The Outdoor School
Adventures in Learning

ASTRONOMY HANDBOOK



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Section 1 – The Night Sky

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Teaching Astronomy

Most schools that come to TOS like to take astronomy. It's a great opportunity for the kids to sit quietly, look at stars and planets that they may not be able to see in a town or city, and listen to myths and legends about the night sky. This information offers a good foundation to astronomy. Please read it and absorb as much as you can before you arrive. During training we will concentrate on learning constellations and the stories associated with them.

Astronomy lasts an hour-and-a-half. We will usually start off with a few games (which we will also show you during training) to burn off some of the kids' energy, and to wait for it to get dark. Once the stars come out, you will gather your team and find somewhere around camp to look at the night sky. After the games portion, you'll have about an hour to spend with the kids. Enjoy the awe and wonder that they will have of what they're looking at; many of them will not have seen stars as clearly as they can at Camp.

Teaching astronomy is a whole lot easier if the kids are comfortable and focused on you. Try to find somewhere they can lie down without getting wet or bitten by ants and away from other teams. Also, make sure there are no lights nearby, which will wash out the stars and that you're sitting in a place where approaching car lights will not be a distraction (if possible!) If car lights cannot be avoided, have the kids turn away to protect their night vision.. If you choose grass make sure it is dry and clear of ant piles! You can always take out a tarp if the grass is wet or sticker-ey, but be aware that it will constantly rustle with fidgety children. If you have blankets available specifically for astronomy, by all means use them!

Set your expectations from the start – no walking around (have them sitting or lying down – make sure they're facing the same direction), no talking when you are, etc. You can also tell them that if they see a shooting star, to make a wish, and at the end we'll tell each other how many we saw. This limits the screaming out every other minute! You should have a teacher or adult chaperone from the school with you.

There are many ways you can teach astronomy – some people prefer facts, others storytelling; most people do a mix of both. We tell schools that we give a "constellation tour" of the sky, so that part is not an option! Stories and myths are very much enjoyed, and can send an eerie silence over the noisiest of groups.

There is a lot of information in this handbook. If you're new to astronomy, try not to be daunted. We've tried to keep the information contained here as concise as possible, without all the physics and detail that tend to confuse or intimidate most people. However, you will always get the kid that knows *everything* and will ask you a multitude of questions – it's nice to feel like a genius and be able to answer every one.

Telescopes

If you are working at one of our Outdoor School locations that maintain telescopes, there are a few additional things you need to know.

At some point during your star gazing/story telling time you will be called over to the telescopes.
Somebody will be manning the telescopes, which will be focused on a planet, the moon, a double star, or something similarly cool! If you find out what it is beforehand then you can tell your team about it so they are prepared for what they will be looking at. After your team has been up, you can return to your spot and resume your lesson; or, if you're the last group, head in for evening snack. Try to keep the kids as quiet as possible when walking to and from the telescopes, as not to disturb other groups.

There are several objects that we may look at through the telescopes. Keep in mind that not all objects are up 365 nights a year, so we will look at what is the best viewing for the season and night. Our favorites include:

- The moon – this is on the STAAR test, so teachers really like this as an option!
- Saturn – the rings are clearly visible as well as moons.
- Jupiter – The gaseous bands and great red spot are visible as well as moons.

- Alberio (the Double Star in Cygnus – Summer sky) – the stars are different colors.
- Orion Nebula (summer sky) – the birthplace of stars.

Other stars and planets are completely unexciting through the telescopes… they simply look like big bright dots. So while you may really want to look at Mars, it's honestly quite boring through our scopes.

A Little History

Since the beginning of civilization, people have been fascinated by the night sky. The ancient Sumerians, Babylonians, Greeks, Romans, Chinese, Arabs and Egyptians were among many throughout the ages to study the heavens. They believed that the skies were a battlefield where gods and demons fought and ruled over their lives on Earth. The changing moon, the setting of the sun, the positioning of the stars, the bright comets, were all signs from the gods. Believing in a relationship between the heavenly bodies and earthly events, the ancients reasoned that if they could learn more about the motions of the Sun, Moon, and stars, they would be in a better position to predict the weather, the onset of changing seasons, and other natural events. They also believed that they would be better able to serve those gods of the sky and in doing so improve their fate on Earth. The beliefs of our ancestors have been passed down to us in a number of ways – astrology, the belief that planets and stars had the power to affect our lives (invented by the Babylonians 3,000 years ago), remains widely recognized; and the names the Greeks and Romans gave to the planets and stars are still used today in the study of astronomy (the word "astronomy" is derived from Greek for "to name a star").

On a clear, dark night you can see approximately 1,500 stars with the unaided eye. The sky that you see differs very little to that seen by our ancestors thousands of years ago. However, since the invention of binoculars, earth-based telescopes and space telescopes (artificial satellites) we are able to "see" a lot more.

History Fun Facts!

- Many of the words and expressions we use today originate from old stargazers; for example, *disaster* means "evil star", and the word *consider* means "to observe stars carefully for an omen".

- Great stone circles, such as Stonehenge in England (built about 3,500 years ago) may have been used to study how the Sun and the Moon moved through the sky.

Random Fun Facts!

- Satellites are used to study Earth's land and weather, beam TV pictures and telephone calls, even to spy on other countries. The IMEWS satellite can be used to give early warning of a nuclear explosion.
- There are about 200 artificial satellites whirling around the Earth.
- Yuri Gagarin survived the first manned spaceflight in 1961, but was killed in a plane crash seven years later.
- To run their equipment, artificial satellites only need about the same amount of power as an electric toaster.
- The Space Age began on October 4, 1957, when Russia launched the satellite 'Sputnik 1'. It also started the Space Race.
- In November 1957, the Russians sent a small dog, called Laika, into orbit on Sputnik 2. She orbited Earth for a week and was the first living thing in space.
- Over a ton of space dust falls to the Earth every day.
- Astronauts become a little taller in Space. There is less gravity, so their bones are less squashed together.

The Universe

The Universe consists of a lot of empty space, with huge swarms of stars called Galaxies. There are billions of galaxies in the Universe. Our Sun is a star that belongs to a galaxy called the Milky Way containing about 100 billion stars.

The Solar System is the name given to our Sun and all the planets, moons and space debris that revolve around it. In our solar system there are officially eight planets orbiting the Sun, over 60 moons orbiting those planets, and other space bodies in the form of dwarf planets, asteroids, meteoroids, and comets. Gravity is the pulling force that exists between things. Just as the Earth's gravity keeps us on it's surface, the Sun's gravity keeps the Earth in its orbit, and the Earth's gravity keeps the Moon in its orbit. The degree of an object's gravitational pull is dependent upon its mass and how close it is to other objects in space.

The Universe Fun Facts!

- The Solar System is about a million times wider than the diameter of the Earth. Our galaxy is about 100 million times wider than the Solar System.
- The nearest galaxy to the Milky Way is Andromeda. It would take 2.2 million years to get there.
- Distances in space are too vast to be measured in miles, so scientists measure in light-years. A light-year is 5.88 trillion miles – the distance traveled by light in one year.

The Milky Way: Myths and Legends:

In 1609, Galileo pointed his telescope on the Milky Way and discovered it was made up of millions of stars. Today, scientists think migrating birds use the light from these stars to navigate. The Estonians of Northern Europe have an old tale that links migrating birds to the Milky Way.

- ***The Milky Way*** **(Estonian)**
  Lindu, beautiful daughter of the sky god Uko, took care of all birds on their spring and fall flights. Many young men wanted to marry her, but Lindu found none as exciting as her birds.

  North Star was the first to propose. He arrived in a fine carriage drawn by six dark horses and laden with ten gifts. But Lindu was not interested because she knew she preferred to stay in one place all the time. Then Moon pulled up his silver coach with ten horses and twenty gifts. But Lindu turned him down because he traveled along the same, well-worn path every night. When Sun appeared in a golden chariot drawn by twenty strong red horses and thirty gifts, Lindu rejected him, too. She knew Sun walked the same path Moon did, except by day. Lindu found all the young men boring.

  The Northern Lights drove up in a diamond carriage drawn by a thousand white horses and carrying gifts beyond counting. He was brash and brilliant; he came and went as he pleased. Dazzled, Lindu fell in love. Northern Lights told her to prepare for their wedding and that he would return – and then he disappeared into the north.

  Lindu put on her bridal dress and waited through autumn, winter, spring and into next summer. She stared north, growing more and more unhappy, never thinking of her friends the birds. As autumn approached again, Uko felt he must do something to help his daughter and the birds. He called upon the wind to carry Lindu into the sky. There she remains, her long, white veil shimmering as the Milky Way, directing the birds in their journeys. But she stares north, trying to catch a glimpse of Northern Lights. When she sees him, she waves. And occasionally he waves back.

- **Milky Way:** ***How the Milky Way Came to Be*** **(Cherokee Tribe)**
  Long ago when the world was young, there were not many stars in the sky. In those days the people depended on corn for their food. Dried corn could be made into corn meal by placing it inside a large hollowed stump and pounding it with a long wooden pestle. The cornmeal was stored in large

baskets. During the winter, the ground meal could be made into bread and mush.

One morning an old man and his wife went to their storage basket for some cornmeal. They discovered that someone or something had gotten into the cornmeal during the night. This upset them very much for no one in a Cherokee village stole from someone else. Then they noticed that the cornmeal was scattered over the ground. In the middle of the spilled meal were giant dog prints. These do prints were so large that the elderly couple knew this was no ordinary dog.

They immediately alerted the people of the village. It was decided that this must be a spirit dog from another world. The people did not want the spirit dog coming to their village. They decided to get rid of the dog by frightening it so badly that it would never return. They gathered their drums and turtle shell rattles and later that night they hid around the area where the cornmeal was kept.

Late into the night they heard a whirring sound like many bird wings. They looked up to see the form of a giant dog swooping down from the sky. It landed near the basket and then began to eat great mouthfuls of cornmeal. Suddenly the people jumped up beating and shaking their noisemakers. The noise was so loud it sounded like thunder. The giant dog turned and began to run down the path. The people chased after him making the loudest noises they could. It ran to the top of a hill and leaped into the sky, the cornmeal spilling out the sides of its mouth.

The giant dog ran across the black night sky until it disappeared from sight. But the cornmeal that had spilled from its mouth made a pathway across the sky. Each grain of cornmeal became a star.

The Cherokees call that pattern of stars, gi li' up stan un' yi (gil-lee-oot-soon-stan-unh-yee), or "the place where the dog ran." And that is how the Milky Way came to be.

The Stars & Our Sun

The Sun is a medium-sized star. It appears large to us because it is the star closest to the Earth – only 93 million miles away. Stars are born in clusters called nebulas. A nebula is a cloud of gas and dust which breaks up over millions of years into smaller clouds. These are pulled tighter and smaller by their own gravity. Eventually they heat up and start to shine. After billions of years, stars finally run out of energy and die.

There are different kinds of stars. Some, like the Sun, shine with a steady light. Other kinds of stars don't shine steadily – they are called variable stars. Variable stars fade and brighten over and over again. This is not the same as the twinkling effect that you may see when you look at the stars. Stars appear to 'twinkle' because we see them through Earth's atmosphere. Stars are also different colors, depending on how hot their surfaces are. Bluish stars are the hottest (36,000 – 90,000 F), followed by white, yellow, orange and red stars. Red stars are the 'coolest' (7,000 F or below).

Star Fun Facts!

- It takes more than a million years for energy from the Sun's core to reach the surface, but from there it takes just eight minutes for it to get to Earth.
- Although the Sun appears yellow when seen from Earth, it is actually white. We see sunlight after it has been filtered through the Earth's atmosphere. Air scatters the blue component, making the sky appear blue and the sunlight yellow.
- Every star would explode if gravity did not hold it together.
- Sunsets often look red even though sunlight is a combination of all colors. When the sun is low on the horizon, its light travels through more of Earth's atmosphere than when it shines from above. Along the way, the sunlight hits many particles in the sir, which absorb or scatter its colors. Only red, orange and yellow penetrate through, giving the Sun its sunset color.

- The Aztecs of Mexico and Central America believed that their world began when the gods sacrificed themselves to create the Sun. To help the Sun in its nightly battles with the Moon and stars, the Aztecs built huge temples, where they offered sacrifices and prayers.

- It is possible to tell the time by looking at the position of the stars. In midwinter, the Sun does not rise in the high Arctic. However, every December, the star Altair appears in the northeast at breakfast time. So the Inuit watched for Altair to time the "dawn" of their sunless winter days.

- The position of a star can also tell the date. The early Egyptians noticed that the Nile River flooded once a year, moistening the dry desert soil. At the same time, the star Sirius returned in the east just before sunrise. So when the Egyptian farmers saw that Sirius had returned, they knew it was a good time to plant their grain.

Stars: Myths and Legends:

You know that stars are born in nebulae, but if you lived a thousand or even a hundred years ago, your elders would have told another story. Here are two explanations for the existence of the stars.

- ***The Making Of The Stars*** **(Cochiti Native American Tribe; New Mexico)**
  Many years ago, a heavy rainfall and great flood forced a little girl named Blue Feather and her people to flee north. When the rain ended, Uresiti, the Mother leader of all Cochiti, said they could return home. Uresiti asked Blue Feather to walk behind her people and carry a small sealed bag. Blue Feather knew it was an important package and must be kept closed.

  With the bag strapped on her back, Blue Feather proudly trudged south, but soon she became curious. What could be inside such a small, light bag? The drawstrings were tightly knotted, but Blue Feather slowly untied them. All she wanted was a quick peek, but she was surprised to find thousands of stars inside the bag. Most of the stars escaped and flew into the sky, ending up wherever they pleased. Blue Feather tugged the strings shut and

managed to trap a few. When she reached home, Uresiti named the remaining stars and carefully placed them in the sky where they belonged. These stars, such as those in the Big Dipper, are the friends of the Cochiti people. The rest are nameless strangers.

- ***Bright Eyes*** **(Scandinavian Folktale)**
  The goddess Idun lived with the other gods in a walled city called Asgard. There, she tended her magical fruit of eternal youth. Thjasse, a giant, kidnapped Idun, stole her magical fruit and went north. In Idun's absence, a terrible cold gripped the land, and without the fruit of youth, the remaining gods began to age and wither. To bring back good weather and their own strength, the gods sent Loki, god of fire, to save Idun and bring back the fruit. Loki, disguised as a falcon, flew into Thjasse's palace and found Idun locked in a tower. He changed her into a nut, grabbed her in his talons and flew off toward Asgard. Thjasses turned himself into an eagle and chased after them. Meanwhile, the other gods prepared for Loki's return by stacking kindling and fuel around the end of the city. When Loki and Idun landed safely within the city walls, the fires were lit. Thjasse, unable to stop, flew into the flames and died. His eyes were thrown into the sky, where they became thousands of stars.

The Sun: Myths and Legends:

- ***Little Brother Snares the Sun*** **(Winnebago Native American Tribe; Michigan)**
  In the old days people were not the chiefs and did not hunt animals. Animals were the chiefs and hunted people. They killed all the people except one girl and her little brother. They hid in a cave. The boy learned to kill snowbirds with a bow and arrow and made a robe from the feathers. They made soup from the birds and that was the first time that people ate meat. The bright sun ruined the robe one day and the little brother swore revenge. His sister helped him fashion a snare. He traveled to the hole in the ground where the Sun rises every morning. As the Sun rose he snared it and tied it up so that there was no light or warmth that day. The animals were afraid and amazed

by the boy. They sent the biggest and most fearsome animal to try and free the Sun. This was the dormouse, which in those days was as big as a mountain. The mouse chewed through the snare freeing the Sun but meanwhile the intense heat shrunk him down to his present size. Since that time the people have been the chiefs and the hunters.

- ***Spider and the Sun*** **(Cherokee Native American Tribe; Tennessee, North Carolina)**

  Long ago the Cherokee people lived in a dark world. They had no Sun or Moon or light of any kind. It was so dark that the animals, birds, and insects kept bumping into each other. One day the animals called a meeting to see what could be done.

  Woodpecker spoke first. "I've heard," he said, "that people on the other side of the world have light. Maybe if we go there, they will give us some."

  "I'll go," said Owl. "I can see in the dark."

  "No, I should go," Opossum said. "If they are stingy with their light, I'll steal some and hide it under my bushy tail."

  They all agreed, so Opossum started at once. As he headed East, the world grew lighter. Soon he had to squint to keep from being blinded, but he kept on going until he found the Sun. Carefully he placed a small piece of it under his tail. He set out for home as fast as his short legs would go, but that piece of Sun was so hot it set his tail on fire. The people who lived in the land of the Sun demanded that he return the piece he took. Poor Opossum. He now had to squint, his fine bushy tail was ruined, and the animals still had no light.

  The animals called another meeting, and this time Buzzard volunteered. "I can fly far and fast," he boasted. "I can bring back the light in no time."

  He flew East and stayed up high so the people couldn't see him. Then he dived straight down, snatched a piece of the Sun, and hid it on top of his

head. But as he was flying away, his beautiful head feathers caught on fire. Buzzard dropped the piece of Sun at once, but his head had turned bright red and was completely bald, just as it is today.

The animals met once more, “What shall we do now?” they asked. “We must have light!”

Grandmother Spider crawled out of the nearby grass. “You big creatures have done all you can,” she said. “Perhaps a smaller creature could do better.”

“You’ll get burned up!” squawked the Owl. “Maybe not,” answered Grandmother Spider. They were so desperate for light they agreed to let her go.

Grandmother Spider felt around until she found some damp clay. Then she rolled it into the shape of a bowl. “It will dry slowly as I travel in the dark,” she said to herself. “That way it won’t crack.” As she traveled, she spun a trail of thread to find her way home. When she came to the place of the Sun people, she quickly reached out and took a piece of the Sun. She dropped it into her bowl and covered it. Then she quietly followed her thread-trail back home.

When the animals uncovered Grandmother Spider’s bowl, they could hardly believe their eyes. The first light they had ever seen shot out of its rays. Even today the spider’s web is shaped like the rays of the Sun. From that time on, not only did the Cherokee people have light, but pottery making became honored work among them.

- ***Sun and her Daughter*** **(Cherokee Native American Tribe; Tennessee & North Carolina)**

  As the Sun traveled across the sky she would stop in the middle of each day to have lunch at her daughter’s house. Now the Sun hated people because they would always squint when they looked at her. “They screw up their

faces at me!" she told her brother the Moon. "I like them," said the Moon, "they always smile at me." The Sun was jealous and decided she would punish the people by sending a fever. Many people were getting sick and those remaining decided they would have to kill the Sun. With some magic, one of the people was turned into a rattlesnake and sent to wait by the daughter's door, to bite the Sun when she stopped for dinner. But when the daughter opened the door to look for her mother the snake accidentally bit her instead. The snake returned to Earth with the Sun still alive and the daughter dead.

When the Sun discovered what had happened she shut herself up in the house and grieved. The people no longer had the fever but it was cold and dark. So, seven people were chosen to visit the land where ghosts dance to see if they could retrieve the daughter. As she danced past them they grabbed hold of her and trapped her in a box. On the trip home she complained of not being able to breath so they opened the lid just a crack. But she turned herself into a redbird and escaped, flying back to the land of the ghosts. Seeing the seven people return empty handed, the Sun began to cry. This caused a great flood. To amuse the Sun and make her laugh so she would stop crying, the people danced. This is why people do the Sundance to this very day.

- ***Chariot of Fire*** **(Greek Myth)**

  As morning turns to afternoon and then to evening, the Sun looks as if it's moving across the sky. We know it's really Earth that's moving and not the Sun, but ancient people believed what their eyes saw. The Greeks said the Sun was a god named Helios who drove his chariot every day from the eastern horizon across the sky to the west. Although they can't see Helios at night, they believed he continued to ride back under Earth to rise again the next morning in the east.

  Phaethon was the son of Clymene. One day Phaethon's mother told him that his father was the Sun-god Helios. Every morning Helios harnessed his four fiery horses to the chariot of the Sun. Then he set out on his daily journey

across the sky to bring light and warmth to the Earth below. When Phaethon boasted to his friends that his father was a powerful god, his friends teased him and said that he was not telling the truth. Hurt, Phaethon went to his mother and asked if he could visit his father.

Clymene told Phaethon that he would have to travel far, through Ethiopia and India, in order to find his father's shining palace of gold in the East, at the place where the Sun rises each day. Phaethon set out and many months later reached Helios's palace. The Sun-god was delighted to see his son and promised Phaethon anything he requested in the way of proving to his friends that he, Helios, was his father.

Phaethon thought and thought and *thought*, and finally decided that he wanted permission to drive the Sun-chariot across the sky for one day. Helios was shocked and tried to convince his son that it was a very dangerous thing to do, in hopes that the boy would reconsider his request. Phaethon refused to change is mind, so there was nothing for Helios to do but keep his promise.

The next day the four fiery horses were harnessed and Phaethon set out. If only he had known of the dangers that lay ahead! "Make sure to steer a middle course, keeping half-way between Heaven and Earth," Helios shouted to his son. But the boy was too excited to hear. A flick of the reins sent the horses leaping forward into the sky. Phaethon was inexperienced in driving a chariot and to the horses the chariot felt light and the reins held no command. They jumped off Helios's well-worn track and started to blaze a new trail across the sky.

They began galloping wildly, with Phaethon unable to control them. First they bolted high up in the sky, far higher than they usually did. They wanted to rise above the eastern horizon and reach the top of the great sky dome. However, they were going at such a speed, that they scorched a great streak across the sky, a streak that became the Milky Way. Meanwhile, Earth's surface became cold because the Sun-chariot was so high in the sky. Next the

horses plunged too close to Earth. As they crossed Africa they scorched the ground, creating a great desert and drying up rivers, lakes, and watering holes.

Horrified, Phaethon saw ahead of him a great Scorpion in the sky. Its mighty tail flashed and stung the lead horse. Up went the chariot again, even more wildly than before. Poor Phaethon now realized his foolishness and wished that he had listened to his father's warning. But now he was lost and he cried, for he could think of nothing else to do.

Zeus, King of the Gods, had been looking on all the while and decided that it was time to stop the youngster from causing even more destruction. He hurled a thunderbolt at Phaethon, exploding the chariot, killing the boy instantly and sending his smoldering body tumbling down to Earth on the trail of a shooting star. The horses returned to their stable and Phaethon's body eventually fell into a river and sank to the bottom.

Helios was so saddened that he refused to repair or drive his chariot for one whole day, and Earth received neither heat nor light. Clymene searched until she found Paheton's body, and she raised a gravestone for her son. Any night we see the Milky Way, the scar left by Paheton's ride in the sky, we are reminded of that day when a boastful young man thought he could ride a god's chariot of fire.

The Planets

There are eight planets in our Solar System, orbiting the Sun at varying speeds. The planets are divided into two groups. The four closest to the Sun - Mercury, Venus, Earth and Mars - are called “terrestrial” or “inner”; they are small and dense and are made of rock and metal. Four of the outer planets – Jupiter, Saturn, Uranus and Neptune – are called the “Jovian” planets; these are larger and made up of gases.

The days and years on each planet are different than those on Earth. A day is the period of time it takes for the planet to revolve once on its axis. A year is the amount of time it takes the planet to orbit the Sun once. Days and years on other planets are often compared to Earth’s hours, days, and years. You don’t have to memorize all the figures for every planet – they are included so you can get a general idea, and copy them onto a notecard if you want to use them in your lesson.

Here is a brief summary about each planet. We have then gone into more detail on the planets that are more recognizable with the naked eye: Venus, Mars, Jupiter and Saturn.

- **Mercury** is the smallest planet in the Solar System (not much larger than our moon), and is also the planet closest to the Sun. Mercury and the Sun are 36 million miles apart. Mercury is the fastest planet to orbit the Sun – it moves at 30 miles per second and takes just 88 Earth days. However, a day on Mercury is 59 Earth days. It is visible with the naked eye from Earth for only a few days each year.

- **Venus** is the second planet from the Sun and is the hottest planet in our Solar System. This planet is the second brightest object in the sky, outshone only by the Moon. There is more detailed information on Venus since you are

able to see the planet with the unaided eye for much of the year, and therefore may be able to point it out to the kids.

- **Earth** is the largest of the four inner planets. It circles the Sun once every 365 days (a year), at a distance of 93 million miles. One day on Earth is 24 hours.

- **Mars** is a small, rocky planet and our closest neighbor. Mars can been seen without a telescope for several months of the year, so there is additional information on this planet below.

- **Jupiter and Saturn** are the largest planets in the Solar System. Their surfaces are made up of a mixture of turbulent, swirling gas and ice. They can also be seen without a telescope for several months of the year, so there is additional information on them below.

- **Uranus** was discovered in 1781. It takes 84 years to circle the Sun, which is 1,780 million miles away. A day on Uranus is about 17 hours long. Uranus is 32,300 miles in diameter and is made up mostly of hydrogen and helium, and a little methane. It is the methane that makes the planet look green from Earth, although it is very hard to see, even with binoculars or a telescope, as it is so far away. Uranus has 13 rings around it, and at least 15 moons.

- **Neptune** was discovered in 1846. It is 2,800 million miles from the Sun. Neptune's day is about 16 hours long, and its year 165 Earth years. Neptune is 30,000 miles in diameter and appears to be a blue-green color. Neptune has a rock center, a layer of water, and hydrogen, helium and methane at the surface. Neptune also has rings, as do all the "gas" planets. There are at least eight moons that orbit Neptune. As with Uranus, the planet is so far away, you will need binoculars, and probably a telescope, to see it.

- **Pluto** lost its status as a planet in August, 2006. About 2,500 scientists met in Prague and agreed that for a celestial body to qualify as a planet it must be in orbit around the sun, be large enough that it takes on a nearly round shape, and has cleared its orbit of other objects. Pluto was automatically

disqualified because its highly elliptical orbit overlaps with that of Neptune. It is now classified as a dwarf planet.

