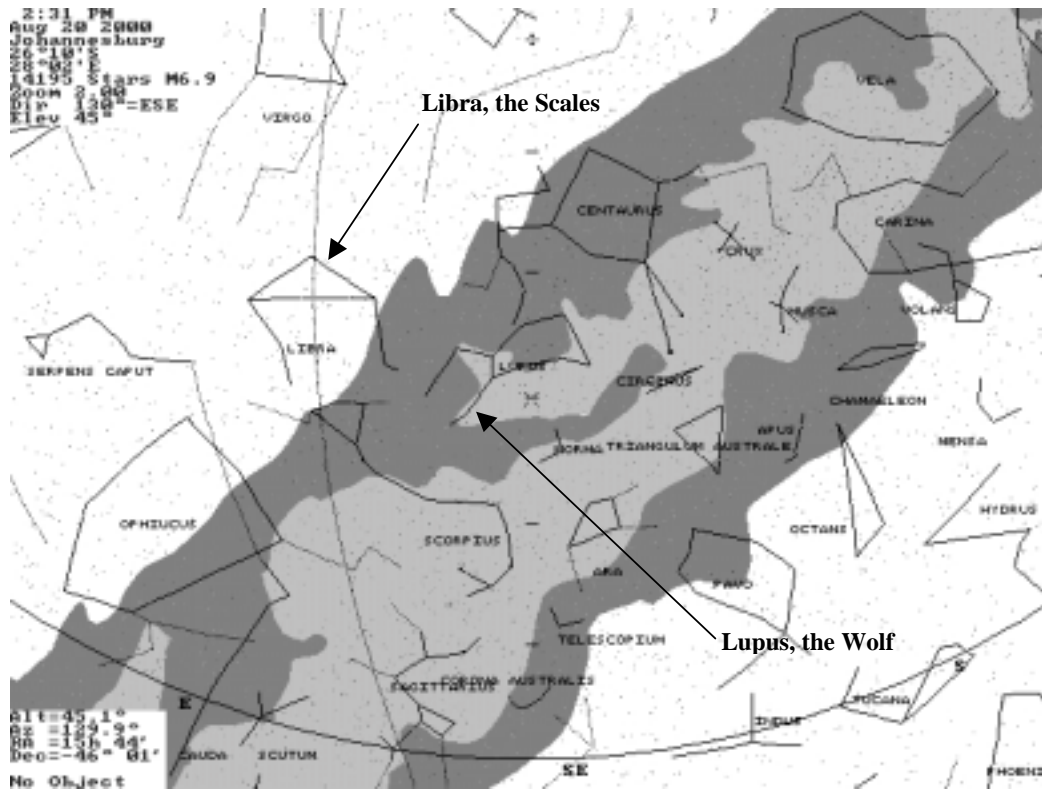
## Constellations:

The whole of the observable sky (also called the Celestial Sphere) has been divided up into 88 areas. Every star, galaxy and other stellar object lies in a constellation. These boundaries were established unambiguously by the International Astronomical Union in 1930.



**Some Constellations and their Boundaries**

Originally, the constellations had no fixed limits, but were groups of stars considered by ancient civilizations to lie within imagined outlines of mythological heroes, animal etc. The names and figures change, but there is remarkable similarity in the images seen by various cultures.



**Constellation lines**

The number of constellations observable on any night is dependant on the observer’s position on the earth, and the length of night. Stars can only be seen when they are above the observer’s horizon during the evening, stars rising on average about 2 hours earlier each month.

Each of the constellations is named in Latin, such as Ursa Major or Lepus. When referring to a star, we use either the common name (such as Canopus or Spica) or refer to the star using its Greek letter or number, and the genitive case of the constellation name (such as Alpha Ursae Majoris or Beta Orionis.)

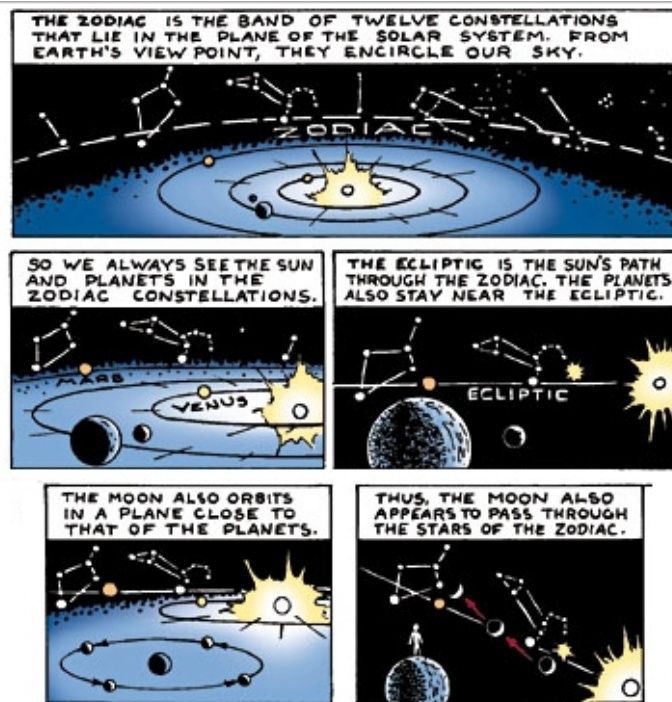
It is important to note that the images formed by the constellations are imaginary. Also, the stars do not usually have any sort of association in space. The simple two-dimensional view that we have of the sky is misleading – the stars in a constellation are usually widely separated in three dimensions. Some of the stars may be close to earth, others much farther away, but all the stars appear projected onto the two-dimensional plane of the sky above us.

## The Zodiac

The word “Zodiac” derives from Greek, meaning “Circle of Animals.”

Of the 88 constellations, 12 are considered to be the constellations of the zodiac. These are the signs that appear to lie along the ecliptic, the path of the sun and planets through the sky. There are actually 13 signs along the ecliptic – the position of the ecliptic through the sky changes due to a phenomenon known as precession. The current ecliptic includes Ophiucus, but this is not counted as a Zodiacal constellation.

A picture makes it clearer:



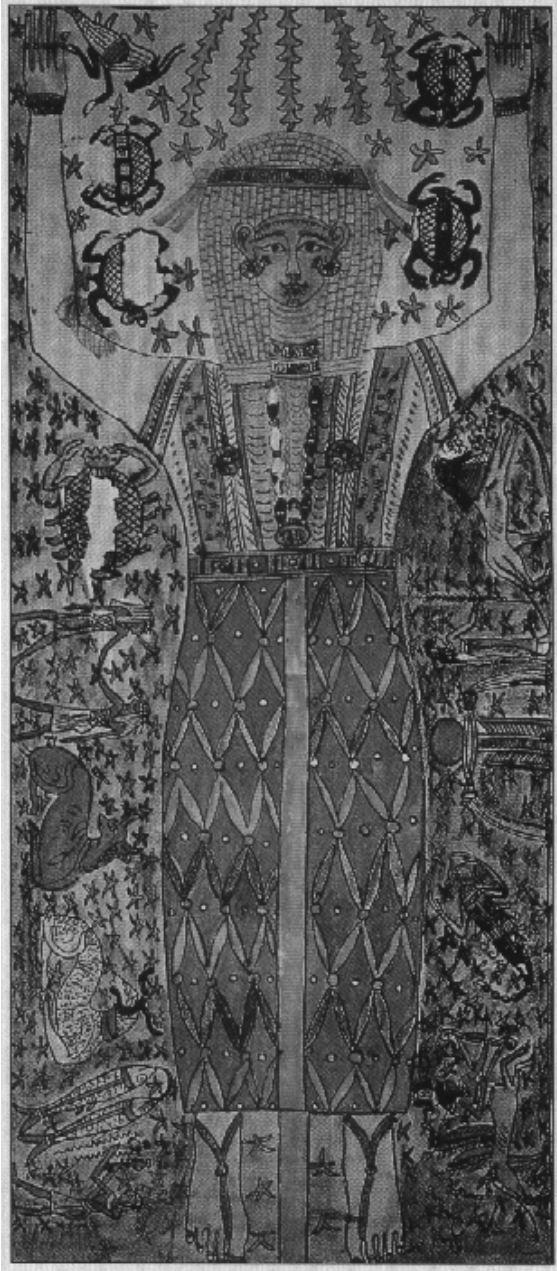
Adapted from Sky and Telescope

### **The origin of the Zodiac:**

Astronomers have long searched for the origins of the Zodiac. Pierre-Simon de Laplace, at the beginning of the 19<sup>th</sup> century, declared: “The names of the zodiacal constellations were not haphazard fancies. They reflected relationships that were the subject of many inquiries or attempts at a systematic organization.” He suggested that some of the signs were connected with the motion of the sun, while others marked the seasons. For example, Libra marks the balance of day and night at the equinox – when the day and night are of equal length. Some constellations were certainly named due to their outward appearance – signs like Scorpio, whose shape is very suggestive of that creature. These facts indicate that the ancients wanted to place markers in the sky, and used images from their culture to do so.

Researches gradually recognized that our star signs were inherited through a long line of ancestry – stretching from the Romans back to the Greeks, and the Babylonians. The Babylonians, it would appear, inherited their signs from the ancient regions of Sumer and Akkad. It has been suggested that the Zodiac is even older, with some scholars placing the origin of the zodiacal signs around or before 4000 B.C.

The names and shapes of the constellations have proven remarkably stable over the centuries. Various Christian authors attempted to re-assign the stars to fit biblical stories. Yet the original names and shapes survived. Below is an image of the Egyptian goddess Nuth, surrounded by the 12 signs of the zodiac. The 12 figures are recognizable. This image is from the second century AD.



## The 12 signs:

Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Sagittarius, Capricorn, Aquarius and Pisces. A nifty mnemonic to remember them by is: A Tall Gentleman Called Leo Very Likely Stole Some Cream And Partook. It didn't make any sense to me either.

Constellation	Abbreviation	Genitive Form
Aries	Ari	Arietis
Taurus	Tau	Tauri
Gemini	Gem	Geminorum
Cancer	Cnc	Cancri
Leo	Leo	Leonis
Virgo	Vir	Virginis
Libra	Lib	Librae
Scorpius	Sco	Scorpii
Sagittarius	Sgr	Sagittarii
Capricorn	Cap	Capricorni
Aquarius	Aqr	Aquarii
Pisces	Psc	Piscium

**Table 1:** Zodiacal Signs, their Abbreviations and Genitive Forms:

We're going to review their mythology, their shapes and the configuration of their stars. We'll also point out some of the more interesting stellar objects visible within their boundaries, including prominent stars, clusters and nebulae. We have restricted ourselves to objects that are visible with the naked eye or a pair of binoculars/small telescope.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ari	Tau	Gem	Cnc	Leo	Vir	Lib	Sco	Sgr	Cap	Aqr	Psc

**Table 2:** Viewability – best constellation of each month.





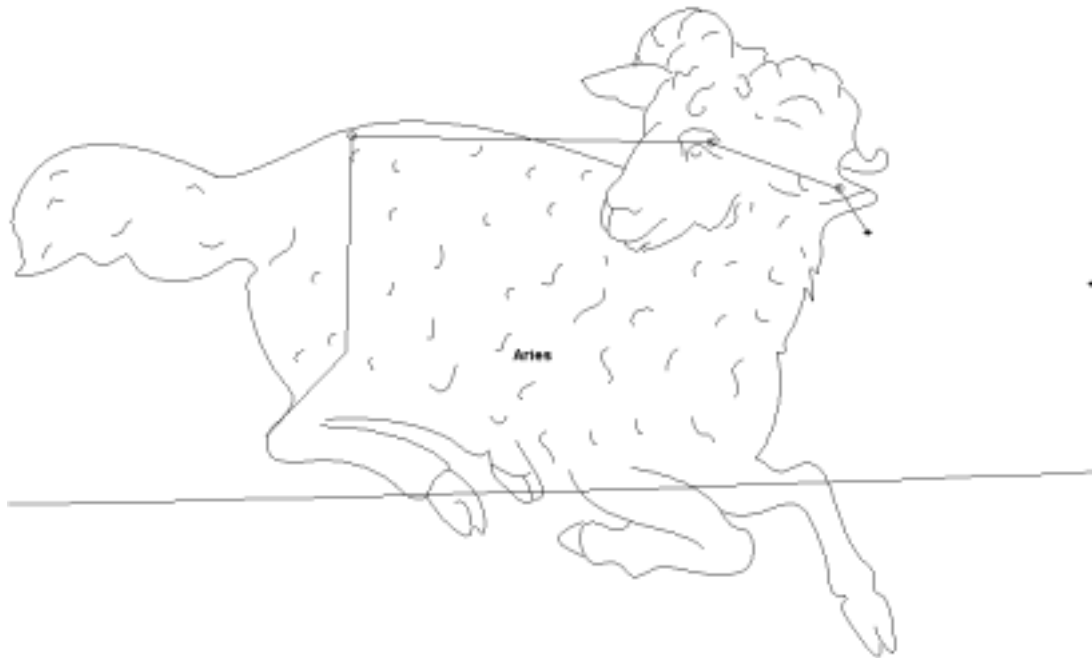
## Aries: The Ram

### Mythology:

In ancient Egypt, the Sun god Amun-Ra had the body of a man and the head of a ram.

In ancient Greece, the ram was associated with the Golden Fleece that Jason and the Argonauts searched for. In ancient Rome, Aries was referred to as *Princeps Signorum Coelestium*, "the indicator of the first day of Spring."

In ancient times, the Sun stood in Aries on the vernal equinox. This explains the association of the constellation with Sun gods and gold.



**Stars and Interesting Objects:**



**Stars:**

**$\gamma$  Arietis – Mesarthim:** a visual binary star. Also known as “the Fat Ram” and “The First Star in Aries”

**Deep Space Objects:**

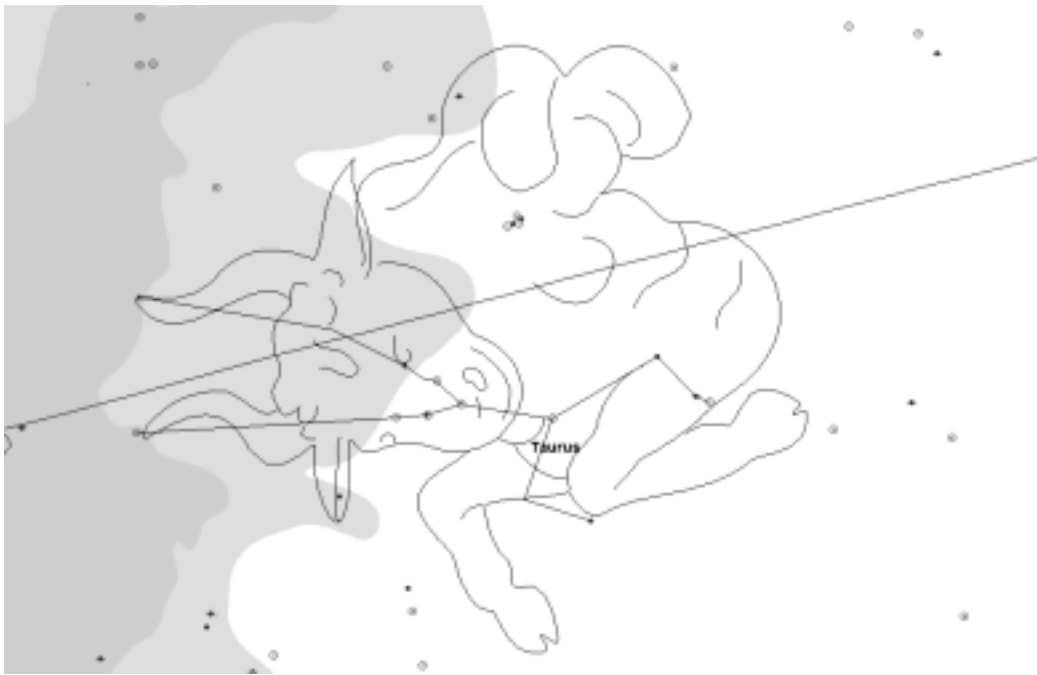
Nothing that is easily visible.