Venus

Venus is about 65 million miles from the Sun. It is hotter than Mercury as it has a thick layer of clouds around it which trap heat (like a car on a hot day; this is known as The Greenhouse Effect). Venus is almost the same size as Earth (7200 miles across), and is sometimes called our Sister Planet. It takes 224 Earth days to orbit the Sun. However, as Venus takes 243 Earth days to spin once, a day on Venus is longer than its year! Even more strange is the fact that Venus rotates from East to West, which is the opposite of Earth and most of the other planets.

Venus is one of the solar system's rocky planets. It has an iron core, which is covered by a rocky layer. This rocky layer has a lot of lava, which has been generated by the many volcanoes on its surface. Despite looking beautiful in the night sky, and being named after the goddess of love, Venus is a very unpleasant place. The atmosphere is deadly. It is made up mostly of unbreatheable carbon dioxide. There are also constant thunderstorms, where winds blow hundreds of miles an hour and drops of sulfuric acid fall from the clouds.

Venus can be seen with the naked eye. It is brighter than all the other planets and stars. It can be seen several months of the year, in either the morning or evening sky. The bright light we see from Earth is a result of sunlight being reflected off the clouds that completely cover Venus's surface.

Mars

With a diameter of 4070 miles Mars is about half the size of the Earth. A day on Mars is about the same as Earth's (24.6 hours long), but its year is much longer at 687 Earth days. Mars is about 140 million miles from the Sun.

Mars has a central core, made of iron. On top of the iron core is a layer of rock. The surface of Mars is barren and dusty with reddish soil. Due to the high iron

content in its surface dirt and rock, Mars appears to be a red color in the night sky. Many cultures have named it based on its color: the Greeks named it Mars, after their god of war; the Egyptians named it “Her Desher”, meaning “the red one”; ancient Chinese astronomers dubbed it “the fire star.” There are deep canyons and high volcanoes. Mars has a very thin atmosphere that covers the planet, but it still has weather, including dust storms and clouds. It is very cold on Mars, with average temperature of –9 C. During the Martian winter, temperatures can drop to –160 C!

Mars has two very tiny moons, Phobos and Deimos. Phobos is only about 18 miles across, and Deimos even smaller at around 9 miles across.

The red planet is home to both the highest mountain and the deepest, longest valley in the solar system. Olympus Mons is roughly 17 miles high, about three times as tall as Mount Everest, while the Valles Marineris system of valleys can go as deep as 6 miles and runs east-west for roughly 2500 miles, about one-fifth of the distance around Mars and close to the width of Australia or the distance from Philadelphia to San Diego.

The dust storms of Mars are the largest in the solar system, capable of blanketing the entire red planet and lasting for months. One theory as to why dust storms can grow so big on Mars starts with airborne dust particles absorbing sunlight, warming the Martian atmosphere in their vicinity. Warm pockets of air flow towards colder regions, generating winds. Strong winds lift more dust off the ground, which, in turn, heats the atmosphere, raising more wind and kicking up more dust.

Robot spacecraft began observing Mars in the 1960s, with the United States launching Mariner 4 there in 1964. NASA’s Viking 1 lander touched down onto the surface of Mars in 1976, the first successful landing onto the Red Planet. In 1996, the Pathfinder was launched and landed a small robot named Sojourner, the first wheeled rover to explore the surface of another planet. Exploration of Mars by rover continues to this day.

Jupiter

Jupiter, is the most massive planet in our solar system, and so huge that all the other planets in the Solar System could fit inside it twice! Had it been about 80 times more massive, it would have actually become a star instead of a planet. Jupiter measures 85,000 miles in diameter, big enough to fit Earth into it 1300 times. Jupiter is 483 million miles from the Sun. A day on Jupiter is only 9 hours 50 minutes long, the fastest spinning planet in our solar system, but it's year (the time it takes to orbit the sun) is 11.9 Earth years (often the kids we get are about 11 years old, so you can tell them that if they lived on Jupiter, they would only be 1 year old right now!).

Jupiter has a very small rocky core, an inner layer of hydrogen, and a shell of liquid hydrogen and helium. On the surface of Jupiter is a swirling surface of clouds. Jupiter's Great Red Spot is a swirling tornado that has been raging for at least 300 years. It is about 25,000 miles long and 7,000 miles wide – that's more than three times the diameter of Earth!

Jupiter has at least 63 moons, possibly more. The largest are Callisto, Ganymede, Europa, and Io. These can be seen through a telescope, and sometimes even through binoculars. Callisto, the outermost, is an icy and cratered satellite. Ganymede is larger than the planet Mercury; its surface is also icy, with grooves and streaks. Europa is smooth and icy with very few craters; and Io, the innermost, has a red, volcanic surface.

Jupiter can be seen with the naked eye. It is one of the brightest objects in the night sky, after the Moon and Venus.

If you went to Jupiter you wouldn't be able to breathe, as the atmosphere contains hydrogen, helium, and ammonia, which are poisonous to humans. You would also have a very hard time moving – because Jupiter is so big, its gravity is very strong, nearly 20,000 times the strength of Earth's. Also, Jupiter is a gaseous planet, so there isn't a solid ground under its clouds for humans to stand on. Last of all,

terrible lightning and winds roar across the ocean of gases without stopping, so Jupiter is probably not a good place to go on vacation.

Saturn

Saturn is smaller than Jupiter, but is still very large. Saturn's most famous characteristic is its brightly shining rings. The diameter of the planet is about 75,000 miles, almost ten times bigger than Earth. Including the rings this brings its size to 169,000 miles across! Saturn is about 887 million miles from the Sun. A day on Saturn is 10 hours, 14 minutes long. Saturn takes 29.5 Earth years to orbit the Sun once.

Saturn is a lot like Jupiter, in that it is a gas planet, made of mostly hydrogen and helium. Saturn has the lowest density of all the planets, and is the only one less dense than water – if there were a bathtub big enough to hold it, Saturn would float! As with all the gas planets, Saturn bulges out at the center. However, due to the combination of its light weight and speedy rotation the bulge is much more apparent on Saturn. Saturn's rings are huge, but very, very thin compared to their width. There are three main rings containing thousands of separate ringlets. The beautiful rings are bands of ice and rock – they are not solid, but consist of billions of snowballs ranging in size from the snowball you would throw in winter, to ones that are bigger than a house!

Saturn has at least 62 moons, each with unique characteristics. The two main satellites are Mimas and Titan. Mimas is one of the innermost moons. It has a crater on its surface over 60 miles wide, nearly two-thirds of its diameter! Titan, the largest of Saturn's moons, is bigger than Mercury. It has a cloudy atmosphere of nitrogen gas, and may have oceans made of liquid methane.

Saturn can also be seen from Earth with the naked eye. The planet has a very faint greenish color that makes it stand out from the rest of the objects in the sky.

If you went to Saturn you would not be able to breathe the hydrogen atmosphere; and the winds (up to 1,100 mph) would tear you apart! If you managed to get

through the clouds and survive the crushing atmospheric pressure, you wouldn't have anything to stand on. An ocean of liquid hydrogen covers the solid core of Saturn. Just to add to the fun, liquid helium would constantly splash into the ocean from the sky. Saturn's moons would be slightly better, although you would be very cold, and still couldn't breathe!

Planets: Myths and Legends:

- **Venus: *Evening Star Wins Morning Star* (Skidi Pawnee Tribe; Kansas, Nebraska)**

  In the beginning there was only Tirawahat, which is the Universe and everything in it. Morning Star (Venus) and the Sun and the other males in sky were in favor of creating the world but Evening Star and the Moon and the females were against it. To win the debate it was clear that Morning Star would have to win the heart of the Evening Star. Many had failed, she was guarded by the Wolf (Sirius), Cougar (Auriga), Bear (Sagittarius), Bobcat (Procyon), and worst of all the Snake (Scorpius). However, the Morning Star was determined. One by one Venus defeated them and won the hand of the Evening Star. And so the world was created.

- **Venus: *Morning Star and Feather Woman: A Romance* (Blackfoot Tribe, from the plains of Canada and the United States)**

  Dazzling white Venus has inspired love stories around the world. Blackfoot elders told the love story of Morning Star and Feather Woman. In their story, Venus is Morning Star, the Spiders Man's lodge is Corona Borealis, the Northern Crown, and the giant turnip is the North Star.

  One spring night, Feather Woman slept out on the prairie grass. At dawn she looked up to the sky and whispered, "I wish I could marry Morning Star."Some time later, Feather Woman was walking alone when a stranger appeared on the trail in front of her. He held a juniper branch covered in cobwebs. Frightened, Feather Woman turned to run, but the stranger called, "Don't be afraid. I am Morning Star. I have loved you from afar, and once you said you loved me, too. Come with me and be my wife."

Feather Woman looked at him, and her heart filled with love. She agreed to go with Morning Star without even saying goodbye to her family. Morning Star placed a strand of cobweb on the ground. He told Feather Woman to shut her eyes and step on it. When Feather Woman opened her eyes again, she was standing in the land of the Star People. Morning Star said, "Walk carefully. We are near the lodge of the Spider Man. The Star People use his webs to climb up and down between Earth and the sky."

Morning Star took Feather Woman to the tipi of his parents, Sun and Moon. Moon, his mother, greeted Feather Woman womanly, but Sun told her to obey the laws of the Star Country if she wished to be happy.

In weeks to come, Moon taught Feather Woman how to tan hides white and dig for roots to eat. Moon gave her a special digging stick. Once, when Feather Woman found an enormous turnip near the Spider Man's lodge, Moon told her it was sacred and must never be dug up.

In time, Morning Star and Feather Woman had a son named Star Boy. Feather Woman's happiness was complete – but the forbidden turnip fascinated her. What could be under it that was so important?

One day when Feather Woman was alone, she decided to dig up the turnip. But it was too high. Two cranes came to her aid and worked at the ground with their sharp bills. Together they finally uprooted the turnip, and Feather Woman looked down the hole. Below, she saw Earth and her own people. She felt homesick.

Late in the day, Feather Woman rolled the turnip back into its hole and slowly returned to her husband. Sun sensed she had disobeyed and said she must return to Earth. Moon and Morning Star begged him to forgive Feather Woman, but Sun said she would never be happy again with the Star People and must leave. Sadly, Morning Star wrapped Star Boy and Feather Woman

in white buckskin. He took them to Spider Man's lodge and gently let them down to Earth with spider webs.

Feather Woman's people accepted her back, but she grew pale and thin. Each night she sat on a ridge and watched for Morning Star to rise in the sky. At dawn one morning, she called out for forgiveness, but Morning Star called back, "Too late, too late," and traveled on. Soon after, Feather Woman died of a broken heart.

- **Jupiter: *God of Sky and Thunder* (Roman)**
  Saturn was long thought to be the largest planet, but Jupiter was then discovered to be larger. This story reflects the replacing of Saturn by Jupiter as the largest.

  Jupiter was the son of Saturn and Rhea. When Jupiter was born, he had a few brothers and sisters (Mercury, Venus, Mars, Uranus, Neptune, and Pluto) that were all swallowed by their own father, Saturn. As Jupiter got older, he forced Saturn to return all of his brothers and sisters as well as other Roman people that were swallowed because they crossed the path of Saturn. As Saturn returned them all, all of the people that were swallowed sided with Jupiter and overthrew Saturn, which let Jupiter become the leader of the gods.

Planet Order:

There are several mnemonics for remembering the order of the planets. Several are listed here both with and without including Pluto. (When Pluto was demoted, many astronomers were angry… the last mnemonic is a humorous attempt to "get even". Clever, but not one to be shared with the students… it's just for your fun.).

Mercury:	My	My	My	Many
Venus:	Very	Very	Very	Very
Earth:	Educated	Educated	Easy	Educated
Mars:	Mother	Mother	Method	Men
Jupiter:	Just	Just	Just	Just
Saturn:	Served		Served	Speeds
Screwed				
Uranus:	Us	Us	Up	Up
Neptune:	Nine	Nachos.	Naming	Nature.
Pluto:	Pizzas.	-	Planets.	-

Planet Fun Facts!

- The ancient Romans and Greeks knew only five - apart from Earth – and gave them names of their gods. The outer planets, discovered later, were also named after gods:
- If you had a ball the size of a dime representing the Earth, Jupiter would be the size of a basketball!
- If the sun was the size of a basketball, the Earth would be the size of a BB!
- Saturn is so light that if it were dumped into a HUGE glass of water, it would float.
- The largest mountain (Olympus Mons) in the solar system is on Mars.
  - It's about 16 miles above the surface of the planet, or 3 times the height of Mt. Everest

  - It’s 374 miles across, roughly the size of Arizona!

- The Cassini Division that separates the A ring from the B ring on Saturn is about as wide as the Atlantic Ocean.

- Venus spins east to west, so the Sun rises there in the west and sets in the east.

- In the late 19th century, the belief that there was life on Mars reached fever pitch – so much so that when a contest was held in 1902 to make contact with extraterrestrials, the discovery of Martians was excluded as they were said to be too easy to contact!

The Moon

The Moon is our nearest neighbor and only natural satellite. It is an airless ball of rock 2,160 miles in diameter. The Moon is almost 239,000 miles from Earth.

The Moon's Surface

The Moon is covered with craters, ridges, mountains, and valleys. Most of the craters were caused by meteoroids crashing into it between three and four billion years ago. The largest crater is on the far side of the moon and cannot be seen from Earth. The biggest crater we can see from Earth is Bailly, measuring about 180 miles across.

The bright areas of the Moon are the mountains, or highlands, whose light rocks reflect the sunlight. These contrast with the darker areas that are called maria (seas). They are made of lava that flowed out from inside the Moon about 3 billion years ago, when the Moon experienced volcanic activity. Earth's surface is varied because it is geologically active and has an atmosphere. When a meteor hits Earth, wind, rain, and earthquakes slowly erase craters. As the Moon has no air or water, and is no longer geologically active, its surface has remained unchanged for thousands of years.

Gravity

The Moon is kept in Earth's orbit due to gravity. The Earth's gravity pulls on the Moon, and the Moon's gravity pulls on the Earth. Gravity on the Moon is one-sixth as strong as that on Earth. This is because the Moon is much smaller in mass. Astronauts have to be weighed down to help them walk properly on the Moon's surface, since they weigh one-sixth of what they do on Earth.

The gravitational attraction is not enough to make Earth and the Moon crash into each other, although it does affect them in other ways. The Moon's gravitational pull on the Earth's causes our oceans to move slightly towards the Moon. This is what produces tides. On the side of the earth that faces the Moon, the water in

the ocean is pulled up by Moon's gravity. On the opposite side of the earth, the water also bulges out to balance the spinning planet. This causes high tides twice a day. In between the two high water bulges are low areas that create low tides twice a day. (The Earth's oceans are also affected by the Sun's gravitational pull, although as it is further away the effect is very slight. However, when the Sun and the Moon are in line with each other, their combined pull produces very high tides called Spring Tides because the water seems to "spring" from the Earth).

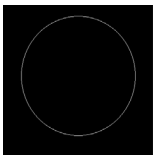
Earth's gravity has affected the Moon by slowing the rotation on its axis, so it only turns once during each trip around the Earth. This keeps the same side of the Moon facing Earth all the time ("synchronous rotation"). The Moon has no light of it's own, but reflects light from the Sun. Just as the Sun always shines on one half of the Earth's surface, one half of the Moon receives light from the Sun at any given time. There is not a "dark side of the Moon", only one side (actually 41 percent of it!) that we can never see from Earth.

Phases of the Moon

While we always see the same side of the Moon, we do not always see the same amount of it. The phases of the Moon are caused by the constantly changing series of angles formed by the Sun and the Moon as the Moon revolves around the Earth. As the Moon moves around the Earth, the amount of sunlight we are able to see falling on the Moon changes. When the Moon and the Sun are on opposite sides of the earth, the Sun shines directly on the Moon's surface, resulting in a Full Moon. There are 29.5 days between one Full Moon and the next. When the area of the lit surface increases, the Moon is said to be waxing; as it decreases, it is said to be waning. When the Moon is between the Earth and the Sun, the sunlight falls on the side that is turned away from the Earth. Since we cannot see the far side of the Moon, it appears that there is no moon in the sky. This phase is called a New Moon.

There are eight phases of the Moon:

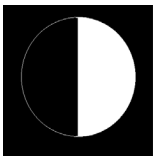
1) <u>New Moon</u> – during a New Moon we can see no portion of the Moon's surface that is lit.



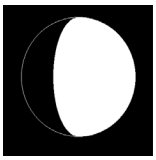
2) Waxing Crescent – during the Waxing Crescent phase, we see on the right side a small sliver of the lit Moon.



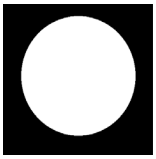
3) First Quarter – during the First Quarter phase, we can see the right half of the lit Moon. The Moon and Earth are now "side by side" in their orbits around the Sun.



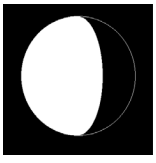
4) Waxing Gibbous – during the Waxing Gibbous phase, we can see almost the entire right side of the lit Moon.



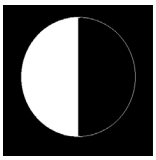
5) Full Moon – during a Full Moon, we see the entire half of the Moon surface that is lit. The Moon is positioned behind the Earth and Sun.



6) Waning Gibbous – during the Waning Gibbous phase, we see almost the entire left side of the lit Moon.



7) Last Quarter – during the Last Quarter phase, we see the left half of the Moon lit. The Moon and Earth are now "side by side" in their orbits around the Sun.

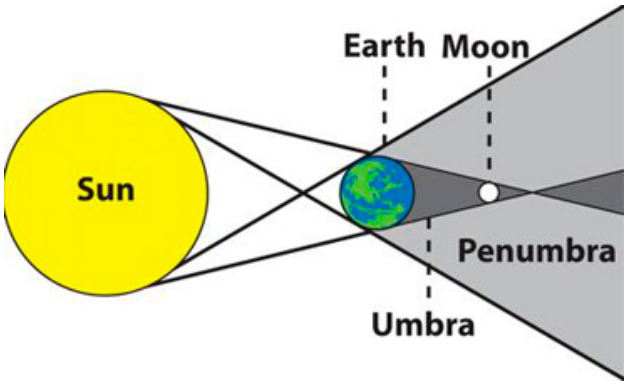


8) Waning Crescent – during the Waning Crescent phase, we see a small silver of the lit Moon on the left side.



Eclipse of the Moon

An eclipse is the passing of one body into the shadow of another. A lunar eclipse takes place when the Earth's shadow is cast on the Moon, darkening its surface. For a lunar eclipse to occur, the Moon must be on the side of the Earth opposite the Sun, i.e., in full moon phase. However, we don't see a lunar eclipse each time the Moon is full. This is because the Moon follows a monthly orbit around the Earth that is slightly tilted from the ecliptic orbit that the Earth follows once a year around the Sun. During its full phase, the Moon passes very close to Earth's shadow, but because of the tilt in it's orbit, usually moves just above or below it. However, Earth's and the Moon's orbital planes will always have two points of intersection, and when the Moon reaches these points, it passes directly in the earth's shadow causing a lunar eclipse.



"Blue Moon"

Once every 2.7 years, there are two full moons in one month. This happens because the twelve months in our calendar do not exactly match the moon's cycle. The second full moon is called a "blue moon". This name has nothing to do with the color of the moon, and it is unclear how the term came about. The expression "once in a blue moon" has come to mean something that doesn't happen very often. (On rare occasions, when it is seen through dust or smoke, the Moon really does appear blue. For example: in 1991 after the eruption of Mount Pinatubo in the Philippines).

Harvest Moon

The Harvest Moon is the Full Moon that occurs closest to the autumn equinox (this is on September 21, when day and night are of equal length). It rises over the eastern horizon about 20 minutes after the Sun sets in the west. The Harvest Moon usually occurs in September, but occasionally in October. The additional light late into the evening allows farmers to gather the harvest, hence the popular name.

Origin of the Moon

The origin of the moon* is still the subject of heated debate. Some scientists believe that the Earth and Moon were formed from the same dust and gas cloud; others think that the Moon was a wandering space body that came close to Earth and became trapped in Earth's orbit. A third theory is that the Moon was formed from the Earth – either that when the Earth was young and molten, it grew a bulge

that spun off and became the Moon; or that a small planet hit the Earth and threw material into orbit, which got drawn together to form the Moon.

**Note: Take care in discussing origins of the Moon with the kids as it may conflict with their religious views.*

Moon Fun Facts!

- The temperature on the Moon is 200 F on the sunlit side, and –270 F on the unlit side.
- The Moon is moving away from Earth at one inch per year.
- It would take 81 Moons to weigh the same as Earth.
- Since there is no atmosphere on the Moon, the sky is black, even during the day!
- The Moon is completely quiet, because there is no air to carry sound.
- Nothing can grow on the Moon, but plants did grow in Moon-soil on Earth.
- The Moon is the only object in space to which people have traveled. The first man on the Moon was Neil Armstrong on July 20, 1969. He landed on the Sea of Tranquility and was joined by "Buzz" Aldrin and Michael Collins on the U.S. Apollo 11 spacecraft.

The Moon: Myths & Legends

- ***Quarrel of the Sun and the Moon*** **(Native American, Eskimo)**
  Long ago, in a cold land far away, there lived a brother and sister who loved each other very much. But they quarreled all the time. They argued about anything and everything. "It's cold," the sister would say. Her brother would shake his head. "It's not too cold." "Spring will be here soon," the sister would say happily. "It's spring already, foolish sister." The brother argued.

Day in and day out they quarreled. Now we would say they were as different from each other as night from day.

One day the sister awoke and said to her brother, “We must change.” “We must NOT change,” he disagreed. But she was determined. “I think we should transform ourselves into wolves and travel together in harmony as they do.” “Wolves howl,” he said. “We must not become wolves.”

“We’ll become bears,” she suggested. “Bears are amiable creatures.” “Bears are blunderers,” he said.

“We’ll become salmon and swim together down river.” “The water is cold. We should not become salmon,” the brother said firmly.

“Beavers, then,” she said. “The Great Spirit praises the beaver who works with his brothers.” “We do not want to have sharp teeth,” said the brother. “We must not become beavers.”

“Seals then,” said the sister. “Their great soft eyes are evidence that they are as kind as we should become. “Slithery creature,” the brother shuddered. “We should not become seals.”

All day they argued. Each time the sister suggested an animal they might become, the brother scowled and said, “No, no, no!” She recommended caribou and musk oxen, eagles, and deer, but he was not convinced. Each Arctic animal the sister suggested brought argument from her brother.

“All right,” she said at last, “I will become the sun and rule the skies!” She snatched a flaming torch of moss from the fire and ran outside. “No, I shall rule the skies,” he cried, and he too grabbed a torch and began to chase her. They ran round and round their igloo, their torches flaming brightly.

The sister turned and ran toward the frozen fields, and all the animals watched in wonder as the brother gave chase after her. Deep into the tundra they ran, faster and faster until their torches looked like shooting flames. Suddenly the sister began to rise into the sky. “Oh!” she cried as she rose, and gazed down at the land to see that her brother, too, had begun to rise.

"We're moving to the sky," she called, "and I will rule," and with that she reached and put out her brother's torch with the touch of her cold hand. Higher and higher they flew in their chase. "I put out your light because you need no light. You will not rule the sky," the sister called.

"I will," he argued, but his torch, darkened now, grew silvery in the chilled air. As they rose, the sister held up her golden torch and her brother raised his silver flame. Higher and higher they drifted, still arguing until at last they were so high that down below the people and all the village igloos looked like toys dotting the cold, snowy land.

"I will warm the land for our people," the sister said, and her brother looked and felt a pang of longing for the people and the land he loved. "I have no warmth," he said. "But I will offer light when you are resting." "That is what we shall do," the sister agreed, for they both loved their people and the land, and they knew they must now share the sky.

And so the brother and the sister became the Sun and the Moon, sharing the task of lighting the world. They still watch over their people, and if you look closely you'll see their faces looking down on the earth. Brother's light is cold and clear and gazed longingly below. Sister's light is the brightest of smiles, for she knows their transformation helped the world to grow. Both of them cherish the power and wisdom of their light and the pleasure it brings to all the people of the Earth.

- The ancient Chinese believed that during a lunar eclipse, a monster was chasing the moon and trying to swallow it. In order to scare the beast, whole villages gathered to shout and bang drums. As the moon gradually reappeared, the people stopped their noise and chanting. They had successfully chased the monster away, and the Moon was once again safe and whole.

- In the Middle Ages, some people believed that the Moon's surface was made of green cheese!

- One superstition about the Moon was that sleeping in the moonlight caused insanity. *Lunatic* comes from the Latin word *luna*, meaning "moon". In Brazil, some village women still shield their babies from moonlight to protect them from lunacy.

- Some Native Americans kept track of the phases of the Moon in relation to the seasons. They called the time during the winter when the wolves were hungry as the "Wolf Moon". In the summer, when the mosquitoes swarmed, it was the time of the "Moon of Blood".

- ***Coyote on the Moon*** **(Native American Kalispel Tribe, Idaho)**
  Once there was no moon for someone had stolen it. "Who will be the Moon?" the people asked. The Yellow Fox agreed to give it a try but he was so bright it made the Earth hot at night. Then the people asked the Coyote to try and he agreed. The Coyote was a good moon, not too bright, not too dim. However, from his vantage point in the sky the Coyote could see what everybody was doing. Whenever he saw someone doing something dishonest he would shout "HEY! That person is stealing meat from the drying racks!" or "HEY! That person is cheating at the moccasin game!" Finally, the people who wished to do things in secret got together and said "Coyote is too nosey. Let's take him out of the sky." So someone else became the moon. Coyote can no longer see what everyone else is doing but he still sneaks around at night and tries to snoop into everyone else's business.