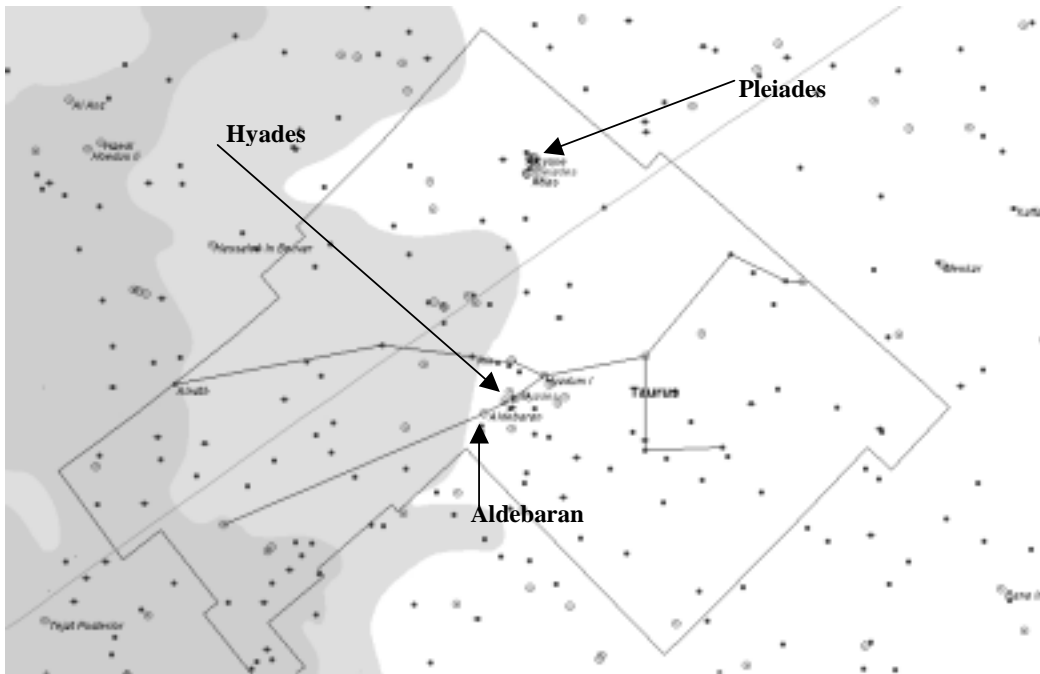
## **Taurus: The Bull**

### **Mythology:**

Taurus, the bull is a very ancient constellation. He was the Sumerian and Babylonian bull god, the Great bull god of Minoa, the Egyptian Apis, the Greek Minotaur, and Mithras the Persian (and later Roman) Sun God. The Romans also saw Bacchus represented in Taurus, (a bull was always decorated with flowers during the Bacchanalia processions).



### Stars and Interesting Objects:



### Stars:

**Aldebaran:** The brightest star in the constellation. Its Arabic name means "the follower". Aldebaran is a giant star of magnitude 0.9.

### Deep Space Objects:

**Pleiades:** An open cluster of stars, clearly visible to the naked eye. It is estimated to contain between 300 and 500 members within a sphere 30 light years across, and is 400 light years away. The stars are embedded in a reflection nebula of cold gas and dust that appears blue in colour photographs. The cluster is young by astronomical standards, about 50 million years old, and contains some very massive bright stars. The popular name for the Pleiades is the Seven Sisters, but most people are able to distinguish only six stars with the naked eye.



**Hyades:** An open star cluster. Its members appear to be scattered around the star Aldebaran (which does not itself belong to the cluster but is in the foreground), over an area 8° in diameter. It is the nearest star cluster, lying at a distance of about 150 light years. Because it appears so scattered, it was not listed in either the Messier Catalogue or the New General Catalogue.



## Gemini: The Twins

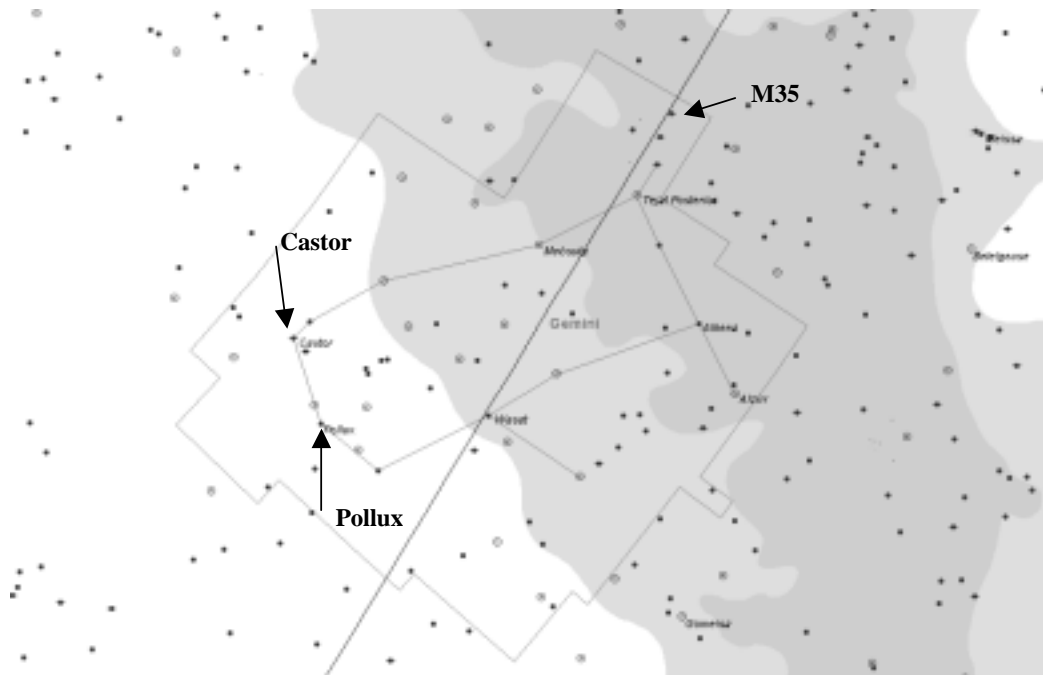
### Mythology:

Twins are a powerful symbol in many cultures, relating in some ancient myths to the children of the supreme Sun god and the beginning of any important cycle. The sign can be seen as a symbol of renewal

Greek and Roman: The Twins are Castor and Pollux, represented by the two brightest stars in the constellation. Castor and Pollux were seafaring warriors who protected the ship Argo on its quest for the Golden Fleece. They were considered as protectors of sailors. The twins were also seen to represent a man and a woman, two inseparable lovers.



### Stars and Interesting Objects:



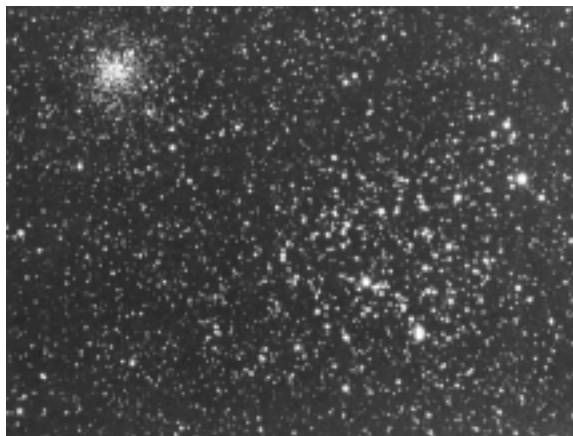
### Stars:

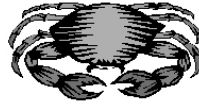
**Pollux:** The brightest star in the constellation. It was nevertheless given the Bayer letter Beta rather than Alpha. It seems unlikely that Pollux has brightened since Bayer's time (1572-1625). Pollux is an orange-coloured, giant K star. Castor and Pollux were the twin sons of Leda in classical mythology.

**Castor:** The second-brightest star in the constellation. Its magnitude as seen by the naked eye is 1.6, but this is the combined brightness of a multiple system with at least six components. There are two A stars of magnitudes 2.0 and 2.9 forming a close visual pair, each of which is a spectroscopic binary, and a more distant ninth magnitude red star, which is an eclipsing binary.