- ***Fox and the Moon*** **(Native American Snoqualmie Tribe, Washington)**
  Long ago, Snoqualm, the Moon, had a spider make him a rope out of cedar bark and stretch it from the sky to the Earth. One day Fox and Blue Jay found the rope and climbed up to where the rope was fixed to the underside of the sky. Blue Jay pecked a hole in the sky and they climbed up through to the sky world. Blue Jay flew to a tree while Fox changed himself into a Beaver and swam in a lake. Meanwhile, Moon had heard that there were trespassers on his property so he set a trap in the lake which caught the Beaver. Moon then skinned him and threw the body into the corner of the smokehouse, ready for a tasty meal the next day. That night, however, while the Moon was busy working, Beaver got up and put his skin back on. He

looked around and concocted a plan. He took a few of the nearby trees, and the Moon's daylight making tools, some fire, and the Sun that was hidden in Moon's house. He changed back into a fox, found the hole that Blue jay had made and took the things to Earth. He planted the trees, made daylight. Gave the fire to the people, and put the Sun in it's place. When the Moon found out he was very angry. He found the tracks that led to the hole and started down the rope. However, he was heavier than the Fox and the rope broke. He fell to Earth in a heap and became a mountain. One can see the face of Snoqualm on one of the rocky cliffs. Today it is called Mount Si and it is in North Bend, Washington.

- ***Walks All Over The Sky*** **(Native American Tsimshian Tribe; Pacific Northwest)**
  Back when the sky was completely dark there was a chief with two sons, ayounger son, One Who Walks All Over the Sky, and an older son, Walking About Early. The younger son was sad to see the sky always so dark so he made a mask out of wood and lit it on fire (the Sun). Each day he travels across the sky. At night he sleeps below the horizon and when he snores sparks fly from the mask and make the stars. The older brother became jealous. To impress their father he smeared fat and charcoal on his face and made his own way across the sky each night (the Moon).

- ***Three Legged Rabbit*** **(Western Rocky Tribe; Rocky Mountains)**
  Once upon a time there was a three-legged rabbit who made himself a fourth leg out of wood. The rabbit was worried that the Sun was so hot that it might catch his wooden leg alight, so he came up with a plan to cool the Sun down a little. One night he hid in the east and waited for the Sun to rise. The next day, when the Sun was half way up the Rabbit shot it with an arrow. As the Sun lay wounded on the ground the Rabbit took the white of the Sun's eyes and made the clouds. He made the black part of the eyes into the night sky, the kidneys into stars, and the heart into the Moon. "There!" said the Rabbit, "Now you are divided up, you will never be too hot again."

- ***Chang'o Chooses*** **(A Chinese Tale)**

When the Moon is full, especially at harvest time, young Chinese women remember the story of Chang'o. They scan the light and dark patches on the Moon's face for two of the creatures featured in her story – a rabbit and a toad.

The story says that long ago, Earth had ten suns and not one. The suns were the children of the Jade Emperor and lived beyond the Eastern Ocean. The suns spent their days bathing and frolicking in the sea and took turns circling Earth to bring it light and heat. At night, like great dazzling birds, they roosted in the branches of an enormous tree.

One day the suns decided it would be fun to light Earth together, so all ten bounced into Earth's daytime sky. Their combined heat scorched the land – it melted rocks, dried up lakes, burned forests, shriveled plants and hurt all living things. But the suns didn't care. The Jade Emperor heard the cries of Earth's people and commanded the suns stop their game, but the suns paid no attention. Even when the emperor raised his voice, they ignored their father.

The Jade Emperor turned to Yi, a god skilled in archery, to bring his unruly children under control. He gave Yi a magic bow and said, "Don't hurt the suns more than you have to – but stop their deadly game." Yi and his beautiful wife, Chang'o, traveled from heaven to Earth to carry out the emperor's wishes.

At first Yi tried to reason with the suns to stop their destructive game. But they said, "We're just having fun." Even when Yi threatened them with his magic bow, they wouldn't stop. Finally, Yi shot down one sun with an arrow. When the sun fell to the ground it turned into a huge dead crow – and all Earth sensed a slight cooling. But the remaining nine suns refused to quit. Yi was so furious that he raised his bow and shot down one sun after another until only one remained. He would have killed the last sun had it not begged for its life.

The Jade Emperor was unhappy that nine of his sons were dead and would not allow Yi to return to heaven. He decreed that Yi and his wife would have to love, grow old and die as people. Yi begged the emperor to reconsider. Chang'o cried out, "It's not fair! Why am I punished for what my husband did?" But the Jade Emperor banished them both from heaven.

On Earth, Yi desperately tried to make his wife happy. He built a house in the mountains and hunted meat for their table. But Chang'o yearned for the palaces and fruits of heaven. Over time, Yi's hunting skills brought him wealth, and he was able to provide Chang'o with servants and a comfortable life. Yet she remained miserable, fretting about growing old and ugly.

One of her servants, Feng Meng, was jealous of Yi's success and his beautiful wife. He wanted to kill Yi but feared the magic bow. So he tried to trick Yi into destroying himself. Feng Meng told Chang'o about a pill that gave ordinary people immortality. It was made from a flower that grew beyond the mountains of Tibet. Feng Meng did not mention that the pill was owned by a monster goddess whose distant fortress was surrounded by a bottomless moat and a shield of flames.

Chang'o begged Yi to get the pill, and because he badly wanted to make his wife happy, Yi agreed to the journey. With great effort, Yi swam the moat and crossed the wall of flames. The goddess was so surprised to see him that she gave him her only pill – enough, she warned, for just one person to go to heaven or for two to live forever on Earth without aging or dying.

When Yi returned home, he and Chang'o agreed to share the pill at a special feast. In preparation, Yi told his wife he must go hunting; instead, he went searching for the fruits she loved – melons, pomegranates, peaches and grapes. When he did not return quickly, Chang'o started to fret – she worried that the more she waited, the more her beauty and youth would fade. The Feng Meng whispered in her ear that Yi wasn't going to come back. Chang'o was so upset she swallowed the pill alone.

Immediately, Chang'o started to float upward. She looked down to Earth and saw her husband on his way home, laden with her favorite fruits, and realized she had betrayed the man who loved her. She also sensed she would never be welcome in heaven. Chang'o looked for somewhere else to go and decided on the Moon.

Yi soon discovered that both his wife and pill were gone. He looked up to heaven and saw Chang'o on the Moon. He lifted his bow to shoot her down – but then decided he loved her too much and broke his bow in pieces.

With the bow broken, Feng Meng lost his fear of Yi. He lay in wait for his master beside a footpath and killed Yi with a wooden stake. Chang'o saw her husband's murder and cried pitifully.

Some say the gods and goddesses were so angry they turned Chang'o into a toad. You can see a toad in the white shape at the bottom of the full Moon. Others say the gods and goddesses knew Chang'o had suffered in the loss of her husband and let her live in sadness on the Moon. Her only companion is a gentle rabbit whose shape can be seen in the dark patches of the full Moon.

Asteroids

Asteroids are bits of rock that have never managed to come together to form planets. They can be as small as a house or as big as a state (asteroids are widely considered to be objects that are up to 1000km (621miles) in diameter, whereas planets are objects more than 1000km in diameter that orbit a star – although this is a contentious definition). Most asteroids orbit the sun along the same orbital path as the planets. This asteroid belt lies between Mars and Jupiter. It probably contains at least 40,000 asteroids, most of which are less than a mile across. Astronomers once thought asteroids were fragments of one mini-planet that broke up. Evidence now suggests they are fragments of smaller bodies that collided with each other.

Asteroid Fun Facts!

- The word "Asteroid" comes from Greek for "starlike". When seen through a telescope, an asteroid looks like a faint star.
- Many asteroids resemble peanuts – like two chunks of rock glued together.
- The largest object in the Asteroid Belt, Ceres, is about 900km in diameter. It was discovered in 1801 and is named after the Roman goddess of agriculture. Ceres is actually a dwarf planet – the smallest of the dwarf planets, but the largest object in the Asteroid Belt.
- Only one asteroid, Vesta, can be seen with the unaided eye.
- The asteroid belt makes journeys dangerous for spacecraft, which can be destroyed if they hit even a tiny object.
- Some asteroids have been found with orbits that cross the Earth's orbit. The chance of being killed by an asteroid that crashes into the Earth is about one in 5,000. However, this is because an asteroid strike would kill millions. No one has been hit in 1,000 years.

- More people work in a single McDonald's restaurant than are employed worldwide to monitor asteroids!

Comets

Comets are often described as "dirty snowballs" – lumps of ice, gas, dust and rock that can be up to 20km (20 miles) across. Their orbits are long and narrow, taking them far from the Sun most of the time. As a comet nears the Sun, it warms up. Ice evaporates from its surface and forms a large cloud called a coma. Solar wind blows the coma away from the Sun, forming a long, glowing tail that may be tens of millions of miles long (they are technically called comets when they are close enough to the Sun to sprout tails). Comets freeze down to a small, dark core when they are far from the Sun.

Some comets go right around the Sun every few years. Others take thousands or millions of years to do so because their orbits are so huge. Halley's Comet takes 76 years to orbit the Sun. It was last seen in 1986, and is due to return in 2061.

Comet Fun Facts!

- The name "comet" is derived from the Greek word *kometes* which literally means "long-haired".

- Halley's Comet was visible to the unaided eye for the longest time – 67 days - in 1066. William of Normandy believed it was a good omen and invaded England, killing its ruler, King Harold.

- The return of Halley's Comet in 1910 was a good excuse for a party. From New York to Paris, friends gathered on the evening of May 18 as Earth passed

through the comet's tail. Ladies in comet-tail hats and men in comet-decorated ties drank comet cocktails and danced to comet-inspired music.

Meteoroids

Meteoroids are pieces of rock and dust formed during a cosmic collision. They were once the part of an asteroid, comet, planet or moon. Most meteoroids are the size of a grain of sand, but a few are as big as a small airplane. If meteoroids enter Earth's atmosphere they usually burn up in flashes of light called meteors (more commonly known as "shooting stars"). However, larger meteoroids are not always destroyed and may land on Earth. Then they become known as meteorites. Thousands of meteorites hit Earth every day, most are too small to find but some are large enough and land with such force that they can make holes in the ground called craters.

Meteoroid Fun Facts!

- The biggest known meteorite weighed 60 tons. It fell in prehistoric times in Namibia, Africa, where it still lies.
- The most famous meteorite crater on Earth is in Arizona. It is nearly a mile wide.
- In Greenland, people dig up meteorites and use the iron in them to make tools.
- Meteors have scared people throughout history. They were believed to be huge, fiery dragons coming to attack the world, or weapons of revenge sent by the angry gods to destroy Earth.

Meteroids: Myths & Legends:

- ***Falling Coyote*** **(Native American)**
  Coyote loved to dance beneath the stars from dusk until dawn. One night he said to the stars, "You are so beautiful and dance so divinely. May I come up and dance with you?" The stars agreed, and Coyote made a ladder by firing arrows into the sky so he could climb up to the heavens. However, Coyote's friends were jealous, and many of them climbed up the ladder after him. The coyotes dance among the stars all night long, but whenever a coyote gets tired, he falls back to earth, creating a bright, glowing streak in the sky.

The Who's Who in Mythology!

Guide to Greek and Roman Gods and Goddesses:

Although you don't have to know all the names of the Greek and Roman gods, this guide should be helpful in understanding the myths and legends about the constellations. It can get a little confusing, because the same god will go by various names, and the relationships between them can be complicated. Basically, Kronos (Saturn) is the father of Zeus (Jupiter), the King of Gods. Poseidon (Neptune), Demeter (Ceres), Hera (Juno), Hades (Pluto), and Hestia (Vesta) are Zeus's siblings. Zeus is married to Hera (yep, his sister), but has numerous children, including Artemis (Diana), Helios (Apollo), Heracles (Hercules), and Dionysos (Bacchus), by many different women. When telling the myths to the kids, try to play down Zeus's "interesting lifestyle" as much as possible!

God's Function	**Greek Name**	**Roman Name**
King of Gods/controls weather	Zeus	Jupiter
God of the Sea	Poseidon	Neptune
God of the Underworld	Hades	Pluto
Messenger of the Gods/Roman God of Trade	Hermes	Mercury
God of War	Ares	Mars
The God's Smith	Hephaestus	Vulcan
God of Light/God of the Sun	Helios	Apollo
Goddess of Wild Animals/Goddess of the Moon	Artemis	Diana
Goddess of Wisdom	Athene	Minerva
Queen of Heaven	Hera	Juno
Goddess of Agriculture	Demeter	Ceres
Goddess of the Hearth	Hestia	Vesta
Goddess of Love	Aphrodite	Venus

God of Wine	Dionysos	Bacchus
God of Love	Eros	Cupid
God of Time/God of Agriculture	Chronos	Saturn
Queen of the Underworld	Persephone	Proserpina
God of Heaven/Father of Saturn	-	Uranus

The Constellations: An introduction

A constellation is a group of stars that seem to form a picture in the night sky. There are 88 constellations recognized by the International Astronomical Union. Constellations appear to move westward as the Earth rotates around the sun. For this reason, certain constellations can be seen only during one of the seasons during the year. The stars that make up constellations are not really close to each other. Sometimes the stars that look closest are really far apart – they just happen to form a pattern and so look like a group when viewed from Earth.

A number of early civilizations remembered the relative positions of the stars by putting together groups that seemed to make patterns, and named them after mythological or legendary men, woman and animals. The constellations, myths, legends, stories, and superstitions about the sky tell us a lot about what the ancient civilizations knew and thought of the world in which they lived. They indicate the cultural stereotypes, fears and taboos of societies before us.

Getting to know the stars and which constellation is where in the sky comes with a little reading, and a lot more standing outside night after night looking up! At first sight, the night sky seems bewildering – there are so many stars, with so little to tell them apart. To make matters worse, the stars rise and set at different times during the year as the Earth orbits the Sun. However, once you recognize a few key constellations they can act as signposts to the many others.

You don't have to know *every* constellation and *every* myth that is included here. For one thing, not all the constellations will be in the sky in the one season you are here. Try to locate all the main constellations that are relevant to you, it is good to be familiar with them. You can then pick and choose which ones you want to show the kids and which stories you want to tell them.

The following sections give you information about the night sky in the different seasons. First we'll give directions on how to find each constellation, and then give you the myths and legends associated with it. We've drawn "maps" of the sky to help you locate the constellations. Remember, when you look up at night, the stars are not going to appear exactly as they do on the page. They may be turned to the side, twisted around, in a different place than the last time you looked, partly washed out by the Moon, etc. All we can give you here is a guide. Real talent for finding constellations comes with dedicated time outside!

In addition to the "regular" constellations, there are also "Zodiac" constellations. There are twelve constellations of the Zodiac, which mark the circle of sky (known as the "ecliptic") through which the Sun travels. The ecliptic is actually the plane of the Earth's orbit around the Sun, but viewed from Earth the Sun appears to move steadily along the ecliptic from west to east, taking a year for full circuit.

The ecliptic is the plane of the whole solar system, which means that the Moon and planets also pass through the same band of sky. In ancient times, that was enough to give the Zodiac special significance. The word *Zodiac* comes from the Greek for "circle of animals." All the constellations (except Libra) are animals or people.

Disclaimer #1:
As mentioned, there are 88 constellations recognized by the International Astronomical Union. **We have included here only a portion of them, not all 88.** These are the most common ones that people can find and recognize. If you know others, and you like them, by all means include them in your lesson. But also recognize that we are trying to make this as easy as possible for instructors who are just learning the night sky and so have included only the most common, not all of them!

In addition, this is a complete Astronomy handbook. Meaning that the sky for the entire year is in this manual. It is senseless for us to take out and put in the correct sections each season, so we leave it as a complete manual. **You will need to read only the seasons that pertain to your tenure here at TOS.**

Disclaimer #2:
We have included myths, legends, and stories from many cultures in our manual. Understand that in school students are focused mostly on Greek and Roman (traditional Western) history. Whether or not you may agree or disagree with that focus, it **is** what schools are focused on. And since what we do is tied to the school system, the Greek and Roman stories are in our manual.

We are not intentionally attempting to "force" you to stick to the Greek and Roman stories; however, stories from other cultures can be difficult to find, and that is why some constellations only have Greek or Roman stories listed. If you find a story online or in a book that you would like to share, please give it to one of the full time staff who will include it in the manual for future seasons.

Constellations: Myths & Legends:

There are some good Native American stories about the constellations and how they compare to the Greek or Roman constellations.

- ***Why the Stars are in the Sky*** **(Eskimo legend)**
  To the Eskimos the stars are not just put in the sky to give light or guide the wandering traveler. They are living things, sent by some twist of fate to roam the heavens forever, never swerving from their paths. One of these creatures who left the earth and went to live in the sky was Nanuk the bear.

  One day Nanuk was waylaid by a pack of fierce Eskimo hunting dogs. Nanuk knew only too well that Eskimo dogs are not to be trifled with, and he tried to give them the slip. Faster and faster he ran over the ice, but the dogs were still at his heels. For hours the chase went on, yet he could not shake them off. In

the fury of and terror of the hunt, they had come very close to the end of the world, but neither Nanuk or his pursuers noticed. When at last they reached it, they plunged straight over into the sky and turned into stars. To the Europeans they are the Pleiades, in the constellation of Taurus the bull. But to this day the Eskimos see them as Nanuk the bear, with the pack of savage dogs out for his blood. Up in the sky directly overhead the Eskimos see a giant caribou, though we call it the Great Bear.

Over on the other side of the sky, they can make out some stars in the shape of an oil lamp. (we say it is the constellation of Cassiopeia). On the horizon between the lamp and caribou the Eskimos see stars like three steps carved out of the snow. They call it the stairway from Earth to the Sky, but we talk of Orion the Hunter. Sometimes, on the darkest nights, the Eskimos' dead ancestors come out to dance. The stars are the lights around the dance floor. Then Gulla glows across the sky: the shimmering pattern of the Aurora Borealis, or Northern Lights.

To the Norsemen it was Bifrost, the bridge from our world to Asgard, home of the gods. But to the people of the Far North, the loveliest and most wonderful star of all is the sun. They see her as a young girl of dazzling beauty. In their brief Arctic summer she is there night and day, for this is the season of the midnight Sun, when her brother Aningan, the Moon, chases her round and round the North Pole so she cannot escape over the horizon. Aningan the Moon is a great hunter, and he chases animals as well as his sister the Sun. He has a faithful pack of hunting dogs to help him. Sometimes his hounds are carried away by the joy of the hunt, and they jump over the edge of the sky and run down the stairway in Orion to Earth. That is why there are shooting stars.

- ***Pushing up the sky*** **(Native American, Snohomish Tribe)**
  The Creator and Changer first made the world in the East. Then he slowly came westward, creating as he came. With him he brought many languages, and he gave each one to each group of people he made. When he reached Puget Sound, he liked it so well that he decided to go no further. But he had many languages

left, so he scattered them all around Puget Sound and to the north. That's why there are so many different Indian languages spoken there.

These people could not talk together, but it happened that none of them were pleased with the way the Creator had made the world. The sky was so low that the tall people bumped their heads against it. Sometimes people would do what was forbidden by climbing up high in the trees and, using their own words, enter the Sky World. Finally the wise men of all the different tribes had a meeting to see what they could do about lifting the sky. They agreed that the people should get together and try to push it up higher.

"We can do it," a wise man of the council said, "if we all push at the same time. We will need all the people and all the animals and all the birds when we push."

"How will we know when to push?" asked another of the wise men. "Some of live in this part of the world, some in another. We don't all talk the same language. How can we get everyone to push at the same time?"

That puzzled the men of the council, but at last one of them suggested that they use a signal. "When the time comes for us to push, when we have everything ready, let someone shout 'Ya-hoh.' That means 'Lift together!' in all our languages. So the wise men of the council sent that message to all the people and animals and birds and told them on what day they were to lift the sky. Everyone made poles from the giant fir trees to use in pushing against the sky.

The day for the sky lifting came. All the people raised their poles and touched the sky with them. Then the wise men shouted, "Ya-hoh!" Everybody pushed, and the sky moved up a little. "Ya-hoh!" the wise men shouted a second time, and everybody pushed with all his strength. "Ya-hoh!" all shouted, and pushed as hard as they could push. They kept on shouting and pushing until the sky was in the place where it is now. Since then, no one has bumped his head against it, and no one has been able to climb into the Sky World.

Now, three hunters had been chasing four elks during all the meetings and did not know about the plan. Just as the people and animals and birds were ready to push the sky up, the three hunters and the four elks came to the place where the earth nearly meets the sky. The elks jumped into the Sky World, and the hunters ran after them. When the sky was lifted, elks and hunters were lifted too. In the Sky World they were changed into stars, and at night even now you see them. The three hunters form the handle of the Big Dipper. The middle hunter has his dog with him – now a tiny star. The four elks make the bowl of the Big Dipper.

Some other people were caught up in the sky in two canoes, three men in each of them (Orion's belt and Orion's sword). And a little fish was also on its way up into the Sky World when the people pushed. So all of them have had to stay there ever since. The hunters and the little dog, the elk, the little fish, and the men in the two canoes are stars, even though they once lived on earth.

Section 2 - The North Polar Sky

There is no 'proper' place in the sky to begin looking at the stars and constellations, but a helpful place to start is the North Polar Sky. The constellations in this part of

the sky can be seen by people in the Northern Hemisphere for the entire year. (This is actually only true if you are standing by the ocean with nothing, such as trees or buildings, above the horizon. Here at TOS, you will be able to see most of the constellations in this part of the sky for much of the year. Some, however, will slip below our horizon.)

There are five constellations in the North Polar Sky:

- Ursa Major (the Greater Bear)
- Ursa Minor (the Lesser Bear)
- Cepheus (the King)
- Cassiopeia (the Queen)
- Draco (the Dragon).

Unlike the stars in the North Polar Sky, stars in other parts of the sky cannot be seen all year round. The stars that you will be able to see change from month to month. Therefore, most constellations are associated with the seasons. It is said that a particular constellation is seen in the Spring Sky, Summer Sky, Autumn Sky, or the Winter Sky. However, most constellations will lap over from one season to the next, since the rotation of the Earth is a gradual process.

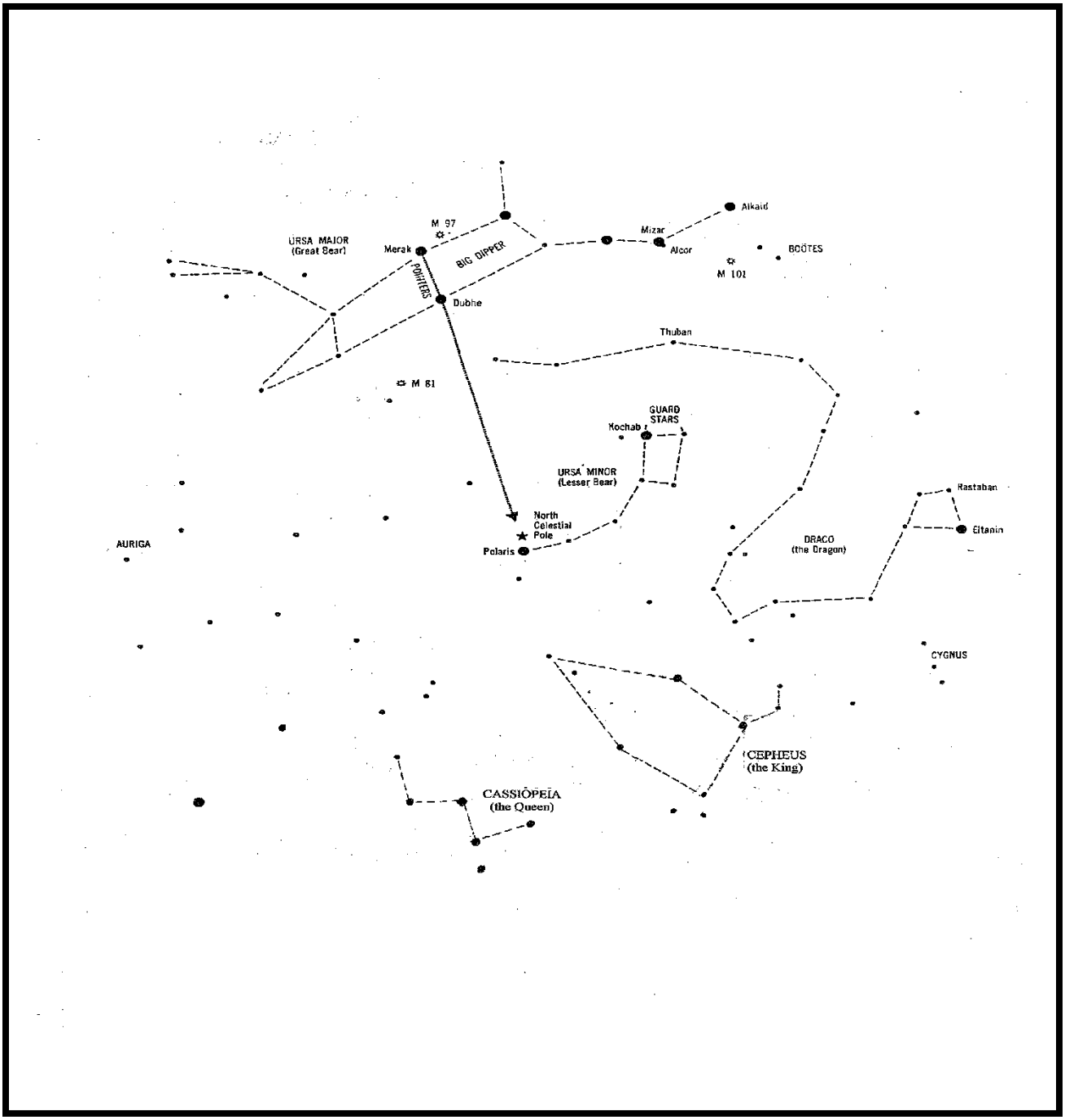
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Quick Reference Guide to the North Polar Sky

Constellation Name	Nickname(s)	What it looks like	How to find it	Notable Stars
Ursa Major	The Great Bear; The Big Dipper	Big ladle	Look north for ladle formation	Mizar: Brightest of middle two stars in handle Alcor: Smaller of middle two stars in handle
Ursa Minor	The Lesser Bear; The Little Dipper	Small ladle	Follow pointer stars from Big Dipper to Polaris	Polaris: End of handle
Cassiopeia	The Queen	Squashed "W"	Follow line from Mizar through Polaris to the squashed "W".	
Cepheus	The King	House	Follow line from pointer stars through Polaris to the point of the "rooftop".	
Draco	The Dragon	Trapezoid with a long curving tail	Tail is between Ursa Major and Ursa Minor. Draco then backwards S's behind the Little Dipper and next to Cepheus and Cygnus	Eltanin: Big star in Draco's head Rastaban: Next to Eltanin

A Map of the North Polar Sky



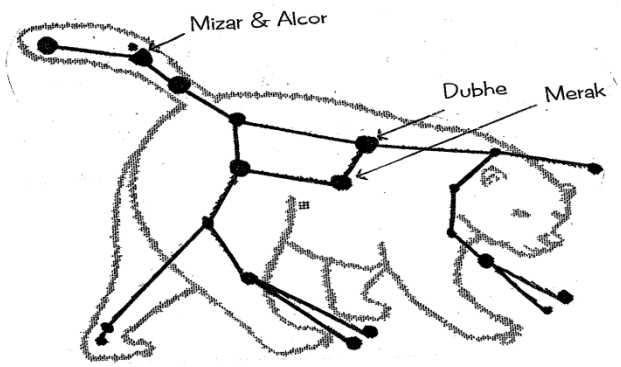
How to find Ursa Major (best seen: always)

Ursa Major (the Greater Bear) is probably the first constellation you learned when you were younger. It is better known as the "Big Dipper" in the USA, "the Plough" in England, a coffin to the Arabs, and as a reindeer in Lapland. The Big Dipper is the common name for just part of the constellation. Ursa Major is the easiest constellation to locate and use as a guide to find the other constellations in the North Polar Sky.

The first thing you need to do in order to find Ursa Major is to locate the direction north, and look for an area of sky with some bright stars. The seven stars that make up the "Big Dipper" are some of the brightest stars in this section of the sky. They are shaped like a giant ladle. After you have found the "Big Dipper", try to make out the rest of the Greater Bear. The dipper forms the back half of the Greater Bear with the handle outlining its tail. Ursa Major contains a total of 53 visible stars! Don't panic, you don't have to know all these!

Stars of interest on the Dipper are the "pointer" stars, Dubhe and Merak, (the two stars in the end of the ladle), and a pair of stars in the middle of the handle. Their names are Mizar and Alcor. Mizar is so close to Alcor that they appear to be one star. These two stars are therefore known as a "double star".

In the past, armies have used the double star in the Big Dipper as an eye test. If you could see both stars your vision was good enough for combat.



3

Ursa Major: Native American Legend (the Blackfoot Tribe)

Among the Blackfoot Tribe is a myth explaining how the stars of Ursa Major came to be. The elder daughter of a large family fell in love with a grizzly bear and married him while her brothers were away on a hunting trip. Now, this was a very special grizzly bear since he had magical powers. Angry beyond words that his daughter had married without his permission, the girl's father ordered that the tribe's warriors track down and kill the bear. The warriors did as they were told. While the bear was dying, he gave some of his magic powers to his wife. With these powers she turned herself into a grizzly bear and destroyed the entire village in revenge for her husband's death. She then turned back into her human form.

What she didn't know was that her younger brother and sister had been hiding. They ran down to the river, and were very pleased when they met their six brothers returning from the hunt. When the youngsters told them what had happened, the brothers were horrified. Late that night, the six brothers and the two youngsters tried to sneak out of the village.

Now the elder sister heard them. She immediately changed herself into a bear and ran after them. When they realized that the bear was slowly catching up with them, they became frightened. The younger brother, who also happened to have certain magical powers, came up with a plan. He shot an arrow in the direction they were running. Instantly all eight of them were at the place where the swift arrow had landed. However, the bear was still catching up. The young brother tried shooting more arrows, but eventually the bear caught up with them and grabbed five of them in her claws. Before she could eat them, the young brother shot eight arrows high into the sky. One by one, each of the children disappeared from the bear's strong grip and became a star in the sky.

The six older brothers and the younger one each became one of the seven stars forming the Big Dipper. The young and very frightened sister became the dim star, Alcor, huddling close by one of her brothers, Mizar.

Ursa Major: A Philippine folktale

Terrible times fell on the village of a poor woman and her son. The hot weather dried up the wells, people became weak and sickly, and the woman lay on her bed gasping. She begged her child for water – even a few drops to wet her tongue.

The boy took a water dipper made from a coconut shell and ran from the house, but everywhere was dry and he became discouraged. Looking to the sky, the boy asked to be guided to water. Instantly, water gushed from the ground where the boy stood. He filled the dipper, gave thanks to heaven and started for home. An old man called out, asking for a sip. The boy stopped, let the old man drink and dashed off toward home.

In his hurry, the boy tripped and fell, spilling the water and smashing the dipper. He sat down and sobbed. Then, looking to heaven again, he asked once more for water. Where he had spilled from his dipper, a well appeared.

Shouting with excitement, the boy called the other villagers to come and drink their fill. He borrowed another coconut shell and filled it with water for his mother. When he looked to heaven again, his broken dipper was being lifted skyward and turned into the stars of the Big Dipper.

Ursa Major: Native American Legend (the Micmac Tribe)

The Micmacs used the different positions taken by the circumpolar stars, starting in the spring, to tell the story of a bear hunt. The bear is the bowl of the Big Dipper. Her seven hunters, all birds, are the three handle stars of the Dipper plus four stars in Bootes, the Herdsman. The bear's den is Corona Borealis, the Northern Crown.

In early spring, a keen-eyed chickadee spotted a bear climbing out of winter's den. The chickadee knew he couldn't take on the bear alone and called his six friends for help – two owls, a blue jay, a passenger pigeon, a gray jay and a robin. The bear caught a glimpse of the hunters and ran for her life. The chase began.

Through all of spring and summer, the hunters tracked the bear across the night sky. In early autumn, the two owls, clumsier fliers than the rest, dropped out of

the chase and fell below the horizon. As the nights grew colder, blue jay and pigeon lost the trail and disappeared. Gray jay, chickadee and robin managed to keep up the chase but grew thin with hunger. In mid-autumn, robin finally cornered the bear. The bear rose up on her hind legs in self-defense, but robin stood his ground and shot her with an arrow. Bear fell on her back and died.

Overcome with hunger, robin jumped onto the bear for a quick bite of fat and was smeared in blood. He flew to a nearby maple tree and tried to shake it off. The blood splattered far and wide, turning the maple leaves red. One patch of blood would not shake off and it stained the robin's breast forever.

Finally chickadee caught up with robin. Together, they started a fire, carved up the bear and cooked the meat. When they were ready to eat, gray jay arrived and demanded his full portion. Chickadee stirred the pot, gray jay and robin danced around the fire. The hunters were thankful for the food.

The bear's skeleton lies on its back all winter while her spirit moves into another bear asleep in the den. Ever since, when spring returns, a new bear climbs out and the hunt starts all over again.

Ursa Major: Native American Legend (also derived from a Mongolian legend).
When the Earth was very young an American Indian wise man sent his seven sons into the forest to learn how to read the wind. They entered the woods and silently walked while listening to every sound of the wind. When night approached they found a place to rest and to sleep.

During the night the oldest brother was suddenly awakened by a strange sound. The wind was singing. He could not read the wind song, but as he looked to the stars he saw a bright flickering light in the Pleiades. He was startled. It appeared to be beckoning for it was flickering in rhythm with the wind song.

He immediately awakened his brothers to listen to the song and to help read the wind. They joined hands and began to dance. The song became stronger and their dance more intense. Suddenly they began to rise toward the flickering star who

was the youngest of the seven sisters of the Pleiades. She had fallen in love with the youngest brother Mizar. Since then, Mizar and his love, given to him by the wind song, can be seen by those sharp eyes in the handle of the Big Dipper – the home of the seven brothers.

Ursa Major: Native American Legend (the Wasco Tribe)

Once there were five wolves who would share meat with Coyote. One night the wolves were staring up at the sky. "What are you looking at?" asked Coyote. "There are two animals up there," they told him, "but we can't get to them." "That is easy," said Coyote. He took his bow and shot an arrow into the sky where it stuck. He shot another arrow which stuck into the first. Then he shot another and another until the chain of arrows reached the ground. The five wolves and Coyote climbed the arrows and the oldest wolf took along his dog. When they reached the sky they could see that the animals were grizzly bears. The wolves went near the bears and sat there looking at them and the bears looked back. Coyote thought they looked good sitting there so he left them and removed his arrow ladder. The three stars of the handle of the Big Dipper and the two stars of the bowl near the handle are the wolves. The two stars on the front of the bowl point to the North Star are the bears. Alcor, the little star by the wolf in the middle of the handle, is the dog.

Ursa Major: Native American Legend (the Musquakie Tribe)

The bowl of the Dipper forms a bear. The stars of the handle are the hunters chasing after the bear. The tiny star Alcor is a small dog named 'Hold Tight.' In autumn when the Dipper is low to the horizon the blood from the arrow wounds drips on the trees and turns them red and brown.

Ursa Major: Native American Legend (the Anishinabe Tribe)

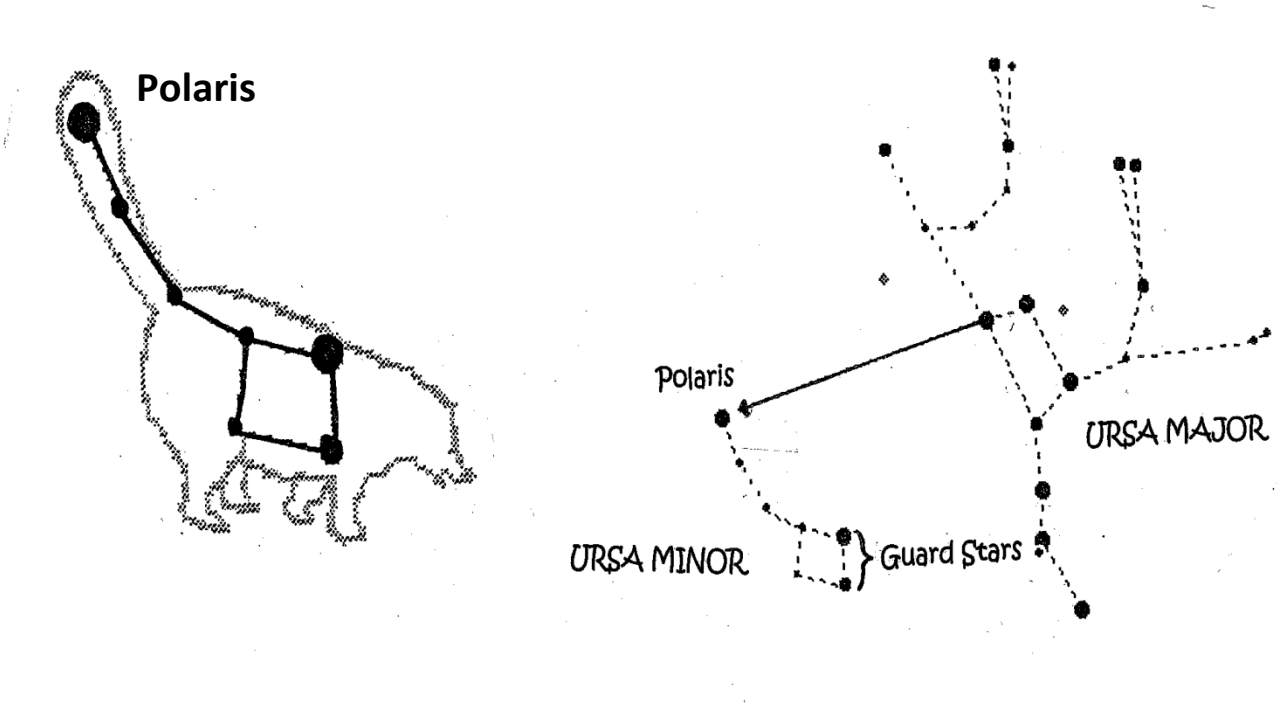
Fisher was a small animal but a great hunter as well. One day the cold became too much so he told his friends, Otter, Lynx and Wolverine, "We will go where the Earth is closest to Skyland. The Skyland is always warm and we will bring some of the warmth down to Earth." They traveled far up in the mountains, closer and closer to Skyland. When they were close Fisher said, "We must jump and break through to the land above the sky."

Otter jumped, bumped his head on the sky and fell back down the mountain. Lnyx jumped, bumped his head and became unconscious. Wolverine jumped, bumped his head and kept jumping over and over until the sky cracked a little, then finally it broke open. Fisher jumped through after him and found the place to be absolutely beautiful and warm. Birds flew through the crack in the sky to the world below. The warmth began to flow to the Earth and melt the snow.

The Sky-People saw the warmth escaping and called out, “Thieves!” Wolverine ran back to the crack in the sky but Fisher was making the crack bigger. Arrows were flying through the air. Fisher was killed. The great Gitchee Manitou took pity on Fisher, healed him and placed him in the sky forever becoming the Big Dipper. Each autumn as Fisher falls towards the Earth, the Sky-People try to patch the crack and winter arrives. In spring, Fisher climbs to the sky and reopens the crack and we have summer.

How to find Ursa Minor and Polaris (best seen: always)

Two stars at the end of the bowl of the Big Dipper, Dubhe and Merak, are known as the pointers. These will help you to locate the North Star, Polaris (named so because it is located directly overhead as seen from the North Pole). A line drawn between them points the way to Polaris. Contrary to popular belief, the North Star is not the brightest star in the sky. It marks due north and has long been used as a compass by mariners and outdoors people. Polaris is the tail star in the constellation Ursa Minor (the Lesser Bear) a collection of seven stars better known as the "Little Dipper".



Ursa Major and Ursa Minor: A Greek Myth

Zeus, King of the Gods, fell in love Callisto, a beautiful, young woman who spent much of her time in the mountains hunting animals. When Hera, Zeus's wife, heard of what was happening she was furious - *she* was the most beautiful woman in the Universe! She decided to track Callisto down and get her revenge. Hera thought the first thing to go should be Callisto's long, silky hair. So she replaced it with short, brown fur that covered every inch of Callisto's body. So impressed was she by her handiwork, she decided to just go ahead and turn her into a bear. This way

Callisto would now be the animal she loved to hunt! To make matters even worse, as Hera was quite capable of doing, she left Callisto with her human feelings rather than those of a bear. So Callisto roamed the forest day and night in constant fear of the hunters *and* in fear of other wild beasts, although she was now one of them.

One day, as she was roaming around the forest, Callisto found herself face-to-face with a young and handsome hunter and suddenly recognized him as her son, Arcas. She raised up on her hind legs to hug him and plant a huge kiss on his cheek. Thinking that the bear was about to attack him, Arcas raised his spear and was about to hurl it when, just at the right moment, Zeus happened to be looking down from his position on Mt. Olympus and instantly turned Arcas into a bear also. Zeus then grasped each bear by its tail and tugged and tugged until he had managed to lift both high into the sky, Callisto as Ursa Major and her son Arcas as Ursa Minor. This tugging of the tails, by the way, over such a long journey through the sky, stretched both tails and explains why our celestial bears, unlike earthly ones, have long tails.

On discovering that her husband had given Callisto and Arcas honored places in heaven, Hera was really mad, she was seriously starting to turn green with jealousy. She went down to Earth to visit her friend the ocean god, Oceanus. “How dare Zeus give these two an honored place in heaven?” Hera fumed. “They have now displaced me, Queen of Heaven, from my place in the sky. I ask that you forever keep these two in a pen so that they may never wander off and make my life more miserable than it already is!”

Oceanus was a little sympathetic, but more than anything just wished that this complaining, whining woman would go away and bother someone else. So he decided to grant Hera her wish. He would see to it that the bears would be forever forbidden to set below the horizon as other constellations do, so there is no way they could reach out onto the land and escape. To this day the Lesser Bear and the Greater Bear are held high in the sky.

Polaris (The North Star):

To our eyes, Polaris appears to be motionless at the center of the circumpolar stars. All the other stars appear to circle about Polaris. As early as 320 B.C. the Greeks had realized that Polaris did not mark the pole exactly. Until then many people had believed that the heavenly pole was absolutely and eternally fixed. In fact, Polaris has long been moving nearer the North Celestial Pole, as it is still doing now. It will be closest to that position in around 2100 A.D. (it is currently about 1 degree away).

Since Earth wobbles on its axis like a slowly spinning top, the Pole Star changes. At the time the Egyptian pyramids were being built, around 3000 B.C., the Pole Star was Thuban, the third star from the end of the tail in Draco, the Dragon. A pyramid in Gizeh was built in such a way that Thuban was visible day and night from the bottom of one of the pyramid's deep air shafts. Other pyramids also seem to have been built with the then Pole Star as a focal point.

Polaris has been known by many names in the past – the Lodestar, the Steering Star, the Ship Star. In China, it was known as *Tou Mu*, Chinese goddess of the North Star. It is believed that *Tou Mu* has the power to prolong life and that if someone prays hard enough to her, the prayers will be answered. The Moguls looked on Polaris as holding the Universe together. They called it the Golden Peg.

The Arabs regarded Polaris as an evil star, calling it *Al Kinblah*, because it was the star "least distant from the pole." It was Polaris, they said, who had slain the great warrior of the sky who forever lies in the huge coffin outlined by the stars marking the Big Dipper. All the other stars mourn for their lost hero and each night march slowly around the sky in a never-ending funeral procession. The villain, Polaris, alone is kept motionless, an outcast forever fixed to the coldest part of the northern sky.

Polaris: Native American Legend (Omaha)

The Omaha Indian story begins during a time of tribal disruption, brought on by disagreements between Omaha chiefs. Tired of all the arguing, one of the chief's sons decided to leave the village for the morning and do some hunting. He had a wonderful day. He killed a rabbit, which he skinned and ate for lunch with a few

berries freshly picked from the bushes. He ran and skipped and jumped and sang at the top of his voice. He was just so happy to be away from the adult "discussions".

The young boy was swinging on a tree branch out in the forest, singing to himself, when he noticed that it was getting kind of dark. With a sinking feeling in his stomach, he suddenly realized that he hadn't paid much attention to where he was going. Disoriented and just a little scared, he pushed back the brush in an attempt to spot *Miki Em Thi Ashi*, the "Star That Does Not Walk." He hoped to use the North Star to guide his way home. He knew his father had told him where it was, but he hadn't really been listening – one of the girls from the tribe had been walking past at the time and he'd been kind of distracted.

He wandered around the forest some more, hoping to see something he recognized, when he spotted a burning light in the distance. Thinking it was a campfire he headed for it. However, when he got close enough to tell what it was, he realized the light was produced from a burning tree. He crept up to get a closer look and noticed something really odd. Despite the roaring flames around the trunk and throughout the branches, the tree remained whole. It wasn't even turning black. Getting more and more curious, he reached out his hand and touched it. It was cold! Amazed at this extraordinary sight, he sat watching the flaming tree, mesmerized until dawn. At sunrise, it returned to normal. The whole experience was so strange, he decided to stay another night and watch the fireworks once more. As the sky turned dark, the tree began to glow the same magical fire.

The next morning, in the daylight, the chief's son was soon able to figure out his way home. He was kind of nervous about returning to the camp – he was sure he would be told off for getting lost. When he arrived, his father told him that his punishment was to receive another lesson on finding the North Star.

He *finally*, after having to listen to his mother go on and on and *on* about the dangers of the forest, was able to describe what he had seen. They decided to go back to the tree together that night to catch its next performance. As they were

sitting there, his father noticed that Thunderbirds trailed fire when they arrived at the tree or departed. Each Thunderbird traveled from one of the World's Four Winds. Journeys the forest animals had made to the tree had worn the four paths smooth with their footsteps.

When the four Thunderbirds took their perches on the tree, it burst into the magical flames first seen by the chief's son, but the light from this fire could only be seen at night. His father was so amazed at this sight he took it as a sign from the gods. He declared the tree to be a gift from Wakonda, the Great Spirit within all life and existence. Wakonda is the source of the world's rightness, or order.

The chief decided, as the wonderful ever-burning tree represented order, that it would be just the symbol needed to keep the Omaha people from dispersing. He returned to the tribe to tell them about this miraculous tree. At his recommendation, a group of warriors went back to the tree, ceremonially attacked the tree, cut it down, and brought it back to their village. There they re-erected it and from that moment on it became the focal point for discussions on the tribe. Through this tree, now transformed into the Sacred Pole, the threatened social order of the Omaha was strengthened. Problems, disagreements, and troubles were all to be brought, with presents and prayers, to the Sacred Pole.

Polaris: Native American Legend: *Why the North Star Stands Still* (the Paiute Tribe)

The People of the Sky traveled so much they made trails in the heavens. If you are patient you can see which way they go. But the North Star does not travel. While on Earth, Na-gah, the mountain sheep, was brave, daring and courageous. Every day he climbed and sought out rough terrain and the high peaks. He lived among them and was very happy. Once, a long time ago, he found a very high peak where the sides were steep and sharp, reaching for the clouds. Na-gah looked up and said, "I wonder what is up there. I will climb to the very highest point."

He wandered all around the mountain trying to find a trail but to no avail. He was sure his father would be ashamed of him if he knew that there was a mountain his son could not climb. He always started out but came right back down. He finally

found a crack in a rock that went down, not up. Down he went into it and soon found a hole that turned upward. He was glad…up and up he climbed.

It became dark and the cave was full of loose rocks. His courage and determination began to fail. He was afraid and also very tired. But when Na-gah turned to go down he found the rolling rocks had closed the cave below him. He must go on climbing! After a long climb he saw a light, "Now I am happy. I am glad I came up through the dark hole."

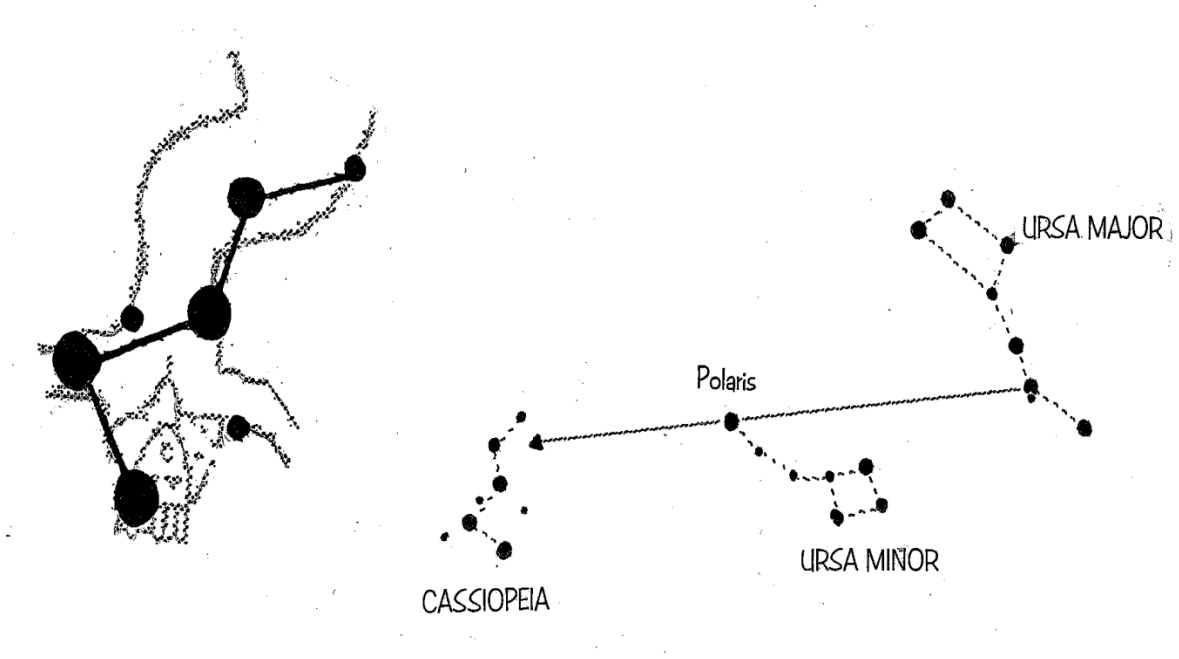
He was indeed up on top of a very high peak! There was scarcely room for him to turn around and the height made him dizzy. There were great cliffs below him in all directions and only a small place in which he could move. Nowhere on the outside could he get down and the cave was closed on the inside. "Here I must stay until the day I die," he said. "But I have climbed my mountain! I have climbed my mountain at last!"

His father was out looking for Na-gah when he called from the highest cliffs. "He must stay on top of the highest mountain and can travel no more," he said sorrowfully. "I will turn him into a star so he can stand there and shine where everyone can see him. He shall be a guide mark for all the living things on the earth or in the sky." Our people call him Qui-qm-I Wintook Poot-see. These words mean "the North Star."

Besides Na-gah, other mountain sheep are in the sky. They are called the "Big Dipper" and "Little Dipper." They too have found the great mountain and have been challenged by it. They have seen Na-gah standing on its top, and they want to go on up to him. Shinoh, the father of North Star, turned them into stars, and you may see them in the sky at the foot of the big mountain. Always they are traveling. They go around and around the mountain, seeking the trail that leads upward to Na-gah, who stands on the top. He is still the North Star.

How to find Cassiopeia (best seen: August - January)

To find the constellation Cassiopeia (the Queen), locate Mizar (the second star in the handle of the Big Dipper), and Polaris. Connect a line through this star from Ursa Major through Polaris. This will point you towards a smashed "W" or "M" shaped constellation. This is Cassiopeia.



Cassiopeia: A Native American Legend (the Yakima Tribe)

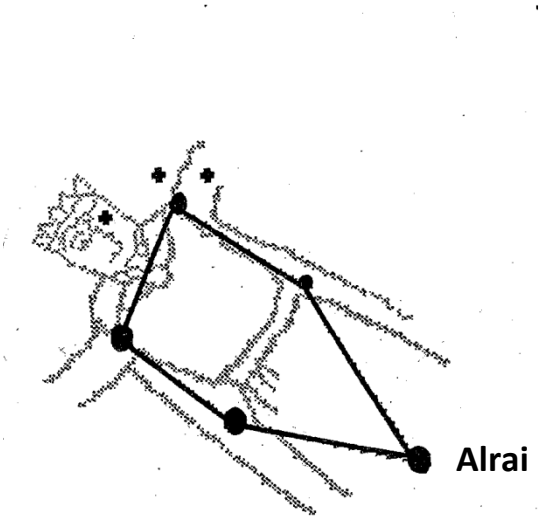
A hunter killed a great elk and stretched the skin to dry by driving wooden stakes through it. Afterwards he threw the skin into the sky (Cassiopeia) where the light above shines through the stake holes forming stars.