### Deep Space Objects:

**M35:** An open cluster, magnitude 5.1.

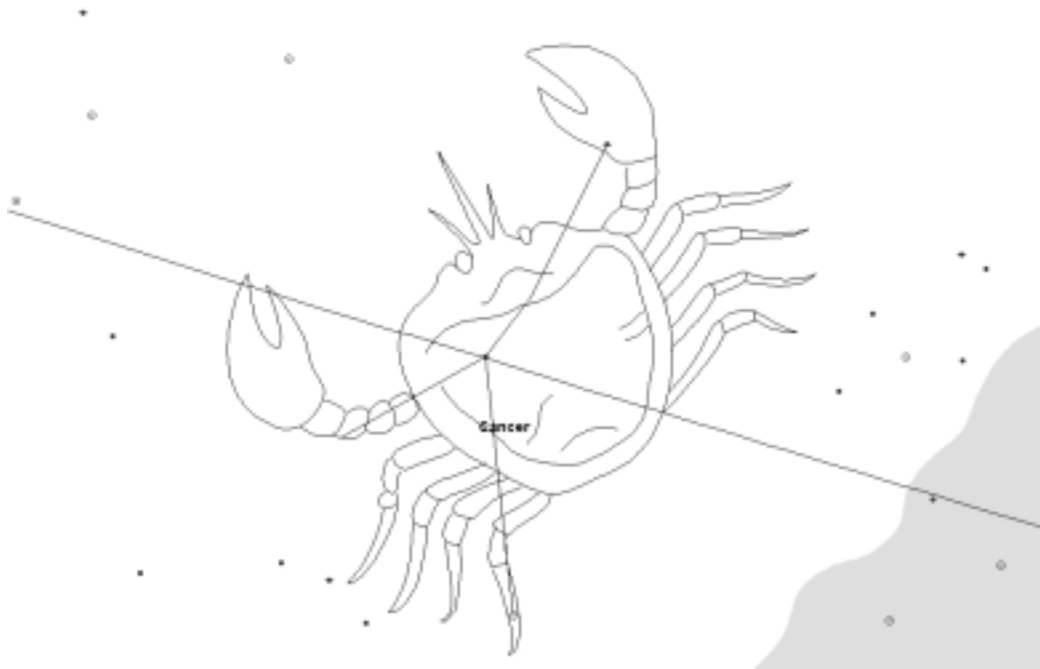




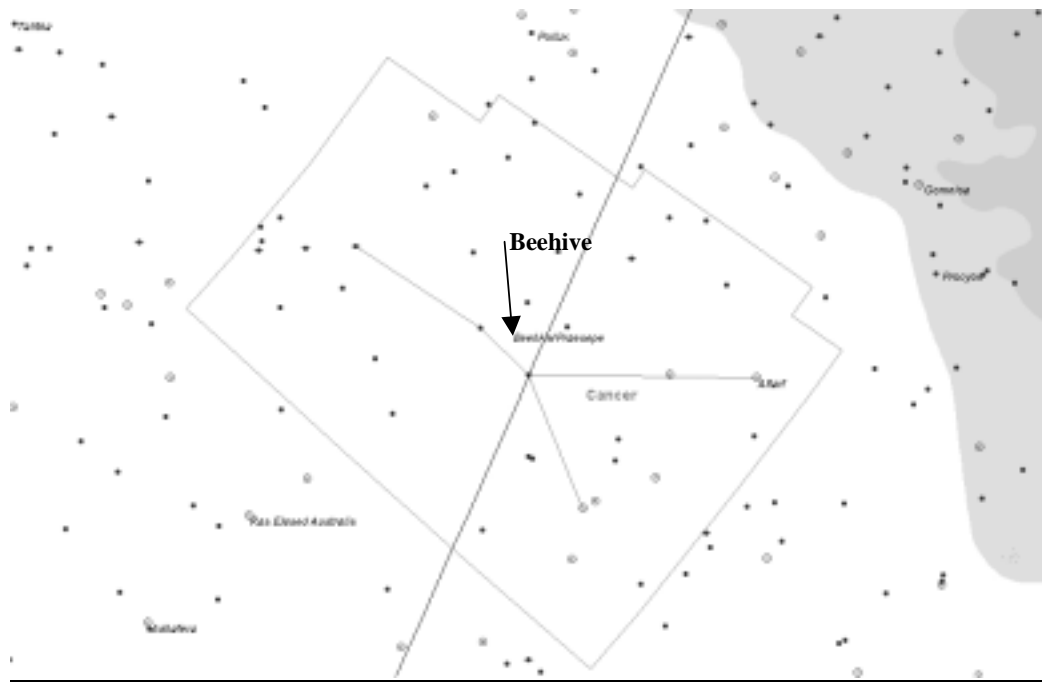
## **Cancer: The Crab**

### **Mythology:**

Cancer, the Crab was seen as the scarab beetle god, Khepri by the ancient Egyptians. The scarab was sacred, as it was responsible for rolling the Sun across the sky, just as an actual scarab beetle rolls dung balls over the ground. The Greeks first saw Cancer as a Turtle, then later as a crab. This constellation was first associated with the Sun on the Summer Solstice. It was later associated with the Moon in Alexander the Great's time.



**Stars and Interesting Objects:**



**Deep Space Objects:**

**beehive cluster:** Also known as Praesepe . An open cluster of stars lying at a distance of 500 light years. Its brightest stars are about sixth magnitude, and more than 200 members are known. In many ways it is similar to the Hyades, even sharing the same direction and speed of motion through space; this suggests that the two clusters originated in the same interstellar cloud.

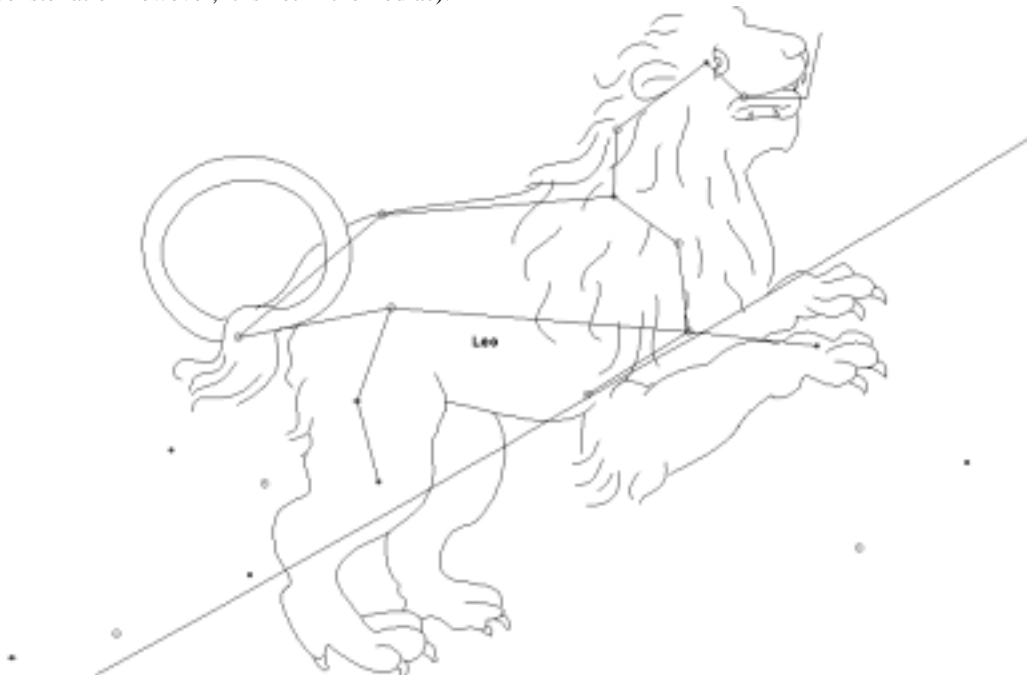




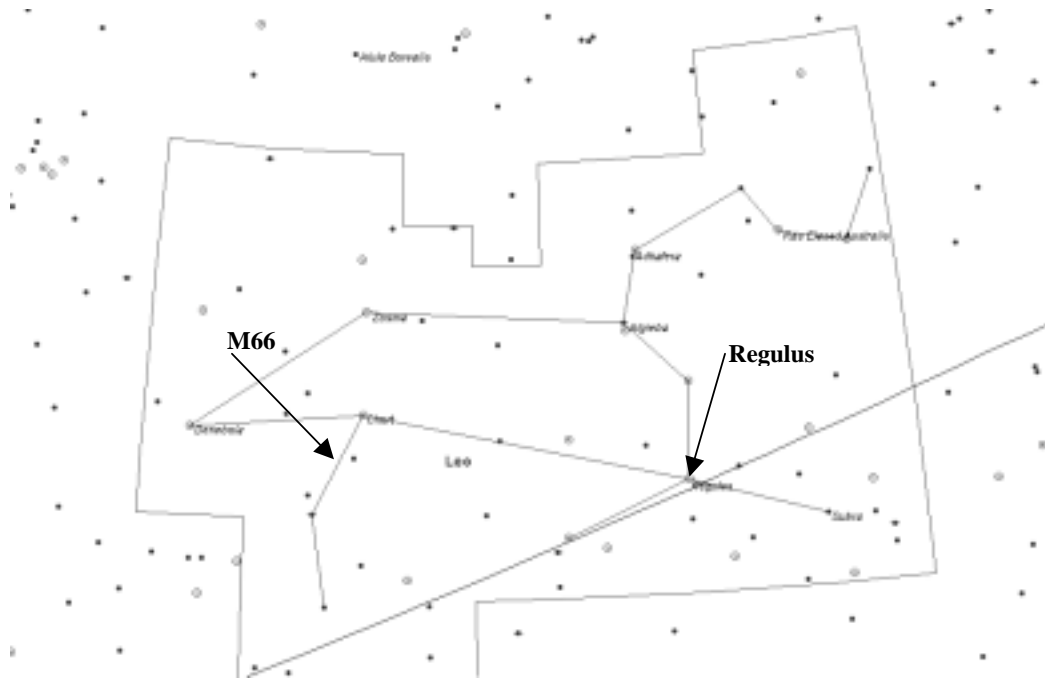
## Leo: The Lion

### Mythology:

Leo, the Lion was the sacred beast of the Sumerian goddess, Inanna. The Babylonians saw the constellation as a great dog, a watch dog and protector of herdsman and caravans. The Egyptians associated Leo with the heliacal rising of the sacred star Sirius, a portent of the coming Nile flood of summer. The Sphinx had the body of a lion, and the head of a man, while the goddess Sekhmet had the body of a woman and the head of a lion. The Egyptian Sphinx was a protector. The Greek Sphinx had the body of a dog, the paws of a lion, and the head of a woman. She was a treacherous beast. Hercules battled the lion for one of his twelve labours; (Hercules is also a constellation however, it is not in the Zodiac).



**Stars and Interesting Objects:**

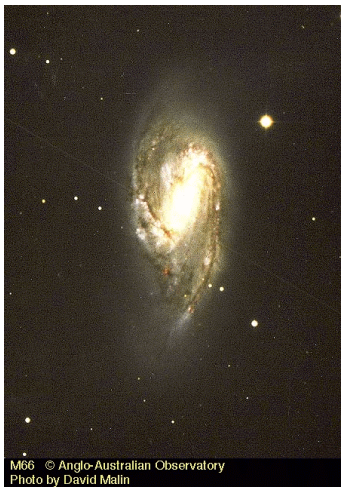


**Stars:**

**Regulus:** A bluish-white star, the brightest in the constellation.

**Deep Space Objects:**

**M66:** A very faint spiral galaxy (magnitude 8.9.)





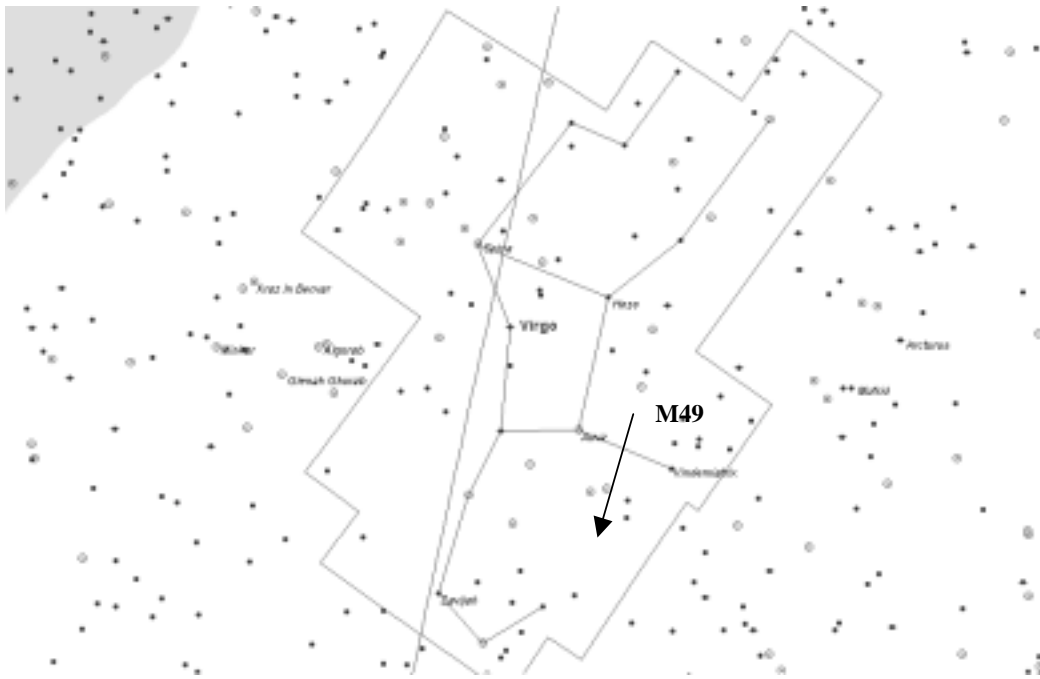
## Virgo: The Virgin

### Mythology:

Virgo, the Virgin or Maiden was seen by the Sumerians as the goddess Inanna, to the Babylonians she was Ishtar, and the Canaanites saw her as Ashtoreth. She was Isis to the Egyptians, holding a child in her lap. The Greeks saw her as both the mother and grain goddess Demeter, and her daughter, Persephone. Spica, the brightest star was seen as a sheaf of grain – hence the name. The Romans saw her as Proserpina, but also as Astrea, goddess of Justice, holding the scales of adjacent Libra in her hands. Virgo is very much a symbol of fertility.