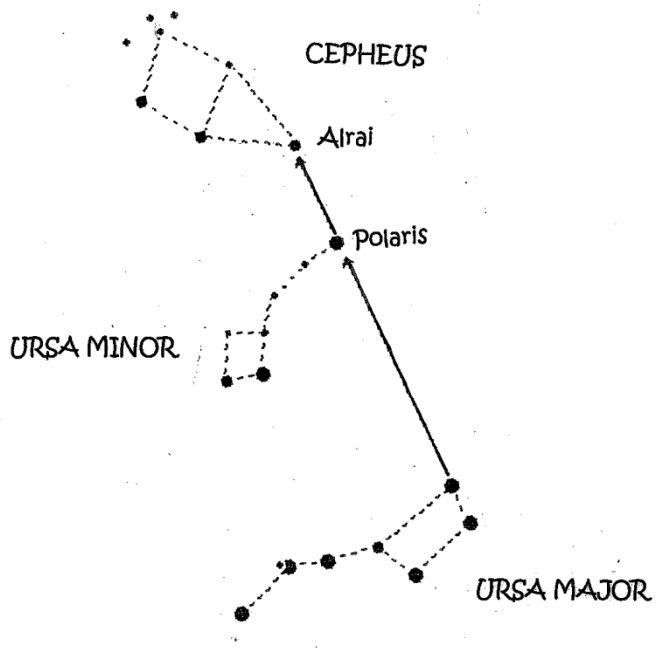
Cassiopeia: Greek Mythology

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

How to find Cepheus (best seen: August – January)

Cepheus (the King) looks like a house. To find the constellation Cepheus locate the pointer stars (the two end stars in the ladle of the Big Dipper). Connect a line through these two stars. This will point to the star Polaris. Continue through Polaris and onto the star, Alrai. Alrai marks the point (rooftop) of the constellation Cepheus.





Cepheus and Cassiopeia: A Greek Myth (also includes Andromeda, Perseus and Cetus)

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

Cepheus was the King of Ethiopia, and the beautiful Cassiopeia was his Queen. Soon after their marriage, Cassiopeia gave birth to a daughter, Andromeda. Even

as a young girl, Andromeda possessed a beauty as great as that of her mother. Cassiopeia was vain and boastful. She claimed so great was her beauty and that of Andromeda that it surpassed even that of the sea-nymphs.
When the sea-nymphs overheard Cassiopeia they were very angry. How dare she be so vain? They complained to Poseidon, God of the Sea, and demanded that Cassiopeia be punished. Poseidon agreed and summoned a terrible sea-monster, Cetus. "Go to the coast of Cassiopeia's land," Poseidon directed, "and destroy all you can find."

To the horror of Cepheus and Cassiopeia, Cetus, in the form of a monstrous whale, set upon his mission of destruction. The frightened people gathered and pleaded to their king to save them. Cepheus consulted an oracle – one with magical powers who could communicate with the gods when men sought their advice. The oracle told Cepheus that there was only one way to stop the slaughter: "You must offer your daughter Andromeda as a sacrifice." She was to be chained to the rocks on the coast and left there for Cetus to devour. Cepheus was torn with grief, for his people and their property, and for his daughter. He made the bitter choice of sacrificing Andromeda. She was chained to the rocks and abandoned to await Cetus.

When Cetus discovered the prize awaiting him, he stopped his destruction of the land and began swimming toward the ledge where Andromeda was chained. But then a distant figure appeared in the sky. It was Perseus, the brave warrior. He was over the coast of Ethiopia when he noticed Andromeda chained to the rocks by the sea, and not far away he could see Cetus rapidly nearing her. He swept down to the girl's side. "Why are you thus bound?" he asked, overwhelmed by Andromeda's beauty. Andromeda told him the story of her boastful mother and the advice the oracle had given to her father.

As he listened, Perseus could hear distant thrashing in the water. It was Cetus, his head above the waves, parting the waters with his massive scaled body as he approached the shore. Meanwhile, people had gathered along the shore, having heard reports of the approaching sea-monster. They were terrified by his awful

appearance as he churned through the waters toward them. Among those present were Cepheus and Cassiopeia, who were tearfully embracing their daughter.

Perseus quickly turned to Cepheus and said: "I can save your daughter from the sea-monster, but for my reward I demand Andromeda's hand in marriage, and a kingdom." Cepheus promised Perseus that he would have what he asked for, whereupon Perseus took out his sword and leapt into the air to attack the whale. Perseus plunged his sword deeply into the monster's chest and directly through Cetus's evil heart. Slowly the monster slipped beneath the waves.

Joyful beyond words, Cepheus and Cassiopeia led Perseus and Andromeda to their house, where a great feast and celebration were prepared. Perseus and Andromeda were married and led a long, happy life together.

When Perseus and Andromeda died, they were given honored places among the stars. Cetus, the sea-monster, was there waiting for them and forever chases Andromeda around the sky, but Perseus continues to guard her well. Meanwhile, Cepheus and Cassiopeia had died and were likewise given honored placed among the stars by Poseidon.

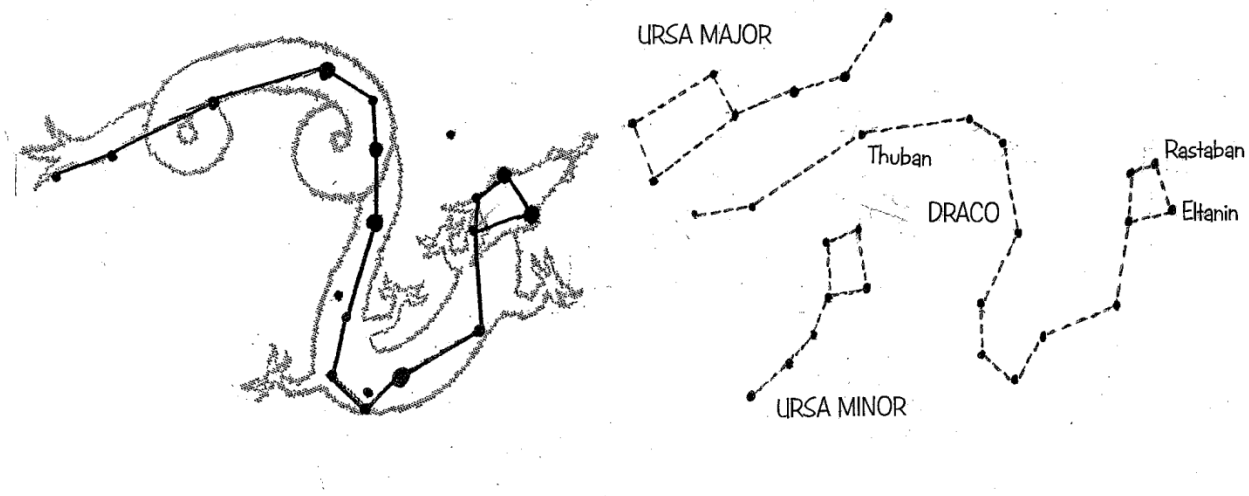
Now, when the sea-nymphs heard of Cassiopeia's reward, which they considered unfair, they complained to Poseidon for so honoring her. Poseidon appeased them by placing Cassiopeia in such a position that for half the night she is seen sitting upright on her throne, but for the other half she is seen hanging upside down in an undignified and most uncomfortable position.

A Greek Myth

There is another version of this story in the Winter Sky section under Perseus. It is longer and involves more characters. It's a tad more interesting.

How to find Draco (best seen: May – November)

Draco (the Dragon) is a great constellation made up of fifteen or so stars. It winds his way across the sky in a huge backwards "S", his tail separating the two dippers. There are no wonderful pointer stars to Draco, but if you remember his shape and look between Ursa Major and Ursa Minor, you should be able to see the start of his long curving tail. Draco then dips around Ursa Minor and curves towards Cepheus, before twisting back in the opposite direction to form the head. This is made up of four stars in the shape of a trapezoid. The star Eltanin in Draco's head is also a double star.



Draco: A Greek Myth

Greek myths tell of a great battle between the young gods and the older ones who had ruled for so very long. The new gods included Zeus, together with his brothers Poseidon and Hades. There were also Hera and Demeter along with Athena and others. Among the older gods, who were associated with evil and darkness, was the many-headed monster known as Hydra. There were also other terrifying figures thrown up out of the volcanoes that belched out of the bowels of Earth. These monsters were known as the Giants, or the Titans.

During the battle, which lasted for ten long years, one of the Giants hurled a fierce dragon at Athena. So great was her strength, however, and so effective her magic shield, that Athena was not frightened. She caught the dragon and, with one mighty heave, swung him high into the heavens. Up he soared, twisting and

coiling this way and that until his long body had become tied in knots. He came to rest in the northern sky and became fixed to that region around which the northern stars circle. Today we see him forever asleep as the much knotted, battered, and twisted Draco.

Section 3 - The Winter Sky

The constellation Orion is the key to learning the winter skies (which you can see well into our spring season here at TOS). Orion has more bright stars than any other constellation in the sky, and is therefore among the easiest to find.

Once you have found Orion, it can be used to locate the other constellations. The constellations of the Winter Sky that we have included here are (zodiac are in bold):

<u>Group 1:</u>

- Orion (the hunter)
- Canis Major (big dog)
- Canis Minor (little dog)
- Lepus (the hare)
- Auriga (the charioteer)
- Perseus (the warrior)
- Eridanus (the river)

<u>Group 2:</u>

- **Gemini (the twins)**
- **Cancer (the crab)**

<u>Group 3:</u>

- **Taurus (the bull)**
- Pleiades (the 7 sisters)

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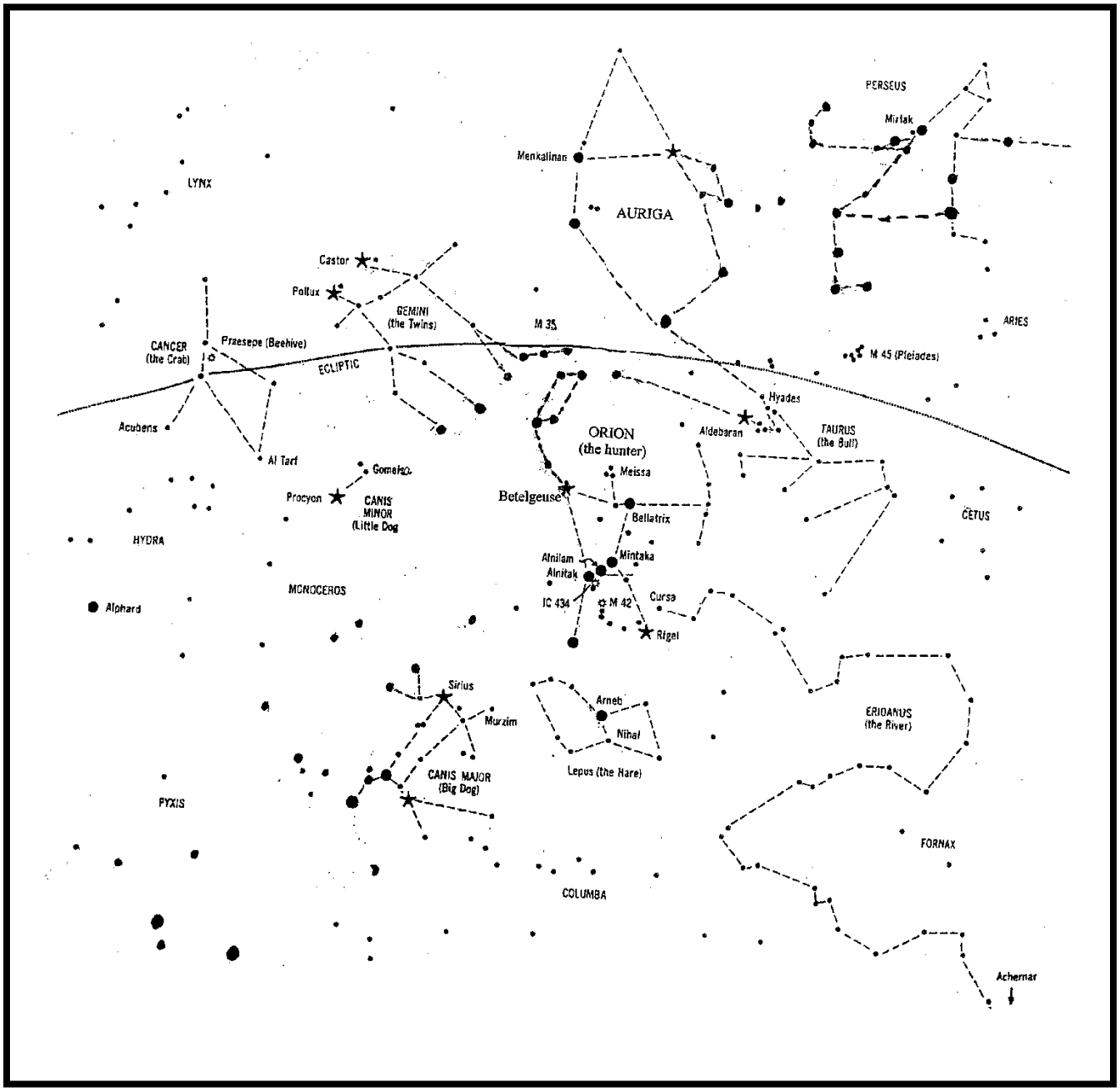
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83	Perseus	Greek
87	Eridanus	Greek

Quick Reference Guide to the Winter Sky

Constellation Name	Nickname (s)	What it looks like	How to find it	Notable Stars
Orion	The Hunter	Man with a bow and a belt	Look for three-star belt	Betelguese: shoulder Rigel : knee M42: Orion Nebula
Canis Major	Big Dog	Dog	Follow Orion's belt down to left	Sirius: nose of dog

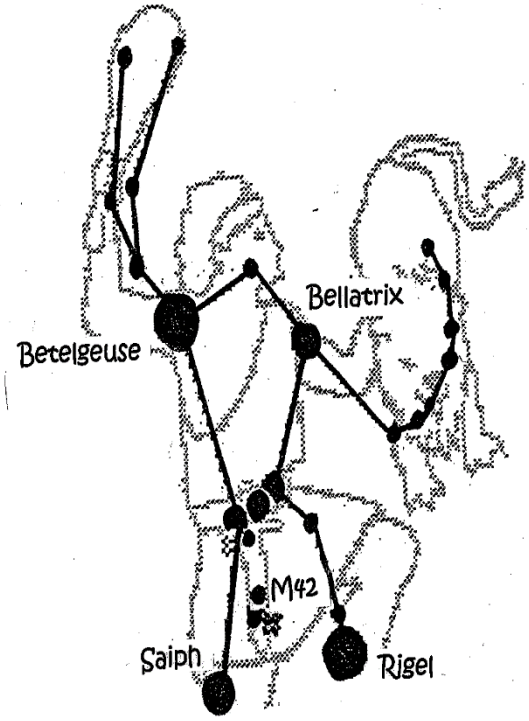
Canis Minor	Little Dog		Two stars east of Betelguese and above Canis Major	
Lepus	The Hare		Orion is standing on it.	
Cancer (zodiac sign)	The Crab		East of Gemini	Acubens: star at left claw
Gemini (zodiac sign)	The Twins	Two stick figures standing next to each other	Follow a line from Rigel through Betelguese and keep going until you see Castor and Pollux.	Castor: Head of twin Pollux: Head of twin closer to horizon
Taurus (zodiac sign)	The Bull	"V"	Between Orion's bow and the Pleiades	Aldebaron: (*Al-and-Deb-are-on*): bright start in horn
Pleiades	The Seven Sisters	Looks like a mini dipper	Located in Taurus' shoulder.	
Auriga	The Charioteer		Shares a star with Taurus. Just north of Orion.	Capella: The 6th brightest star in the sky.
Perseus	The Warrior		Located above the Pleaides	Mirfak: left shoulder
Eridanus	The River	A winding river.	Cursa is just to the west of Rigel.	Cursa: The beginning.

A Map of the Winter Sky



How to find Orion (best seen: December - March)

Orion is relatively easy to spot. Simply look toward the southern horizon for three condensed stars that form a straight line. This is "Orion's Belt" and it marks the center of the constellation. Above his belt are two bright stars, Betelgeuse (meaning "armpit of a giant" in Arabic) and Bellatrix. These stars form the shoulders of the Great Hunter. Another very bright star can be seen below the belt, Rigel. This is one of Orion's knees, the other is a dimmer star to the left (Saiph). The "haze" of 3 stars in a line directly below his belt is Orion's sword – the middle star is actually a nebula, called the Orion Nebula (or M42). A nebula is a "star nursery" – a cloud of gaseous material where new stars are being formed.



Orion: A Greek Myth

The goddess of Wild Animals and the Moon, Artemis, fell in love with the handsome Orion. They spent all their time together. Each night Artemis was supposed to drive her silver Moon-chariot across the sky, but as she was with Orion *so* much, she neglected her duties.

On noticing that there had been no Moon for several nights, Apollo, the Sun god, became angry with his sister and told her that she must do her job. But so great was her love for the handsome giant that she ignored her brother's words.

Then one day near sunset Apollo tricked his sister. He had seen Orion bathing by himself by the shore. With his blinding rays, Apollo caused a bright patch of light to surround Orion on the water. Only a dim gray patch in the middle could be seen. Apollo then teased Artemis by saying that she had been spending too much time with her lover that she had lost her eye as a marksman and he challenged her to hit the dark spot in the center of the shimmering patch of light. Artemis was angry with her brother for teasing her and quickly sent an arrow across the sea to its mark, killing her lover.

Later, when Orion's body was washed ashore by the waves, Artemis was horrified to see her arrow and to learn that she had been tricked by Apollo. In great sadness, she tenderly placed the body of Orion in her silver Moon-chariot and carried him high into the sky. Then finding the darkest place, so that all his stars would shine the brightest of all surrounding stars, she placed him where we see him today.

Orion: A Japanese Legend

According to Japanese legend, the two brightest stars in Orion, Rigel and Betelgeuse, represent two Samurai warriors. Separated by the constellation's three central stars, the warriors are about to engage in combat. The Japanese see the three central stars, known as Orion's belt in the West, as a separate

constellation, representing a row of cups from which people sip wine at the New Year.

Orion: Native American Legend: *Canoe Race* (The Chinook Tribe)

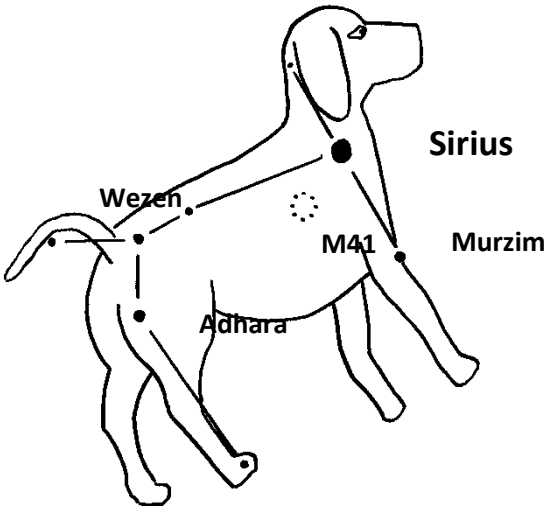
A big canoe (Orion's belt) and a small canoe (Orion's dagger) are in a race to catch a salmon in the Big River (Milky Way). The little canoe is winning the race. Can you find the salmon in the river?

Orion: Native American Legend (The Wasco and Wishram Tribes)

These two tribes saw in the stars of Orion a great struggle between Winter's 'Cold Wind' from the east and Spring's warm 'Chinook Wind' from the west. According to legend, long ago when all stars were human beings, there lived an old grandfather who was a renowned salmon fisherman. Old Grandfather had three grandsons, the strongest of which was named Chinook Wind. At the beginning of spring, the three brothers left on a journey to visit faraway relatives. All summer long and throughout the fall, the tribe always had plenty to eat, thanks to Old Grandfather's fishing skills. But then late in the fall, another fisherman from the east named Cold Wind began stealing the fish from the river, so Old Grandfather caught less and less, leaving the tribe little to eat over the winter. Finally, in the midst of winter, the three brothers returned upriver in their canoe. Seeing how Cold Wind was stealing the fish from the people, Chinook Wind stepped forward to protect his tribe and ordered Cold Wind to stop stealing fish. Cold Wind refused to give back the fish, so the two wrestled. Chinook Wind fought longer and harder and won the struggle. Cold Wind was banished back to the east. To this day, Chinook Wind is stronger than Cold Wind and every spring forces Cold Wind to leave. You can tell that the time is near for Chinook Wind's return when you can see him and his two brothers paddling their canoe up the celestial river (represented by the stars of Orion's belt and sword.)

How to find Canis Major & Sirius: (best seen: November-March)

First, locate Orion and imagine a straight line through his belt. Follow the line to the southeast, and you will see Sirius (the Dog Star) perched right below it. Sirius is the nose of the dog and the brightest star in our sky. His body stretches to the southeast, and his front leg is to the west of Sirius. He appears to be chasing after or playing around Orion's feet.



Sirius: Ancient Egyptian legend

About five millennia ago in ancient Egypt the new year was marked by the dawn rising of Sirius. The people of the Nile watched the early morning sky to catch the first glimpse of the star sitting in twilight glow. When it appeared on the morning side of the Sun Egyptians rejoiced for they knew that soon the Nile waters would rise, spreading out in shallow lakes along its banks to deposit fertile soil and renew the fields for abundant crops. Temples were aligned to the direction of rising of the Great Star they named Sothis, "mistress of the year."

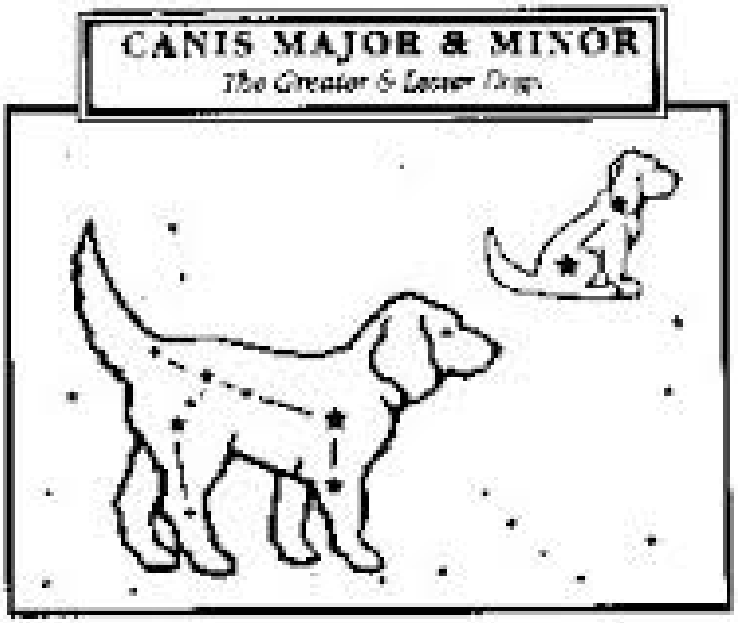
Sirius: Greek legend

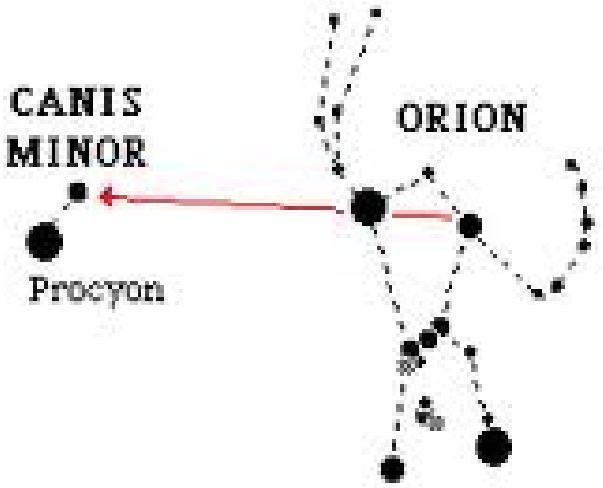
The name Sirius derives from the Greek word for "scorcher" and in old Greek times the dawn rising of Sirius marked the hottest part of the summer. It's position so

close to the sun led to the belief that the light and heat of “the scorcher,” when added to the light and heat of the sun, gave us the long, hot days of summer that we still call “the dog days of summer” after the Dog Star.

How to find Canis Minor: (best seen: November - March)

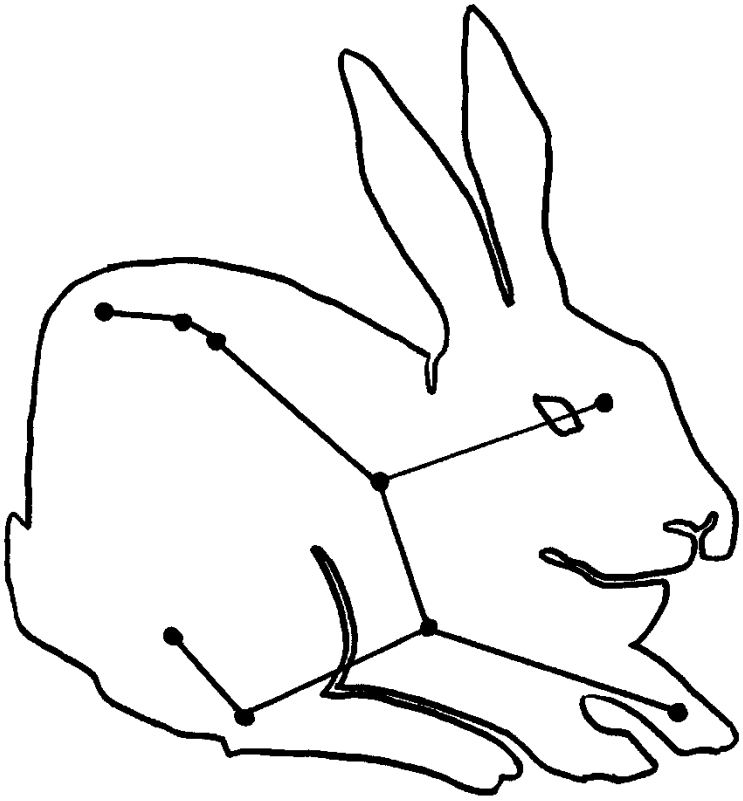
Draw a line through the shoulders of Orion, heading East. Canis Minor sits just south of this line. It is really two stars, the brighter of the two called Procyon.




CANIS
MINOR
ORION
Procyon

How to find Lepus: (best seen: December - March)

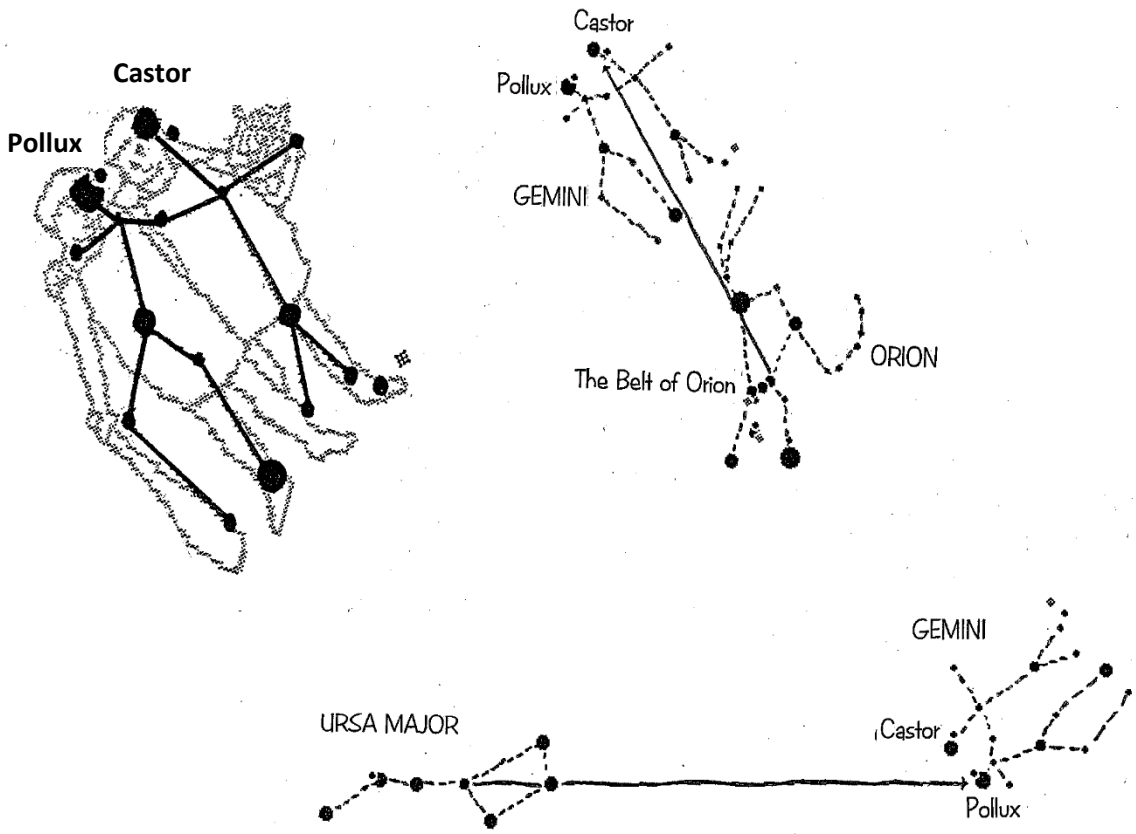
Lepus is located directly beneath Orion's feet and is sort-of the shape of a bow tie. He is often thought of as being hunted by either Orion or by Canis Major.



How to find Gemini (best seen: December – May)

To find Gemini, locate Rigel and Betelgeuse. Connect a line from Rigel through Betelgeuse. Continue up this line and it will lead you to the bright star, Castor. Castor forms one of the two heads of the "twins," Gemini. The brightest star in Gemini is Pollux. Pollux forms the other head of the twins.

You can also use Ursa Major to find Gemini. Draw a diagonal line from the base of the handle to the opposite end of the dipper. Continue on that line and you'll come to Pollux.



Gemini: A Greek Myth

The twins were sons of Zeus and the mortal Leda. Pollux had an immortal soul, so when he died he would be given a place in Heaven with the gods. However, Castor had a mortal soul and would therefore be transported to the Underworld with the rest of mankind.

Castor became famous as a rider of horses, while his brother Pollux became equally skilled at boxing and fighting battles. One day they joined their cousins, Idas and Lynceus, on a joint raid on some cattle. They were successful, but trouble between

the two pairs of thieves broke out when they tried to divide the cattle among themselves.

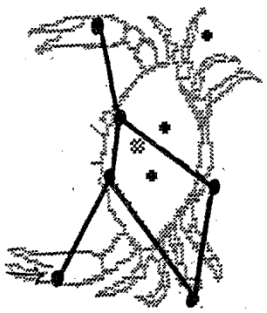
Idas had the solution. He chopped one of the cows into four equal pieces and said that whichever two individuals completely finished eating their quarters first would keep the rest of the herd. This took the twins off guard, they had just eaten a large meal, and they watched helplessly as their two cousins wolfed down their quarters of the cow. Idas and Lynceus then drove off with the entire herd.

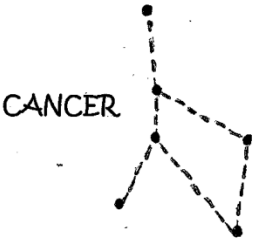
Castor and Pollux vowed to get even with their cousins. Within a few days they set out after Lynceus and Idas to recover their share of the cattle. During the fight that followed, Idas killed Castor with a spear. Infuriated over the loss of his twin brother, Pollux chased his cousin and killed Lynceus with a single blow. Just as Idas was about to hurl a tombstone at Pollux, Zeus came to Pollux's aid and hurled a thunderbolt at Idas, killing him on the spot.

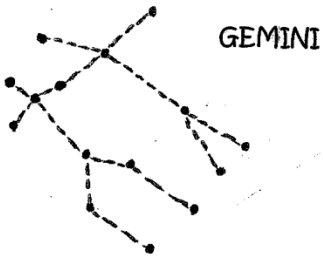
Realizing that his brother's soul would go to the Underworld, Pollux prayed to his father and asked that he, too, be killed and his soul sent to the Underworld so that he would not be parted from his brother. Even the great Zeus was not able to grant such a wish, but he told Pollux that there was a way the boys could be together. Half the time they would spend together in the Underworld and the other half on Mount Olympus with the gods. In addition, both would be given a place in the sky as the constellation Gemini.

How to find Cancer (best seen: January - May)

Cancer lies just to the east of Gemini. This is the faintest of the twelve Zodiac constellations and can be *really* difficult to find!







Cancer: A Greek Myth

The swamps of Lerna were home to Hydra, an enormous water snake with nine heads, and with breath that could kill on contact. Hercules was sent to kill him, but the struggle between them soon turned into a standoff. When one head was sliced off, another would appear in its place.

Hydra called upon a crab to bite Hercules. The crab rose from the swamp and dug his claws into Hercules's foot. However, Hercules simply stepped on the crab and crushed it. Hercules eventually won the battle with Hydra, and dipped his arrows in the water snake's blood – the slightest scratch from one of these arrows would bring instant death to his enemies.

Cancer: A Greek Myth

The Scriptures of Delphi has a different version.

According to the Scriptures, a giant crab named Crios guarded the sea nymphs in the Greek god Poseidon's kingdom. He was enormous and strong, and Poseidon himself had blessed him with immortality.

When the god of monsters Typhon terrorized the gods of Olympus, Poseidon along with most of the other gods, went into hiding. He left Crios in charge of protecting the sea nymphs, who were considered to be Poseidon's daughters. The crab took his role as protector very seriously, and wouldn't let any of the sea nymphs outside of his reach. After a while, some of the sea nymphs became restless, and convinced that they were in no danger from Typhon, escaped into the open sea.

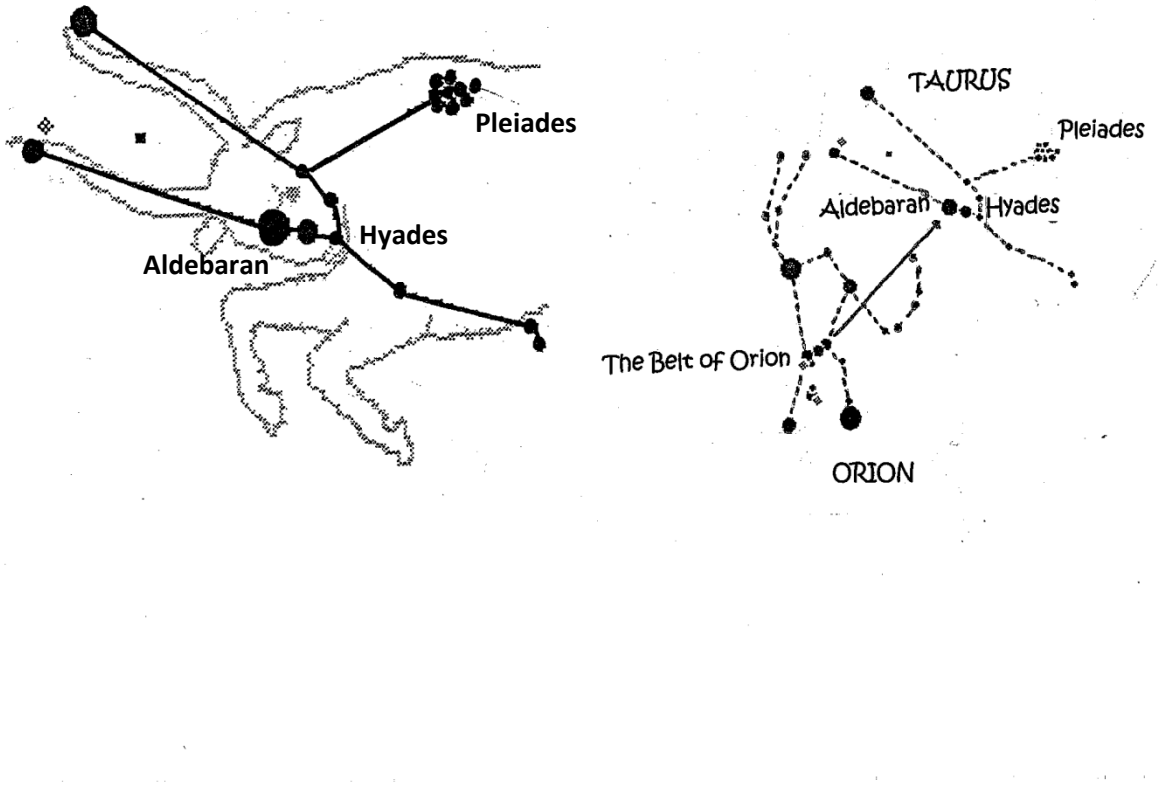
Crios could not chase them as he was charged with protecting the other sea nymphs, so he enlisted the help of the giant squid, Vamari. Little did he know that Vamari (whose name translates to "Vampire Squid") had ill intentions, and when he caught up to the sea nymphs, he devoured them.

When Vamari returned to Crios, he told the crab that despite a valiant effort, he could not find any of the missing sea nymphs. Crios knew that he was lying and attacked him. They battled for hours until the crab finally won. But he had sustained such bad injuries that he was terribly crippled from that time forward. Since he was immortal, though, he could not die, but had to live in pain.

When Poseidon returned he saw the bravery that the crab had shown and relieved him of his pain, but not his immortality, by placing him in the sky as the constellation Cancer.

How to find Taurus & the Pleiades (best seen: October–March)

To find Taurus, first locate Orion's Belt. Connect a line through the three stars away from the horizon. This line will point you north and west of Orion to a bright star, Aldebaran. This giant star forms the "Bull's Eye" of the constellation Taurus. Taurus has two star clusters – the Hyades and the Pleiades. The Hyades, a cluster of five stars in the shape of a "V", form the head of Taurus. The Pleiades form Taurus's left shoulder.



Taurus: A Greek Myth

In one Greek myth, Zeus falls in love with Europa, the daughter of the King of Tyre. However, Europa was constantly guarded by her father's servants, so Zeus decided he would have to come up with a plan. He noticed that the royal bulls always grazed in a large field by the sea where Europa would walk. So one day Zeus changed himself into a beautiful white bull with golden horns. Europa, who had been walking along the beach, noticed this beautiful animal and could not resist going up to it and feeding it. So friendly and gentle was this splendid bull that she climbed onto it's back. Gradually the white bull wandered closer to the sea and when near the beach ran into the water and began swimming toward the island of Crete. By this time it was too late for Europa to climb off. When the two arrived in Crete, Zeus changed himself back into his own form. Zeus then raised the form of the bull to a place of importance among the stars as Taurus.

When you look for Taurus in the sky, don't expect to find the entire bull. You are supposed to see only his front half. The explanation is that his hind legs are underwater since he is busy carrying Europa across the sea.

Taurus: A Greek Myth

The Scriptures of Delphi give us another possible explanation of the Taurus constellation,

According to the alternate myth, the mythology of Taurus begins with a wandering bull known as Cerus. Cerus was a large and powerful bull who villagers were terrified of because of his tendency to trample their villages to pieces on a whim. He was owned by no one, and none of the farmers knew where he came from. Though he was not immortal, most people assumed him to be so because of his sheer size and strength and the fact that despite all of the destruction he caused nobody was ever able to stop him.

Cerus was wild and out of control, choosing to follow his emotions on a whim. One day the Spring goddess Persephone found him trampling through a field of recently-bloomed flowers and went to him. Though he could not speak, he seemed to understand her and her presence calmed him. They formed a bond together, and the bull learned to behave himself. Persephone taught the bull patience and how to use his strength wisely.

Every year in the spring when Persephone returns to the land, Cerus returns to the land to join her. She sits upon his back and he runs her through the fields, allowing her to set all of the plants in bloom as they ride by. In the fall when Persephone returns to Hades, Cerus returns to the sky as the Taurus constellation.

The Hyades: A Greek Myth

According to Greek myth, the Hyades were the half-sisters of the Pleiades. Now the Hyades had a brother named Hyas, who they loved very much. One day while out hunting, Hyas was killed by a lion. When word of his death reached his sisters, they all died of grief. Feeling sorry for them, Zeus placed them in the heavens as that cluster we now call the Hyades.

The Pleiades: A Greek Myth

In Greek mythology, the Pleiades were seven daughters of the Creator-god Atlas. It is said that Zeus raised them to the heavens as stars to protect them from Orion, who for seven long years pursued the maidens to claim them for himself. If you can see all "Seven Sisters" (often only six can be spotted) then you can make a wish.

The Pleiades: A Polynesian Myth

The Polynesians call the Pleiades cluster *Mata-riki*, "Little Eyes," and believe that long before Man inhabited the Earth, they formed a single star. This was the most brilliant star in the sky. Its light rivaled that of the Quarter Moon, and when it rose, its reflection sparkled and danced along the sea and the whole world was white from its brilliant light. The star was not only beautiful, it was also extremely

conceited and was always bragging of its splendor among the other stars, saying, “I am more beautiful than any of you, even more beautiful than the gods or the jeweled heavens themselves.”

The god Tane, guardian of the four pillars of heaven, heard this and was angry. He decided to drive this rude star out of the sky, away into the dark regions. To do so, he asked for help from two other stars, Sirius and Aldebaran. Sirius was the second brightest star in the sky and had no sympathy with a rival who was brighter than himself. Aldebaran was located so close to the brilliant star that his light was always being dimmed by that of his neighbor. Both stars agreed to the plot against Mata-riki.

One dark night the three allies crept up behind their victim and got ready to chase him from the skies. Mata-riki was frightened when he saw them coming and at first he ran and hid under the waters of a stream, the Milky Way. Sirius climbed to the top of the stream and changed the course of water. As it drained away, the poor fugitive was left unprotected and again started running. Mata-riki was quick, and before long it had completely outdistanced the pursuers.

It looked as though the star might escape altogether, but Tane was a god and not one to be beaten. Suddenly he picked up Aldebaran and threw him with all his force against the great star. Tane hurled him with such a force that the star was struck unaware as it ran and smashed into six little pieces. The god and his star companions were satisfied and went away.

The six little fragments limped back to their place in the sky. Since that time, Sirius shines as the brightest star in the sky and Aldebaran is undimmed by any near rival. The “Little Eyes,” small as they are, remain exceedingly brilliant and sometimes whisper proudly to each other that they are more lovely as six than as one. They no longer dare brag aloud how beautiful they are, but when the nights are dark and quiet they still lean down close to Earth to see their reflection in the oceans, and smile at how wonderful they are.

The Pleiades: *The Seven Hungry Dancers* (Onondaga Tribe, New York)

When people talk about the seasons and the Pleiades, they often talk about food, hunger, and magical departure from the Earth. Parts of this pattern are very clear in this story told by the Onondaga Indians of Upstate New York.

After reaching one of their favored hunting territories, a party of Onondaga decided to build their lodges by the lake and stock up on fish and game for the winter. By autumn most of the work had been done, and a group of the children decided to spend their days dancing by the side of the lake. One day an old, white-haired man appeared among them and warned them to stop. Not believing any harm could come from their dancing they refused to take the old man seriously. After he had gone, they decided that next time they should bring a picnic with them, so they could spend longer out by the lake.

So the next day, they asked their parents for some food, but were told they couldn't take any – it must be saved for winter; if they were hungry they should return to the camp and eat the animals hunted that morning. Irritated but unwilling to give up the pleasure of dancing, they returned to the lake and continued dancing on empty stomachs. As they danced, they became giddy and light-headed. Their bodies must have been light, too, for they started to rise into the air. Realizing that something weird was happening, one of them warned that they should not look back to the ground. He had heard you must always look where you're going. A woman who saw them called out, but they continued to rise. All the parents came out of the lodges and yelled to them, but it did no good. One child glanced back at his father, and as he did, he was transformed into a "falling star." The rest rose higher until they found a place in the sky as the seven Pleiades. One of them yelled all the way up, and as he did, he became fainter and fainter. By the time they reached their new home, the seventh child could scarcely be seen.

Pleiades: *The Lost Children* (Blackfoot Tribe; North Dakota, Montana)

There were once six young brothers who were orphans. They lived from handouts and wore castaway clothing. No one cared much about them except the camp's pack of dogs. They loved the dogs and played with them all day. People were

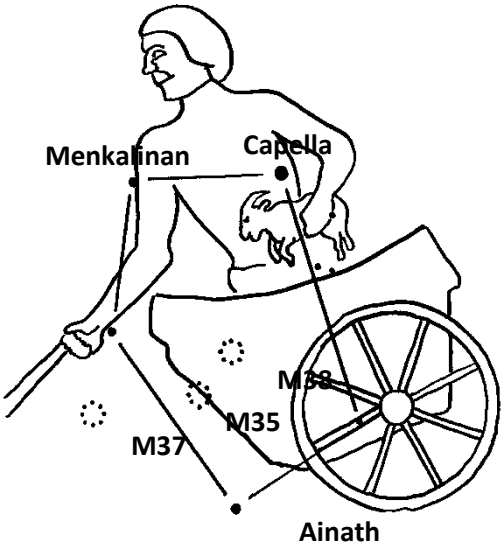
unkind to the boys because of their ragged clothes and uncombed hair. The brothers were teased by the other children who wore fine buffalo robes. The boys no longer wanted to be people. They considered becoming flowers but the buffalo might eat them. Stones? No, stones could be broken. Water could be drunk, trees could be cut and burned. They decided they wanted to be stars (Pleiades). They were always beautiful and safe from others. The Sun welcomed the boys and the Moon called them her lost children. Then the Sun punished the people with a drought. Meanwhile the people heard the dogs howling at the sky, because they missed the boys so much. Finally the dog chief asked the Sun for pity because drought hurts all creatures. Then the rain came.

Pleiades: Native American Story (The Western Mono Tribe)

The Mono told the story of the husbands (The Hyades) that had six wives (The Pleiades). The Hyades threw their wives out of the dwelling because they ate too many wild onions that gave them very bad breath. When the wives went up to the sky to live, the lonely husbands followed them but to this day have never caught up with them.

How to find Auriga: (best seen: November - April)

Look for the shared star. Auriga shares a star with Taurus. If you extend a line from the top of the "V" of Taurus outwards, like the horns of a bull, you will come to the bottom of Auriga. It is also directly above Orion. Auriga has the shape of a pentagon, or a house with a roof. Capella is a brilliant star in the top corner of the "house", and diagonal from the shared star.



Auriga: Greek mythology

- Auriga is most frequently identified with Erichthonius, king of Athens and son of the fire god Hephaestus. Erichthonius was raised by the goddess Athena, who taught him many skills he wouldn't have ordinarily learned. He was the first man to tame and harness four horses to a chariot, imitating the chariot of the Sun god. Zeus was impressed and later placed Erichthonius among the stars. Erichthonius is usually credited for the invention of the four-horse chariot, the quadriga.

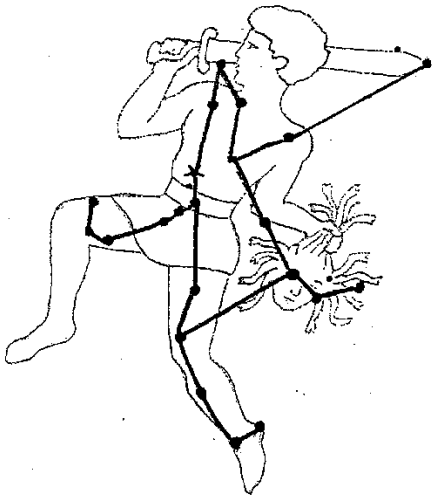
- In another myth, Auriga represents Hephaestus himself, the lame god, who built the chariot so that he could travel anywhere he wanted, whenever he wanted, without difficulty.

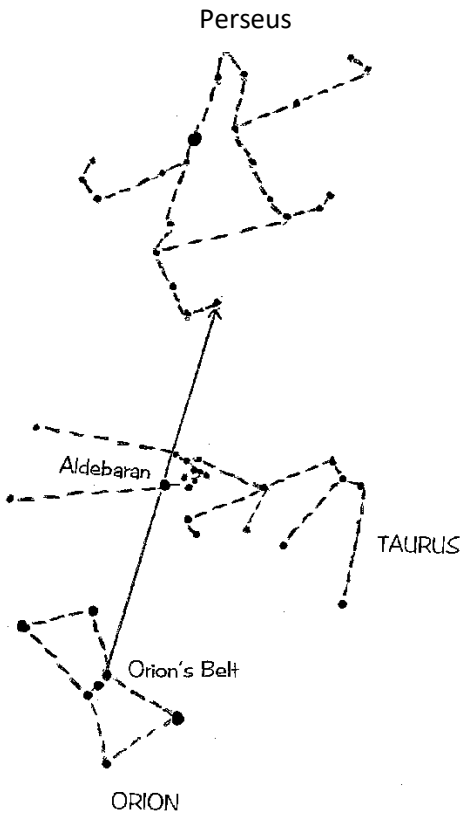
- In another popular myth, the charioteer is Myrtilus, son of Hermes, who served King Oenomaus of Pisa. Oenomaus had a beautiful daughter, Hippodamia, and was determined not to give her hand away to any of her suitors. He would challenge each of them to a chariot race. If he caught up with them before they arrived to Corinth, he would kill them.

  With Myrtilus driving the king's chariot, none of Hippodamia's suitors survived the race until Pelops, son of Tantalus, came to ask the king for his daughter's hand. Hippodamia fell in love with Pelops at first sight and asked Myrtilus to let him win. The charioteer, who was himself in love with the king's daughter, obeyed and tampered with the chariot's wheels. During the race, the wheels fell off and King Oenomaus was thrown off the chariot and killed. Once Pelops had won the race, he cast his rival Myrtilus into the sea. Betrayed, Myrtilus cursed the house of Pelops before he drowned. It was Myrtilus' father Hermes who placed his son's image among the stars.

How to find Perseus (best seen: December – February)

To find Perseus, first locate Orion's Belt. Connect a line through the three stars away from the horizon. This line will point you to Aldebaran, a bright star in the zodiac constellation, Taurus. Continue the line through Aldebaran, past Taurus, and you will reach one of the feet (our left, his right) of Perseus.





Perseus: Greek Myth

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

Perseus's adventures began before he was born. An oracle told Perseus's grandfather, the King of Argos, that he would die at the hand of a future grandson. To keep his daughter, Danae, from ever having his child, the king shut her in a tower. But mighty Zeus loved Danae and entered her window as a rainshower. When she gave birth to Perseus, the king dared not kill Zeus's son. Instead, he put mother and child in a chest and sent them out to sea. After drifting for days without food, they were found by a fisherman on the shore of a distant land.

Several years later, Polydectes, ruler of the island, asked Danae to marry him. When she refused, Polydectes tried to carry her off, but Perseus, now stood in his way. So Polydectes devised a scheme to get rid of Perseus. He invited all the young men on the island to a feast. The guests were expected to bring gifts. Because he had nothing to give, Perseus offered to perform a feat of Polydectes' choice. Polydectes was ready with his answer: "Bring me the head of Medusa."

Perseus realized he'd been tricked. No one had ever faced Medusa and returned alive. She had writhing snakes for hair, tusks like a pig, brass scales on her hands and neck, huge wings and, worst of all, the power to turn into stone anyone who looked at her eyes. She lived with her two monster sisters, but no one knew where.