**Stars and Interesting Objects:**



**Deep Space Objects:**

**M49:** An elliptical galaxy

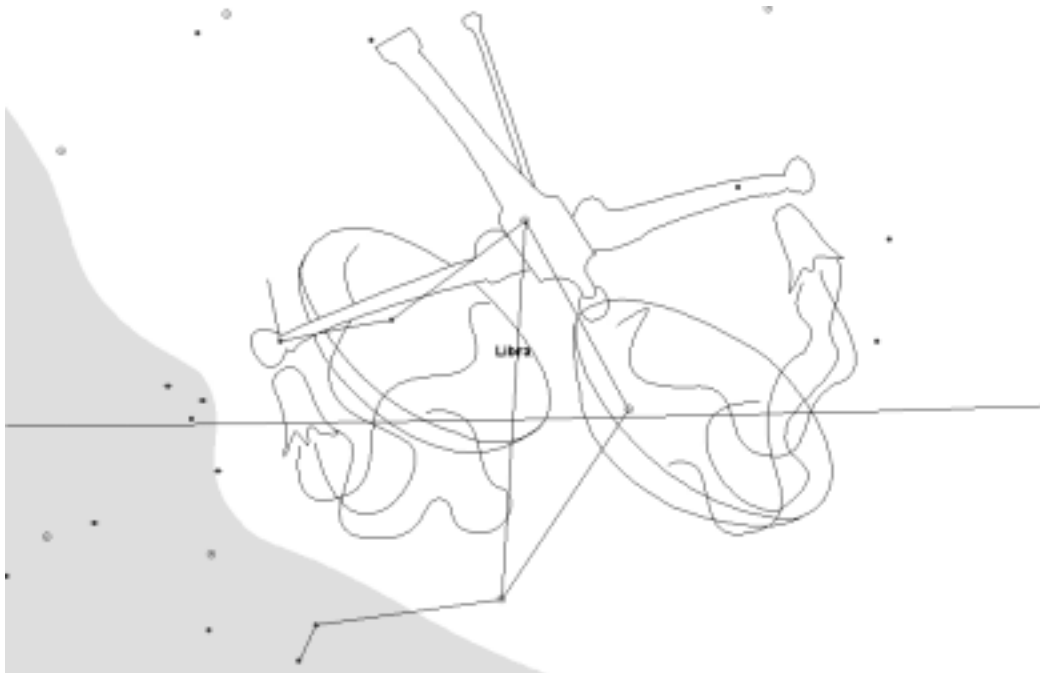




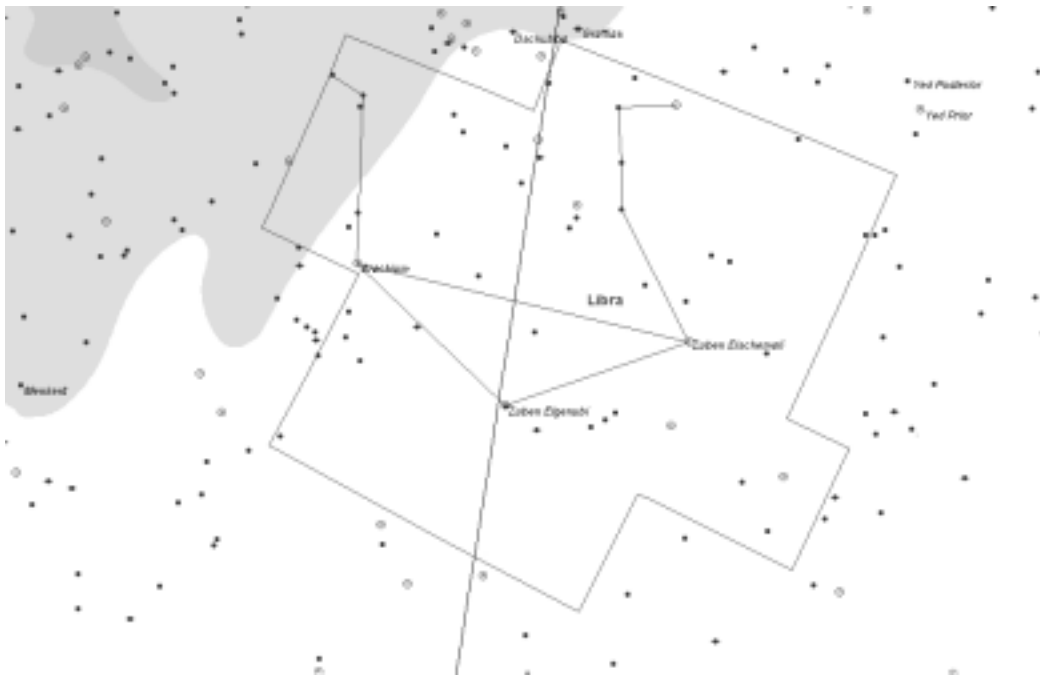
## Libra: The Scales

### Mythology:

Libra may have represented scales or a balance as early as the time of ancient Sumeria, as the Autumnal Equinox, when day and night are balanced, occurred when the Sun was in Libra at that time. However, the stars of this constellation were often blended with those of adjacent constellations. The ancient Egyptians, for a time began their year on the Autumnal Equinox, and saw the pattern of the Divine Child, Osiris, next to his mother Isis (Virgo).



**Stars and Interesting Objects:**

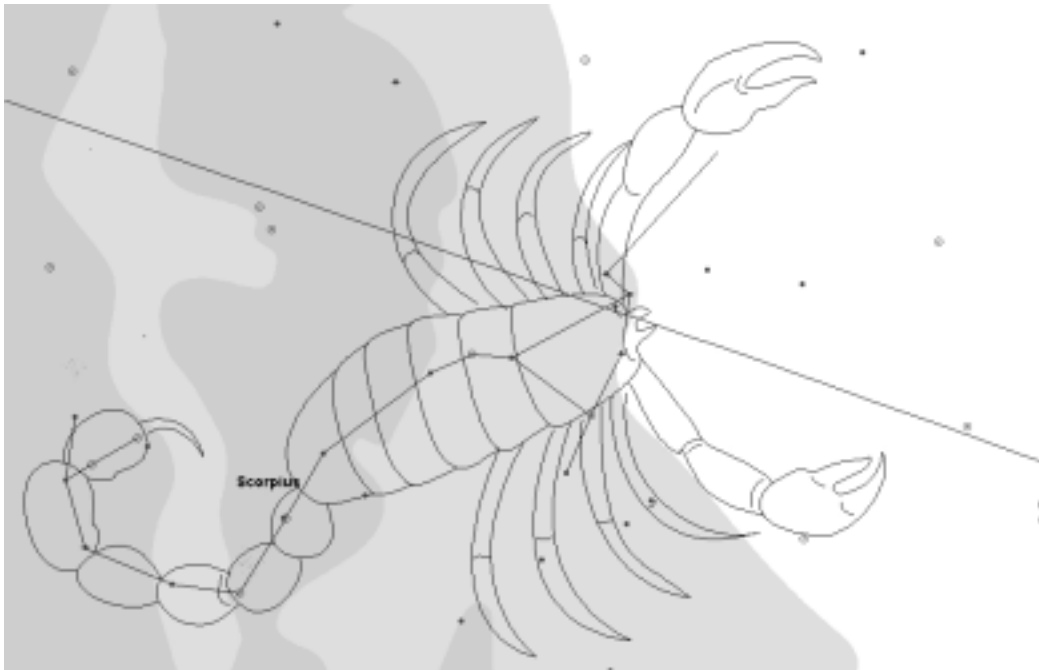




## Scorpius: The Scorpion

### Mythology:

The Scorpion was first seen as a serpent by the ancient Egyptians, but the constellation had become a scorpion by the Ptolemaic period. The scorpion was associated with the Egyptian scorpion goddess Selket, a goddess of magic, medicine, and the afterlife. She was a psychopomp, or guide of souls into the afterlife. The association of the Scorpion with the afterlife is a very ancient one. The ancient Sumerians saw the scorpion as a guardian of the underworld, and believed that scorpion-men guarded the distant mountains which led to the gates of the underworld. The Scorpion rises early in the evening at the onset of summer; an association with heat, dryness, and the desert. The Scorpion contains one of the brightest stars in the Zodiac, the red giant, Antares, also seen as a sign of scorching heat in the night sky.



### **Stars and Interesting Objects:**

This constellation lies in the band of the milky way, and because of this contains many interesting objects.



### **Stars:**

**Antares:** A red supergiant, conspicuous in the night sky. Its red colour and its position on the ecliptic led to it being often mistaken for Mars, which appears similar. Hence the name “Antares” which means rival of Mars.