Zeus saw that Perseus was in a desperate situation and sent two gods to help his son. Athena gave Perseus a shield polished like a mirror. Hermes handed him a sword that could cut metal. Hermes took Perseus to find the Nymphs of the North, who possessed three magic items needed to behead Medusa – a cape of invisibility, winged sandals and a magic bag.

Perseus put on his winged sandals and flew west until he found Medusa's island. He spotted Medusa and her sisters asleep among their victims' stone bodies. Carefully looking into her reflection in Athena's shield and not at Medusa herself, Perseus dove down and cut off Medusa's head with Hermes' sword. As he picked up the head, the snakes hissed in Medusa's hair and Pegasus, the Winged Horse, burst out of her neck. Medusa's sisters woke up, but Perseus threw her head in his magic bag, pulled on the cape of invisibility and rode off on Pegasus.

On the way back to Polydectes' island, Perseus and Pegasus flew over the Kingdom of Ethiopia. Looking down, Perseus saw the beautiful Princess Andromeda by the seashore – but a giant sea monster was swimming close by. Perseus and Pegasus swooped down to warn Andromeda, only to discover she was chained to the rocks. Perseus tried to break the chains with his hands, but he could not.

Perseus asked Andromeda why she was chained to the rocks. Andromeda said her mother, Queen Cassiopeia, had angered the gods by boasting she was more beautiful than even the nymphs of the sea. As punishment, the gods sent a sea monster to terrorize the kingdom. King Cepheus decided to appease them by sacrificing his daughter. Andromeda's husband-to-be refused to defend her, so she faced the monster alone.

After Andromeda finished her story, Perseus said, "I will save you and you will be my bride." With that, the monster reared up from the sea, and Perseus thrust Hermes' sword into the beast's mouth and killed him. Then Perseus cut Andromeds's chains with the sword and carried her to the Ethiopian palace.

King Cepheus and Queen Cassiopeia welcomed the couple. But Andromeda's former fiancé arrived with armed followers and demanded his promised bride. The king and queen cowardly agreed and told Perseus to leave. Perseus asked Andromeda to shut her eyes, then he opened his magic bag and held Medusa'a head high. Everyone but Andromeda and Perseus turned to stone.

Perseus married Andromeda and took her to Polydectes' island. He found his mother, Danae, and the old fisherman in hiding because the ruler had tried to force Danae to marry him again. Perseus left Andromeda with his mother and entered the palace. Polydectes demanded that Perseus leave.

"I have brought what you wanted," Perseus said. With that, he pulled Medusa's head from the bag, and Polydectes and his friends instantly turned to stone.

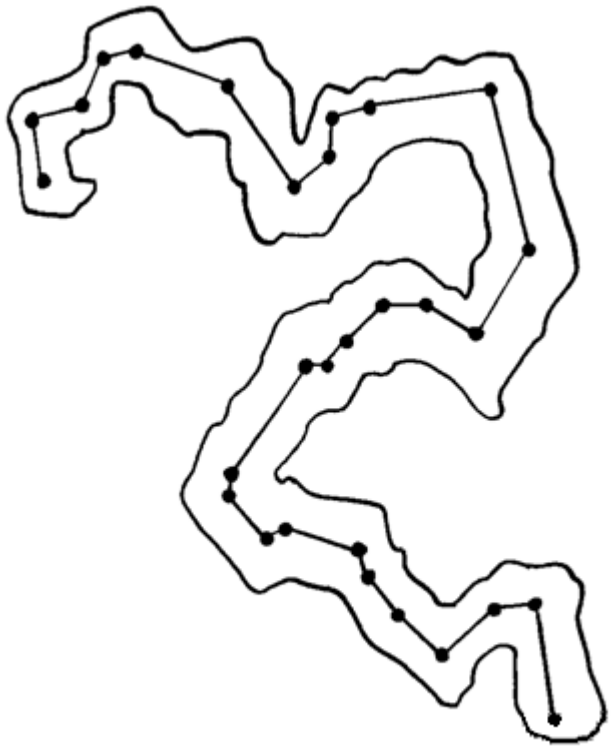
The islanders were happy to be free of their ruler. They asked Perseus to be their king, but he said no. He wanted to return to Argos, the land of his birth. When his grandfather heard that Perseus was returning, he fled Argos, and Perseus was named king.

In the years to come, Perseus competed in games of strength all over Greece. One day he was throwing the discus in a faraway city when it slipped and killed an old man watching the games. As it happened, the man was Perseus's grandfather. The prediction of the oracle had finally come true – the old King of Argos died at the hand of his grandson, Perseus.

Many years later, when Perseus and Andromeda had also died, Zeus put them into the heavens along with Pegasus, Queen Cassiopeia and King Cepheus so people would remember all the parts of Perseus's fantastic story.

How to find Eridanus: (best seen: December - February)

Eridanus sits just to the west of Orion. Locate Orion and then look just to the lower right of Rigel for the star called Cursa. This star is the beginning of the meandering Eridanus constellation, which is the second longest constellation after Hydra. In Arabic, “Cursa” translates roughly as “footstool of the giant.” Look upward and slightly to the west to see the second star in Eridanus. The constellation swings from this star to the right, and then begins to form a downward arc. Subsequent stars are dim and hard to spot. However, the majority of the constellation forms what looks like a huge number 2 before dipping below the horizon. In more southern locales (like Miami or South Texas) you can see Achemar, which marks the end of this celestial river. Achemar is the brightest star in Eridanus.



Eridanus: A Greek myth

Eridanus is associated with the myth of Phaeton the son of the sun god Helios, who one day took the reins of his father’s chariot, but was not able to control it and ended up burning both heaven and earth. This story, called “Chariot of Fire” is listed

the section "The Night Sky" under the "Sun" section. The constellation Eridanus represents the path along which Phaeton drove (instead of the Milky Way as listed in the story).

Section 4 - The Spring Sky

In the Spring Sky we'll point out seven constellations (zodiac are in bold):

Group 1:

- Bootes (the herdsman)
- Coma Berenices (Bernice's hair)

Group 2:

- **Leo (the lion)**
- **Virgo (the virgin)**

Group 3:

- Crater (the cup)
- Corvus (the crow)
- Hydra (the sea serpent)

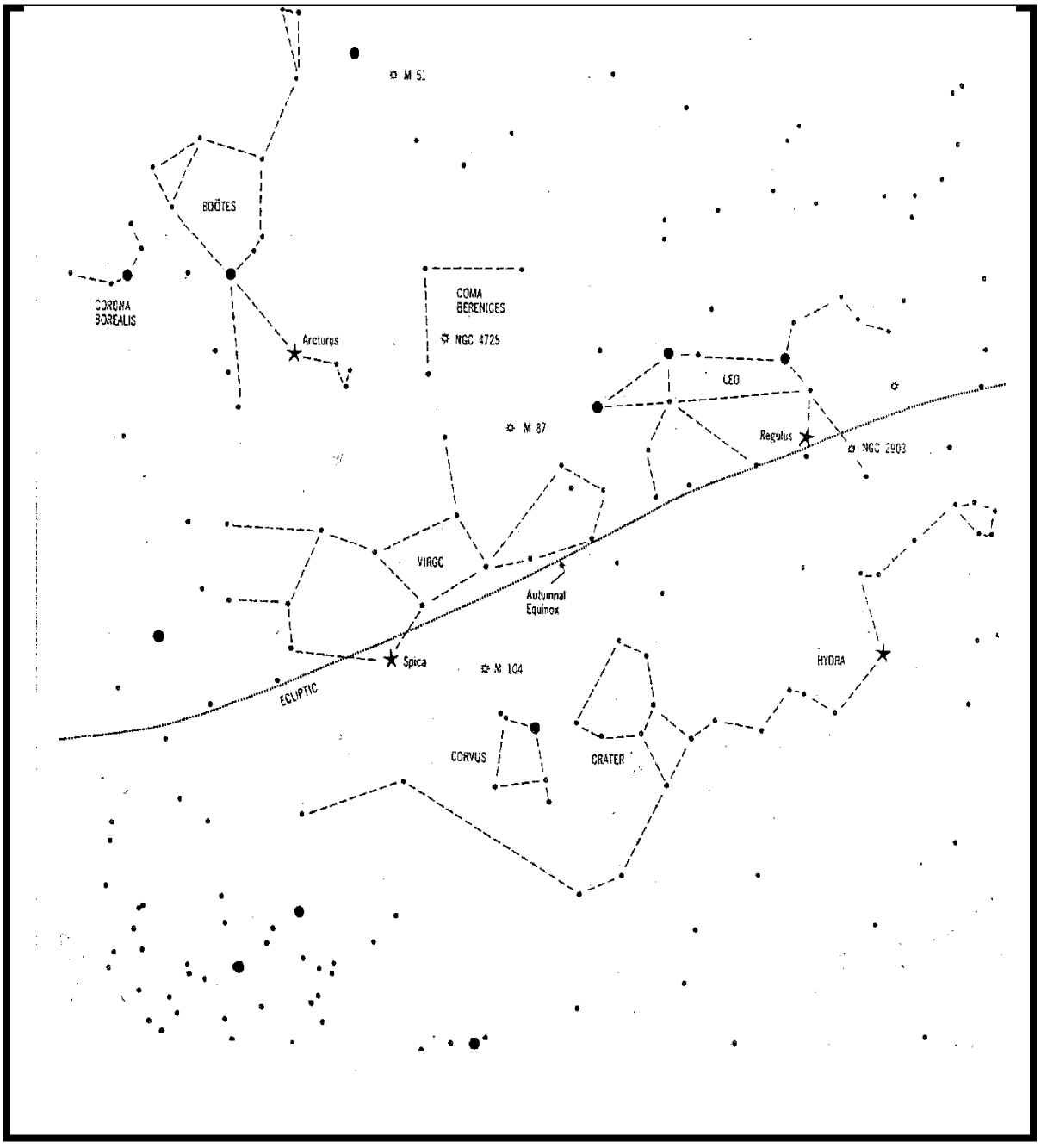
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97	Virgo	Sumerian
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Quick Reference Guide to the Spring Sky

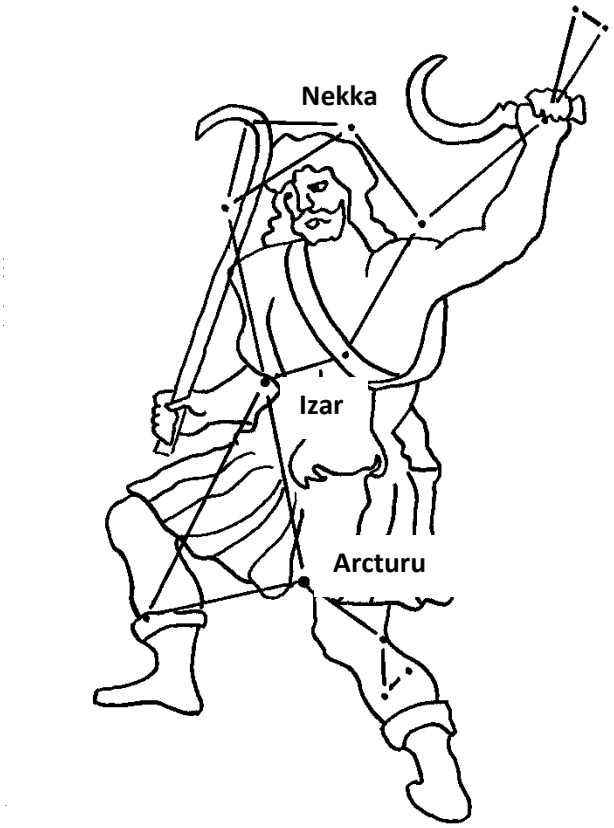
Constellation Name	Nickname(s)	What it looks like	How to find it	Notable Stars
Leo	The Lion	A backwards question mark.	Form a line through the non-pointer stars in the big dipper's cup to Regulus.	Regulus
Virgo	The Virgin		Arc from the handle of the big dipper through Arcturus to Spica.	Spica
Bootes	The Herdsman	Pentagram or house.	Arc from the handle of the big dipper to Arcturus.	Arcturus
Coma Berenices	Berenice's Hair	"L"	Diagonal line through the big dipper; keep going.	
Crater	The Cup	A wineglass	Rides on Hydra's back	
Corvus	The Crow	Trapezoid.	Rides on Hydra's back	
Hydra	The Serpent	A serpentine line.	Along the southern horizon.	

A Map of the Spring Sky



How to find Bootes (best seen: April – June)

Bootes is pronounced Boh-oh-tees. Locate the handle of the Big Dipper. Continue the curve of the handle to the bright star Arcturus. Arcturus is the third brightest star in the night sky and may look to be a light orange color. It belongs to the constellation, Bootes.



Bootes: Greek myth

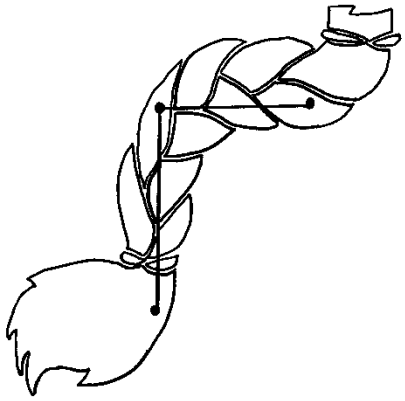
Legend identifies Bootes with Icarius (not Icarus). According to this tale, the god Dionysus taught Icarius how to cultivate vines and make wine. When he offered some of his new vintage to shepherds, they became so intoxicated that their friends thought they had been poisoned, and in revenge they killed Icarius.

His dog, Maera fled home howling and led Icarius' daughter Erigone to where his body lay beneath a tree. In despair, Erigone hanged herself from the tree, and Maera died from grief. Zeus put Icarius into the sky as Bootes, his daughter Erigone became the constellation Virgo, and the dog became Canis Minor.

Arcturus: Native American: *Coyote's Eyeball* (Lummi Tribe)
The Coyote liked to show off to his girlfried by juggling his eyeballs. One day he threw one so high that it stuck in the sky and became what we know as Arcturus, the first star you see after the sun sets.

How to find Coma Berenices (best seen: April – June)

Trace a line through the diagonal of the bucket of the big dipper (top right to bottom left). That line will point to Coma Berenices. It lies between Bootes and Leo and forms an “L” shape in the sky.



Coma Berenices: Greek myth

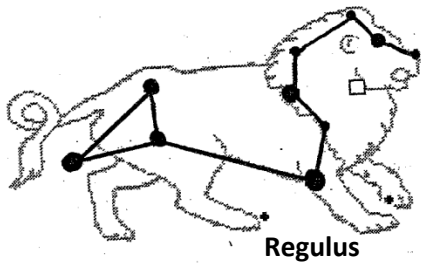
Berenice was the queen of Egypt in 245 BC. Her name meant “bringer of victory”, and she was renowned for her striking beauty, and the loveliness of her long golden hair. When her husband, King Ptolemy III, left to lead his armies to war against the Syrians, Berenice prayed every day at the altar of Aphrodite (Venus), for his safe return. When news came that the war was going badly, she cut off her beautiful long golden tresses, and laid them on the altar as an offering, in the hopes that it might please the goddess, and she would protect her husband.

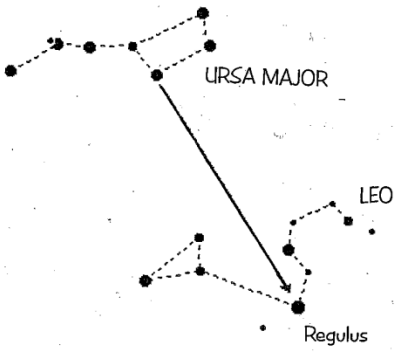
Ptolemy returned safe and victorious the next day. When he learned of his wife’s sacrifice, he went to the altar of Aphrodite himself to thank the goddess for her protection, only to find the altar empty, and the queen’s hair stolen. In a rage, he vowed to kill all the priests who tended the altar. But that night, the royal astronomer, Conon, came to the king’s court, and announced that the missing hair had been found.

He stepped outside and pointed at an area of the sky between the herdsman (Bootes), and the lion (Leo), announcing that Aphrodite was so impressed with the queen's offering, she took the long golden locks herself, and placed them in the sky, to honor the queen. The mystery was solved, and the grouping of stars became known as the constellation Coma Berenices (Berenice's hair)

How to find Leo (best seen: February – June)

Lying not far from the Big Dipper, its pattern of major stars traces out the shape of a crouching lion, ready to leap toward the western horizon (or a backwards question mark attached to a triangle). To find the constellation Leo, locate the two inner most stars of the cup of the "Big Dipper". Connect a line through these stars extending from the bottom of the Dipper. This line will point to the bright star Regulus in the constellation Leo.





Leo: Greek Myth

The constellation of Leo was named by the ancient Greeks for an episode in the life of their greatest and strongest hero, Heracles (better known today by his Roman name of Hercules). The hero had been given 12 labors – tasks of impossible difficulty and danger. The first of these involved tackling the great lion of Nemea, which had been terrorizing the city. Despite the efforts of Nemea's warriors, the huge beast carried off and devoured people one after the other. Heracles's enemies hoped that the hero would be the next victim.

Undaunted, Heracles tracked the Nemean lion to his den in a mountain cave. There, he discovered that the beast had a magic hide that was invulnerable to his spears and arrows. When the lion closed in for the kill, Heracles threw his arms around it. After an epic struggle, he strangled it with his bare hands. Heracles kept the magic hide as armor, removing it with the lion's own claws, and used the beast's great head as a helmet.

The defeated lion was not forgotten. It was set up in the sky for evermore, as a reminder to people of its ferocity and of the courage of the hero who had overwhelmed it at last.

Leo and Coma Berenices: A Roman Story (by Ovid, a Roman poet)

Pyramus and Thisbe lived side by side. They were in love but their parents would not allow them to marry. All they could do was whisper to each other through a hole in the wall between their houses. One day, they planned a secret meeting at the edge of a white mulberry grove. Thisbe arrived first and was horrified to find a lion devouring its prey. As she ran away to warn Pyramus, her silk scarf fluttered to the ground near the lion. He swatted it away, covering it in blood. When the lion had his fill, he sauntered off.

Soon, Pyramus arrived at this grisly scene and immediately saw Thisbe's scarf covered in blood. Assuming his loved one had perished in the jaws of the lion, he flung himself on his sword and died. Thisbe returned and found Pyramus's body. She kissed him and then stabbed herself with his sword. Their blood entered the roots of the mulberry, whose fruit has been red ever since.

Jupiter placed Thisbe's scarf in the sky as Berenice's Hair, a wispy constellation that floats near Leo.

Leo: Egyptian Story

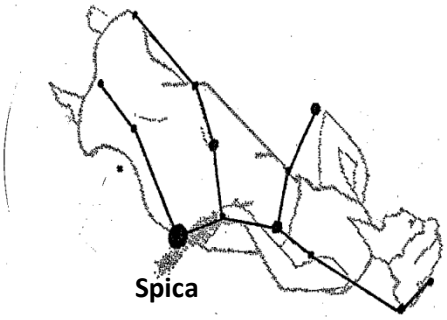
This is less of a story than it is information. You can make your own story up based on it.

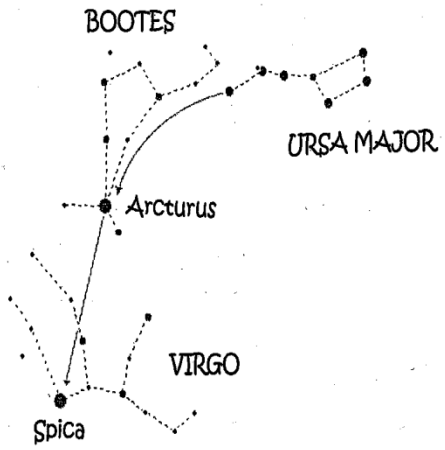
If we go across the sea to Egypt, we can see a different take on the constellation Leo myth. The Egyptians also recognized the Leo constellation and its champion star, Regulus. In Egypt, though, the constellation had more to do with the river Nile than with a mythical beast.

It's not entirely clear where the Egyptians believed the constellation to have come from directly, but the lion in Egypt is represented as an important animal to the livelihood of the Egyptians. They relied on the Nile river to flood every year and nurture the land for the harvest. During the summer months, the heat in the desert would be so great that the lions of the plains would move closer to the Nile to stay cool and have access to water. This coincided with the river's yearly inundation - an event so crucial to the survival of the Egyptians that festivals were held to the gods regularly in hopes that the inundation would be good. Statues depicting lion heads can be found along building by the Nile.

How to find Virgo (best seen: April – June)

Virgo is the second largest constellation in the sky, after Hydra. Ancient skygazers visualized it as a young woman, usually identified as the goddess of justice, holding an ear of corn that is marked by Virgo's brightest star, Spica. To find Virgo, locate the handle of the Big Dipper. Continue the curve of the handle to the bright star Arcturus. Arcturus is the third brightest star in the night sky and may look to be a light orange color. It belongs to the constellation, Bootes. Continue the curve past Arcturus, until you reach another bright star. This is Spica, a blue star, which belongs to the constellation, Virgo.





Virgo: A Sumerian Myth

According to Sumerian mythology, there was an Earth-goddess named Ishtar, whose husband, Tammuz, died and was destined to spend eternity in the dark underworld. Now, Ishtar loved her husband very much and realized that the only way she could get him back was to make the long journey through the Seven Gates to the Underworld, which she did. However, one of her duties was to bring spring to Earth. Therefore, as she passed through the first gate, her absence from the World caused winter to grip the land.

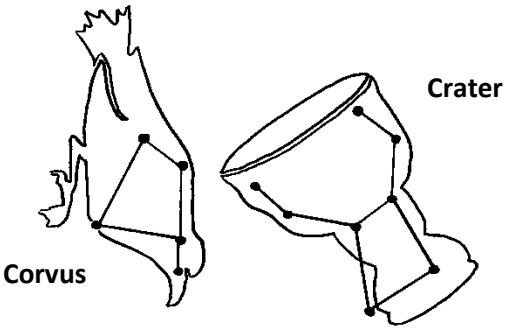
When Ishtar managed to find the Queen of the Underworld, Eresh-ki-gal, she explained that she wished her husband restored to life. Eresh-ki-gal said that would be quite impossible, that no such request had ever been granted. Now Ishtar was not one to give up easily and remained there pleading her case. Days, weeks, and then months passed. Winter did not leave the Earth above. Crops did not grow and animals did not bear young.

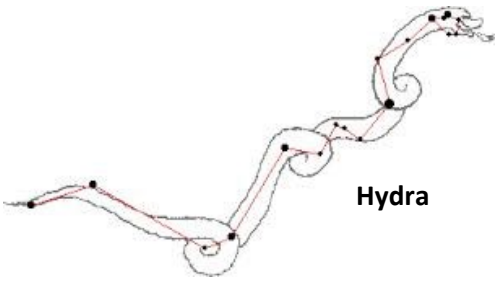
Alarmed over this situation, the other gods realized that they must do something or the world would come to an end. So they sent a messenger to the first gate where the gatekeeper was told to inform Eresh-ki-gal that it was the will of all the gods that Ishtar return to Earth's surface. Each gatekeeper in turn passed along the message until it was delivered to the great queen herself. Knowing full well that the gods of Heaven were more powerful than she was, she granted Ishtar her wish. As Ishtar and Tammuz made their way up toward Earth's surface, winter slowly melted away. By the time they reached the first gate the sun had risen high overhead and the fields had turned green. By the time they emerged into the bright sunshine and warmth the fields were rich with newly sprouted grains. Spring had come.

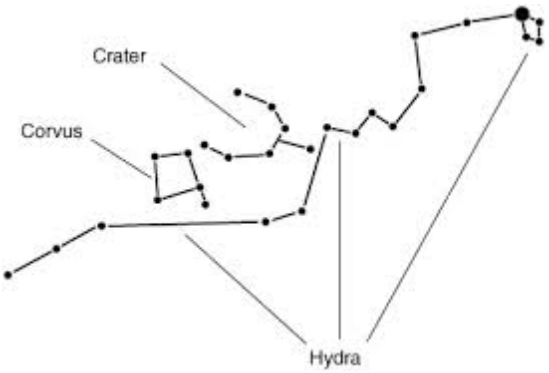
Now it is said that so great was the favor done for Ishtar by the Queen of the Underworld, that once each year Ishtar must leave Earth for a while to pay her respects to Eresh-ki-gal. When she is gone winter once again covers the land, but each time she returns life springs anew.

How to find Crater, Corvus & Hydra (best seen: March–June)

Hydra is the longest constellation in our sky; in fact it takes over 6 hours for the entire constellation to rise! Locate Cancer, Leo and Virgo and look toward the Southern horizon. Hydra lies between the 3 and the horizon, with the head near Cancer and the tail near Virgo. Corvus and Crater ride on Hydra's back on the northern side.







Crater, Corvus & Hydra: Greek myth

The story of these three involves Apollo and his wrath and sense of humor. The Hydra here is not the multi—headed beast that Hercules fought in his second labor; this Hydra has just one head.

At one time Corvus, the Crow had beautiful silver-white plumage and a lovely singing voice, but he lost both of these as a result of not carrying out Apollo's orders. It seems that Apollo sent Corvus to fetch a cup (Crater) of water. Corvus

set out immediately to complete this task, but along his way he noticed a fig tree, laden with juicy figs. However, these figs were not quite ripe. Corvus could not pass these lovely, juicy figs by and leave them for someone else to devour, so he decided to wait until they ripened. When the figs had finally ripened, he enjoyed his tasty but final meal. When Corvus had eaten all of the figs he suddenly remembered his task of fetching water for Apollo. Corvus quickly filled the Cup (Crater) and raced back to Apollo, offering a rather lame excuse that the Water Serpent (Hydra) had hindered his efforts to scoop up the water. Apollo was young but not that gullible, so Apollo punished Corvus. For his selfishness, Apollo changed the beautiful silver-white plumage of Corvus to dirty black. For lying to Apollo, Corvus' lovely song was changed into a raucous screeching caw. The worst punishment by far was that Apollo placed Corvus and the Cup (Crater) in the sky on the back of the Water-Serpent (Hydra). Hydra was instructed to make sure that Corvus never came near enough the cup to drink.