### **Deep Space Objects:**

**M4:** A globular cluster, magnitude 5.9.





**M7:** An open cluster





## Sagittarius: The Archer

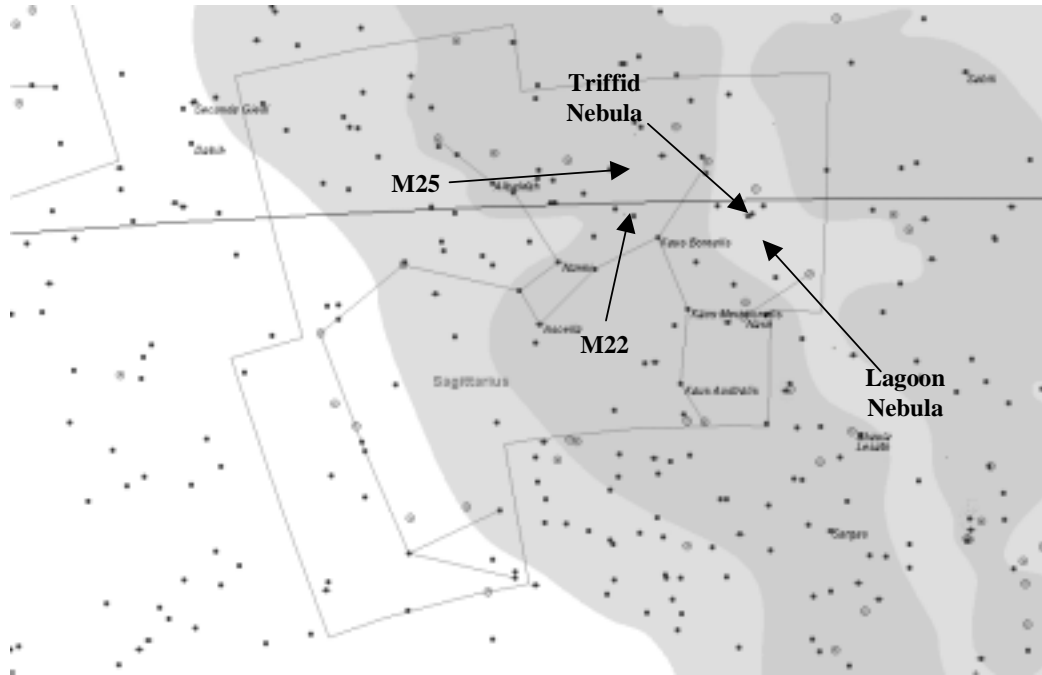
### Mythology:

Sagittarius, the Archer is next to the Scorpion. This association may have carried over to this constellation. The Sumerians believed that the scorpion men who guarded the distant mountains were fierce archers. Babylonians and Assyrians associated Sagittarius with Nergal, a wrathful, archer-hunter god. The ancient Greeks saw him as a satyr, half man, half goat, and the Romans saw him as Chiron, the wise and gentle Centaur who was Jupiter's half-brother. The easiest pattern to recognize in the constellation's brightest stars is that of a teapot, thus leading to the constellation's modern nickname.



**Stars and Interesting Objects:**

The center of our milky way galaxy lies in the direction of Sagittarius.



**Deep Space Objects:**

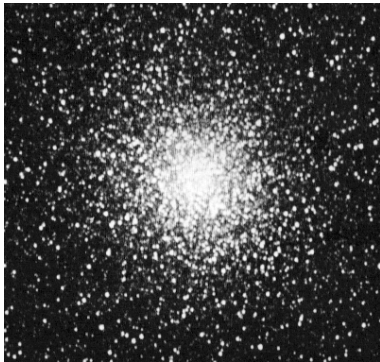
**The Lagoon Nebula:** glows with the red light of hydrogen (H-alpha) excited by the radiation of very hot stars buried within its centre. Deep within the cloud, dark filaments of obscuring matter emit strong, infrared radiation. Several peculiar variable stars in the nebula occasionally flare up, increasing in brightness to some 25 times their normal luminosity. The nebula is at a distance of 6,500 light years and has a 60 light year diameter.



**M25**, a small open cluster.



**M22**, a globular cluster.

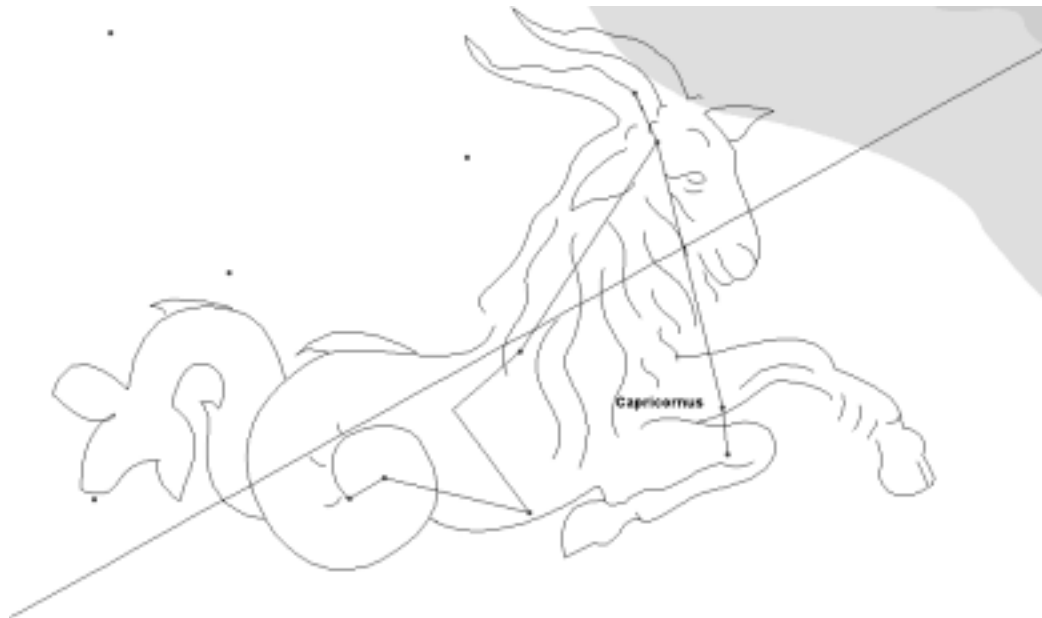




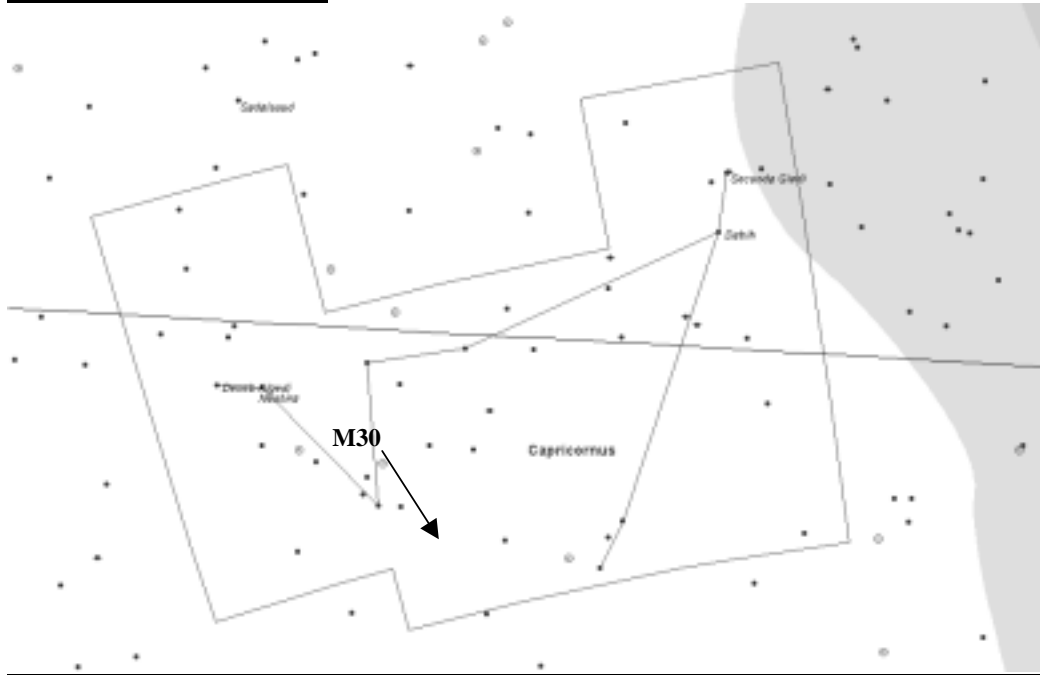
## Capricorn: The Sea Goat

### Mythology:

Capricorn (Capricornus), the Water Goat or "Goat-Fish" begins the "watery" portion of the Zodiac, three constellations associated with water, the Water Goat, the Water Bearer, and the Fishes. The ancient Babylonians saw the constellation as representing Ea, the fish-god who they also associated with an antelope. Earlier, the Sumerians had seen these stars as Enki, their river god. He was the ruler of the waters of the Euphrates. The Assyrians saw him as half fish, half man, Oannes, god of wisdom. The Egyptians associated the constellation with the Nile. The ancient Greeks first saw these stars as Pan, half man, half goat, and all boisterous, mischievous, and lustful. He was also seen as the Anatolian and Roman phallic god Priapus, with the head of a man, the forebody of a goat, and the hind portion of a fish; the fish portion being symbolic of a huge erect phallus, making up a large part of his body. He is thus associated with fertility, (the horns of the goat are also a fertility symbol). Capricorn has also been associated with the darker side of human nature. The Tropic of Capricorn lies in the southern hemisphere, (the "dark hemisphere") and the Sun lies in Capricorn during the "dark" season of Winter. The constellation has also occasionally been with the Devil because of these traits; (a further association with the Devil is the horns and cloven hooves of the goat).



**Stars and Interesting Objects:**



**Deep Space Objects:**

**M30:** A globular cluster.





## Aquarius: The Water Bearer

### Mythology:

Aquarius, the Water Bearer is a very old constellation that has consistently maintained this theme across many cultures. It should be noted that the Sun is in this constellation during Winter, the typical rainy season in the Mediterranean and Near East, (not Egypt), a time when water "pours forth" from the sky. In Mesopotamian cultures, the constellation was seen as an overflowing or upset urn of water. Even though the Nile is not in flood when the Sun is in Aquarius, the Egyptians associated the constellation with the Nile, perhaps because the constellation is up at night during late Summer when the Nile is in flood. To the Greeks, Aquarius was variously seen as both Ganymede, the young male cupbearer of Zeus, and as Hebe, the young female cupbearer who was also the daughter of Zeus and Hera. The analogy was continued by the Romans.



**Stars and Interesting Objects:**

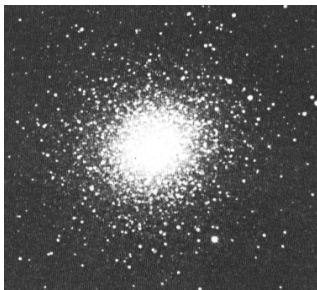


**Deep Space Objects:**

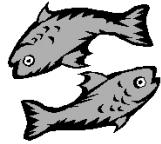
**Helix Nebula:** A large, ring-shaped planetary nebula in the constellation Aquarius. Its apparent diameter is a quarter of a degree (half the size of the full Moon) and, at a distance of about 500 light years, it is the nearest planetary nebula.



**M2:** A globular cluster.



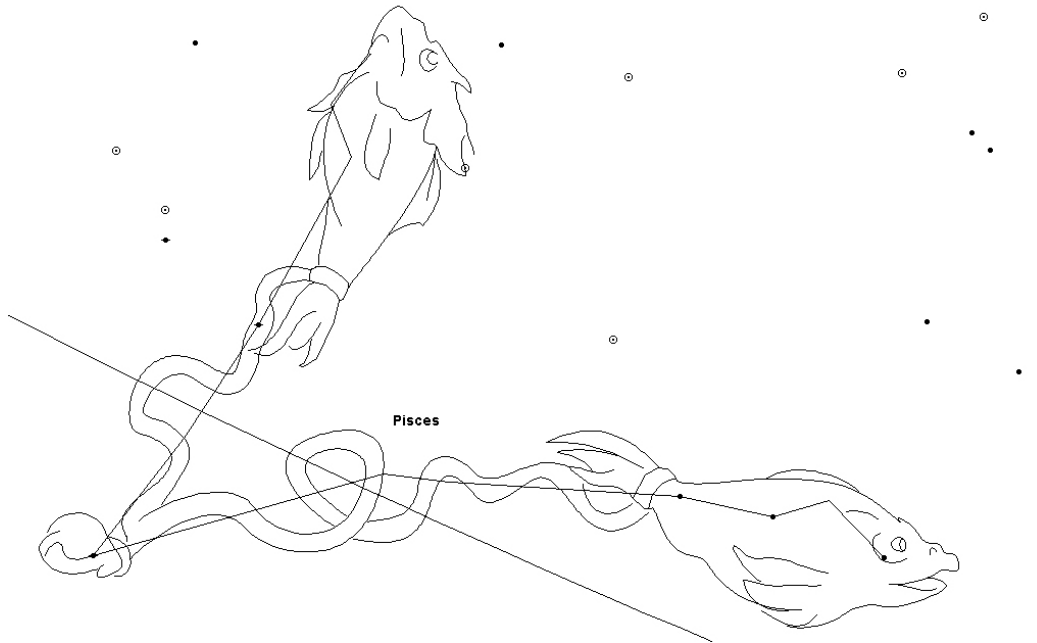




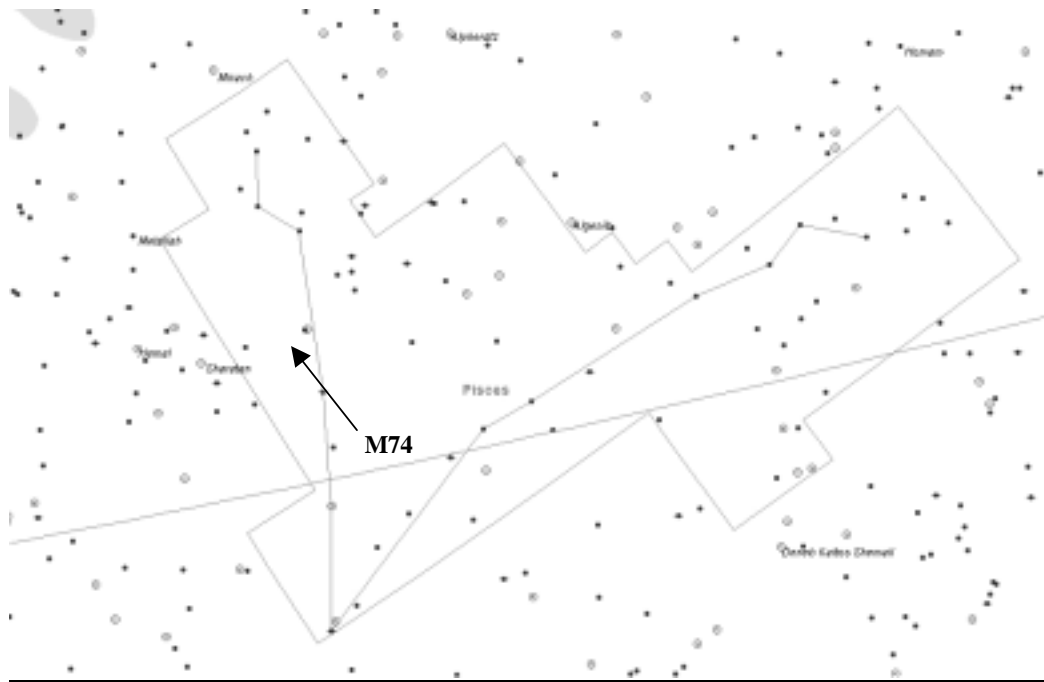
## Pisces: The Fish

### Mythology:

Pisces, the Fishes are usually symbolized as two fish, chained together. The constellation is often associated with love, Both the ancient Greeks and the Romans felt that this constellation represented Aphrodite and her son Eros (Venus and Cupid). The symbolism can be interpreted as that of mother and son, and the love that binds them. It can also represent, a less familial, more sensuous or erotic form of love. The fish was a symbol of this aspect of Aphrodite in ancient times. Lastly, Christians associate this constellation with Jesus Christ, a fisherman who preached love of fellowman. The "Christian Era" has coincided with the "Age of Pisces."



Stars and Interesting Objects:



Deep Space Objects:

M74: A spiral galaxy.



## **References:**

The Signs and Constellations of the Zodiac.

<http://www.louisville.edu/~aoclar01/ancient/astronomy/zodsigns.htm>

An excellent site.

Gurshtein, A. "When the Zodiac climbed into the sky," Sky and Telescope, October 1995.

Redshift 3, Maris Multimedia

The Constellations and their Stars.

<http://www.astro.wisc.edu/~dolan/constellations/>

Charles Messier's Original Catalog

<http://seds.lpl.arizona.edu/messier/xtra/history/m-cat.html>