Section 5 - The Summer Sky

A good starting point in the Summer Sky is the Summer Triangle. This is not a constellation in itself, but is worth showing to the kids as the three stars that form it are some of the brightest in this section of the sky. The three stars that make the triangle are Deneb, Vega and Altair. It is easy to find, as Vega, the brightest star in the triangle, is directly overhead in the summer. The constellations in the Summer Sky that we have included here are (zodiac are in bold):

Group 1:

- Cygnus (the swan)
- Aquila (the eagle)
- Lyra (the harp)
- Delphinus (the dolphin)

Group 2:

- **Libra (the scales)**
- **Scorpius (scorpion)**
- **Sagittarius (archer)**

Group 3:

- Heracles (great warrior)
- Corona Borealis (northern crown)
- Ophichus (serpent holder) & Serpens (serpent)

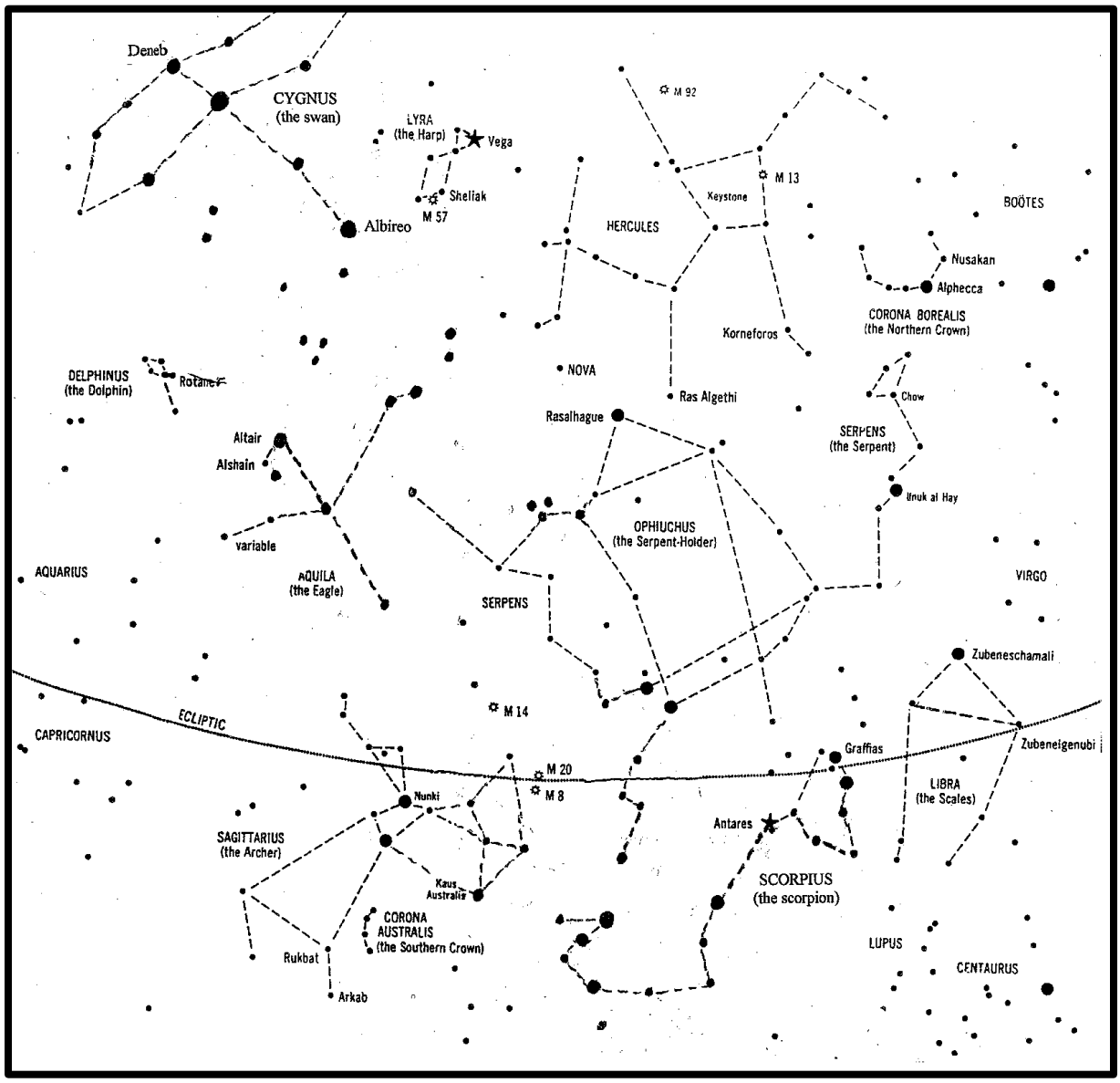
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112	Delphinus	Greek, Native American, Australian
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115	Scorpius	Greek, Native American, Polynesian
118	Sagittarius	Greek
120	Heracles	Greek
122	Corona Borealis	Greek
124	Ophichus & Serpens	Greek

Quick Reference Guide to the Summer Sky

Constellation Name	Nickname(s)	What it looks like	How to find it	Notable Stars
Summer Triangle		A triangle	Directly overhead in summer.	Deneb, Vega, Altair
Cygnus	The Swan, The Northern Cross	Cross with long neck	Next to Draco's head. Flies south along the Milky Way	Deneb
Aquila	The Eagle	Cross with short neck	Flies in the opposite direction from Cgynus	Altair
Lyra	The Lyre, The Harp	Diamond	Third corner of the Summer Triangle	Vega
Delphinus	The Dolphin	A dolphin	Next to (east of) the Summer Triangle between Cygnus and Altair	
Libra	Scales			
Scorpio(s)	Scorpion		Southern sky. Huge curlie-cue.	Antares
Sagittarius	The Archer, Centaur	Teapot	East of Scorpio	
Heracles	The great warrior	Trapezoid	Stands on Draco's head. Body is a trapezoid.	
Corona Borealis	Northern Crown	Semi-circle	Between Bootes and Heracles	
Ophichus & Serpens	Serpent Holder & Serpent	House	Between Heracles and Scorpio. Head is next to Heracles' head.	

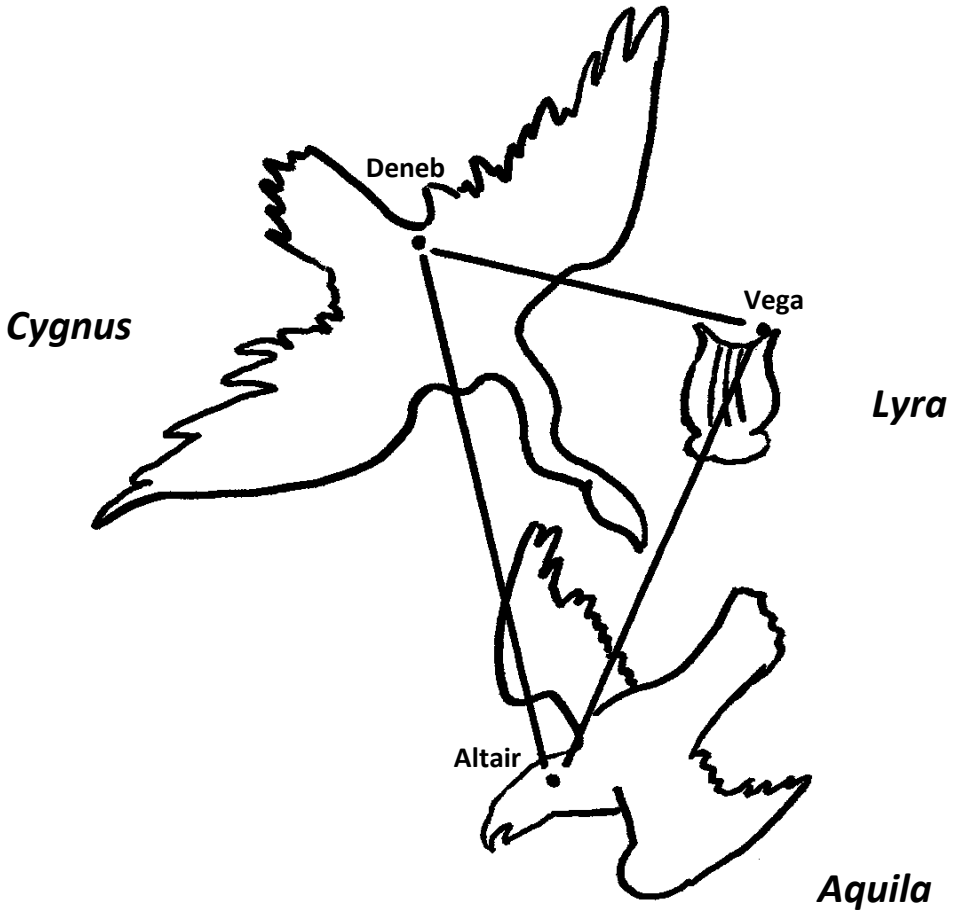
A Map of the Summer Sky



How to find the Summer Triangle (best seen: May – November)

Directly overhead in the sky you will find three bright stars that form a large triangle. The Milky Way flows through the Summer Triangle.

Vega is the brightest of the trio and lies to the West and closest to Draco's head. Deneb is toward the North and lies near Cepheus. Altair forms the third point toward the East.



Altair and Vega: A Chinese Story

Long ago and after a hard day's work, a lonely herdsman and his old ox rested in the shade beside a stream. Seven beautiful sisters appeared and, not seeing the herdsman, bathed in the water. The herdsman was dazzled by the beauty of the youngest but was too shy to stand up and speak to her.

The old ox whispered to the herdsman, "She is the weaver princess - the one who weaves the clothes of the gods. If you hide her robe, she will be unable to fly back to heaven. Then she will be your wife."

The herdsman was surprised to hear the ox speak, but took its advice. While the princess searched for her hidden robe, her sisters dressed and flew away. Then the herdsman stepped forward and gently offered his coat to the princess. She was grateful and soon agreed to become his wife.

In time, the herdsman and the weaver princess had two children. The princess was happy and forgot about her work in heaven. But when the gods needed new clothes, the goddess Queen Mother found the princess's weaving loom quiet. Queen Mother's heavenly guards took three years to find the weaver princess. When they did, they carried her back to heaven.

The herdsman and his children were desperately lonely for the princess. But the old ox spoke again: "I will die soon. When I do, cut off my hide and wear it over your shoulders. It will take you to your wife."

The herdsman was sad to lose his old friend the ox, but followed his advice. The herdsman put his children in buckets on either end of a pole, then placed the pole across his shoulders and the ox hide over his back. Immediately, he rose to heaven and the family was reunited.

Once again the weaver princess stopped weaving. When Queen Mother saw the weaving loom quiet, she took a silver hairpin and drew a line across heaven. Water gushed into the line and formed a silver river (the Milky Way) that separated the herdsman (Altair) from his wife (Vega) and children.

Both the herdsman and the weaver princess wept bitterly. Eventually, their sadness touched the heart of the King of Heaven and he ruled they could spend one day a year together – on the seventh day of the seventh month. He said all the magpies in the world would form a bridge of wings for them to cross the silver river for their short reunion.

If it rains on July 7, people say the weaver princess is weeping tears of joy to be with her husband again. If the night is clear, people look at the stars and think of the faithful love of the separated couple.

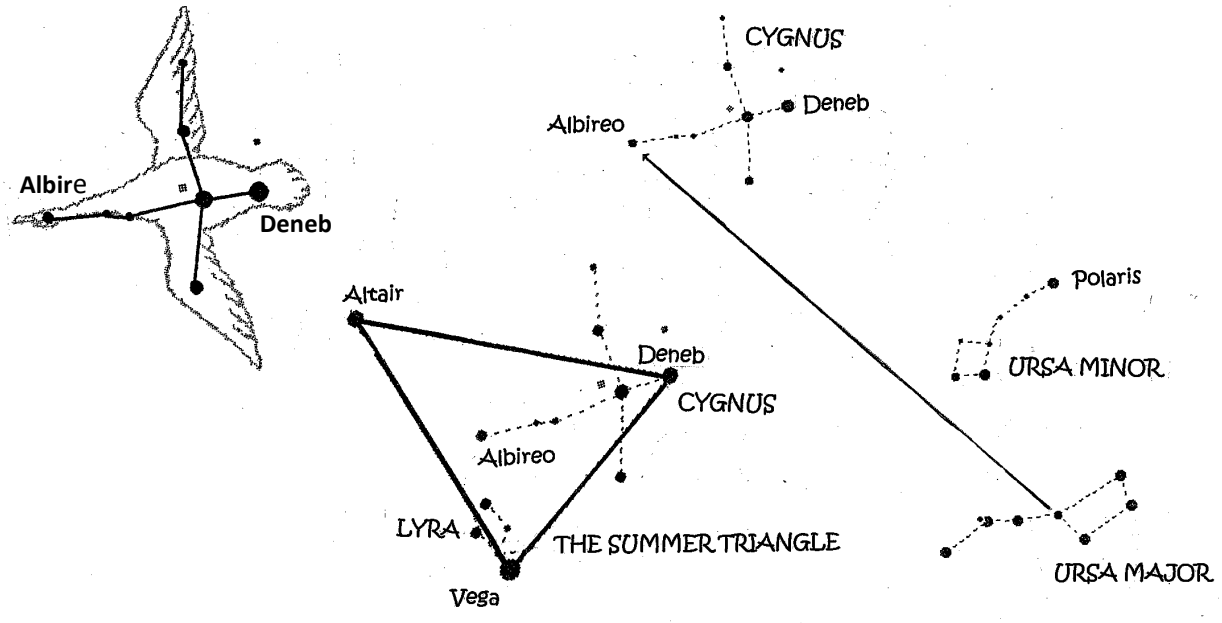
Among the fainter stars that twinkle near Vega and Altair, look for the children of the weaver princess and the herdsman. Some people even see two buckets, a herdsman's staff and a weaving shuttle.

How to find Cygnus (best seen: May – November)

To find Cygnus, locate the two innermost stars of the cup of the Big Dipper. Connect a line through these stars extending from the top of the Dipper. This line will lead you straight past the base of Ursa Minor. Continue on this line and you will find the star Albireo (a double star). Albireo forms the head of the Swan, Cygnus. Deneb is the tail. The line in between is the body. Swans have long necks and short tails, so look for the extended wings closer to the tail (Deneb). Cygnus flies south along the Milky Way.

This constellation is also called the "Northern Cross." Albireo forms the bottom of the cross and Deneb forms the top part of the cross.

Cygnus can alternatively be found using the Summer Triangle. Simply locate Deneb by looking for the cross formation by one of the Triangle's stars.



Cygnus: Greek Myth

For the beginning of this myth, look in the "Night Sky" section, under "Stars" and find the myth called "Chariot of Fire." Replace the last paragraph with the following one:

Phaethon had a very devoted friend, Cygnus, the Musician-king. His people lived on the coastal area of northwestern Italy and southern France. On hearing of Phaethon's fate, Cygnus plunged into the river and swam back and forth, diving repeatedly to try to find the body of his friend. His motions through the water made him look like a swan searching for food. Helios took pity on Cygnus, who died of grief, and raised him to stardom, where he became the constellation Cygnus, the swan.

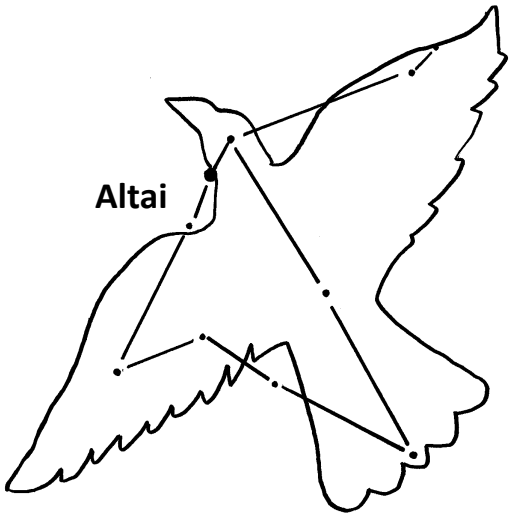
Cygnus: Greek Myth

Just as he was beginning his life as a great Trojan hero, Cygnus was tragically killed in battle by the famed and clever warrior, Achilles. As Cygnus drew a last breath of life, his father, Poseidon, transformed the young man into a beautiful swan and carried him to the heights of Mount Olympus, home of the gods. Here, Cygnus displayed his grand grace and elegance, inspiring the King of the Gods to change himself into a swan, too. Disguised as the majestic creature, Zeus sped to earth and courted the lovely Leda, who gave birth to their sons, Castor and Pollux. Zeus also took the form of the swan to trick Nemesis, the stern goddess of Divinity from Cygnus' attack. In the starry skies, the great white swan forever flies, with wings outstretched, southward along the Milky Way.

How to find Aquila (best seen May – November)

Go to the Summer Triangle and find Altair. Altair is the center of the wings of Aquila who flies in the opposite direction from Cygnus. Eagles have short necks and long tails, so trace out the body in that way. The head is a very dim star and can only truly be seen on a very dark night.

Aquila is depicted as flying in all kinds of directions (you'll find differing pictures online and in books). In fact, the picture of the Summer Triangle in this manual shows Aquila flying at a right angle from Cygnus. There is no "correct" picture… it's a constellation, after all, and if you see a slightly different grouping of stars, that's fine. However, we've chosen to show/teach you the version that flies in the opposite direction from Cygnus.



Aquila: Greek Myth

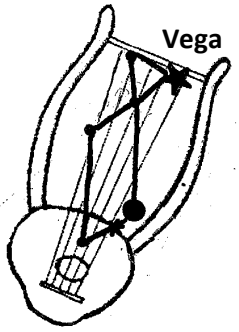
This story is similar to the Greek Myth about Aquarius in the "Fall Sky" section.

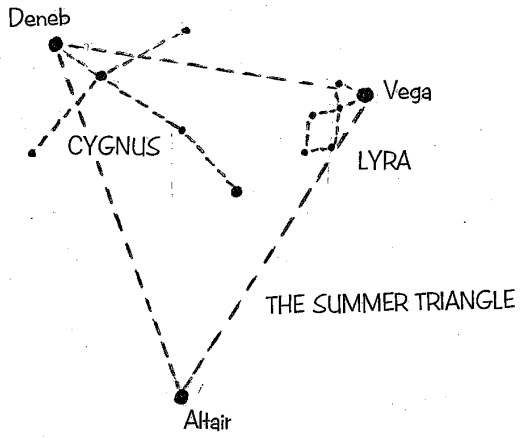
Aquila, The Eagle, was the divine bird of Zeus and bearer of his sacred thunder. Aquila began servicing the King of the Gods as Zeus was battling with his father, Cronus, to gain control of the universe. During this fierce combat Aquila faithfully provided his master with plentiful food, drink, and weapons, enabling Zeus to become victorious in his quest for supreme power. Aquila continued to faithfully

attend to his lord's wants and needs, and when Zeus enlisted the young Trojan boy, Ganymede, the powerful eagle descended to gather him. Aquila then Carried Ganymede through the air to Mount Olympus, where he became the cup-bearer of the gods. Zeus was so pleased with Aquila's actions that he placed The Eagle among the stars to eternally soar through the sky.

How to find Lyra (best seen May – November)

To find Lyra the Harp, simply locate the Summer Triangle. Lyra looks like the shape of a fish. Vega, the very bright and blue-white star that is part of the Summer Triangle, forms one tip of the tail.





Lyra: A Greek Myth

Hermes, Messenger of the Gods, one day came upon an empty tortoise shell on the beach and out of it he made a small harp-like instrument, the lyre. When in the right hands the instrument produced the most beautiful music ever heard by either gods or mortals. Hermes decided to trade his invention with the Sun-god, Apollo. Later, Apollo presented the lyre to his son, Orpheus. So gifted was Orpheus at playing the lyre that neither the mortals, beasts, nor the gods themselves could turn away when he played. It is said that on hearing Orpheus play, the dark god Pluto, Lord of the Underworld, wept tears of iron.

When he became an adult, Orpheus got married to the young and beautiful Eurydice. Sadly, soon after their marriage she was bitten by a serpent and died. She was transported to the Underworld, where all mortal souls went. Orpheus decided that he could not live without her, so he followed her, playing the lyre as he went. Pluto and all the other ruling spirits were so enchanted by Orpheus's music that they agreed to restore life to Eurydice – but only on one condition – that as Orpheus left the Underworld, he would not look back to see if his wife were following him. He agreed and started the long journey home.

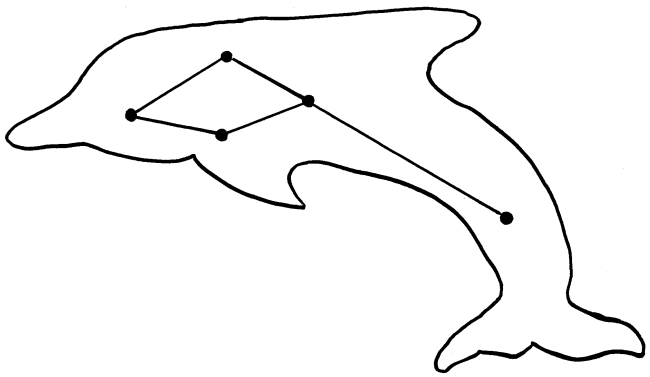
When Orpheus was nearly back at Earth's surface he could not understand why he had not heard footsteps behind him if his wife were really there. So, breaking his vow, he looked back. He saw Eurydice, but she rapidly faded away into the mists of the Underworld. Now she was lost to him forever, for once reborn, a departed soul cannot be reborn a second time.

Utterly sad and lonely, Orpheus spent the rest of his days roaming over the land playing sweet but sad music to himself in memory of his dear wife. So sweet was the music that maidens from far and wide came to him and followed him, pleading that he forget his sorrows and marry one of them. But he would not.

Eventually Orpheus died of heartache. Zeus who had also been enchanted by the sweet music of Orpheus, decided to make his music immortal. He raised the lyre into the skies and placed it beside the graceful swan, Cygnus.

How to find Delphinus (best seen June - November)

Delphinus is located directly east of the Summer Triangle. It is neither large nor bright, but it is a distinctive constellation and once you find it, you will always remember it. It doesn't take much imagination to see a tiny dolphin traveling northward in this figure. The diamond represents the body and a line to the fifth star forms the tail.



Delphinus: Greek Myth

This is the story of the beautiful nereid Amphitrite. Neptune saw her dancing on the island of Naxos, fell in love, and did what any self-respecting god would do: He kidnapped her. Amphitrite escaped and fled to the farthest end of the ocean. Neptune sent all manner of sea creatures looking for her. One of the dolphins found her and persuaded her that the god of the sea wasn't so bad. She returned and married Neptune. In gratitude, Neptune placed the dolphin in the sky.

Delphinus: Greek Myth

In the other myth, it was Apollo, the god of poetry and music, who placed the dolphin among the constellations for saving the life of Arion, a poet and musician whose skill with the lyre made him famous in the 7th century BC.

Arion was sailing back to Greece after a concert tour of southern Italy when the sailors who were also on the ship started plotting to kill him and take the money he had earned. Surrounded, Arion asked them to let him sing one last song. The sailors allowed this, and Arion's music drew several dolphins to the ship. As he played, the dolphins swam alongside the ship and Arion decided to take a leap of faith and he jumped overboard. One of the dolphins carried him all the way back to Greece. Later, Arion confronted the sailors and had them sentenced to death. In this version of the myth, Apollo placed the dolphin next to the constellation Lyra in the sky, and Lyra represents Arion's lyre.

Delphinus: Native American (Chumash Tribe, California)

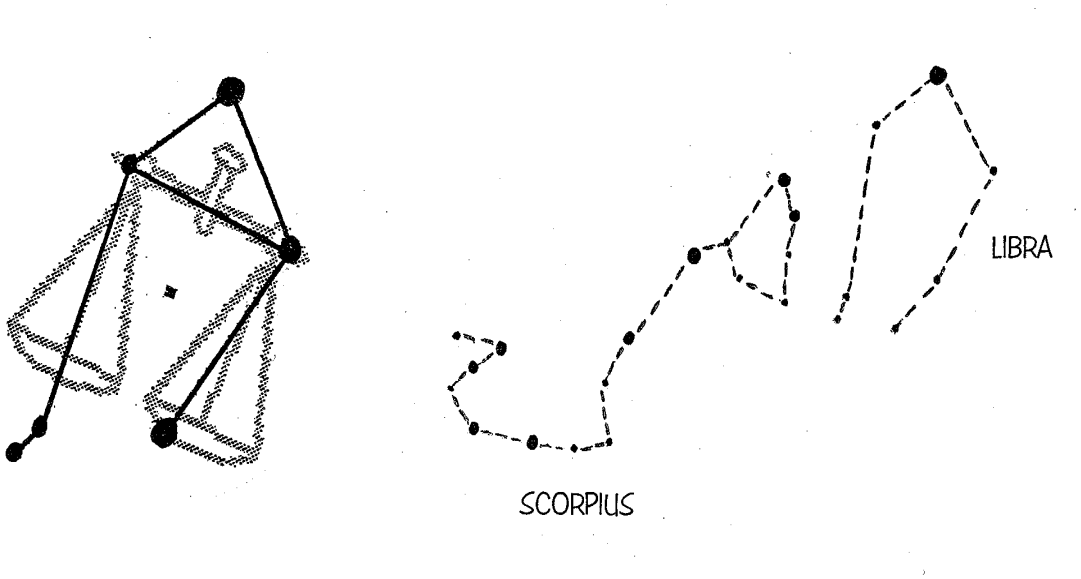
The Chumash tribe of California call this dolphin A'LUL'QUOY, which means "to go in peace and to protect." It is said that when the Chumash migrated to the mainland, their grandmother, Hutash, built them a rainbow bridge on which to cross. She warned them not to look down as they were crossing or they would fall down into the sea and die. Some did look down and fall, but because of her great love for her children, she turned them into dolphins before they hit the water.

Delphinus: Australian Aborigine Tale

The Aborigine of Australia hold the dolphin as very sacred, the wise, older brother. When a member of the tribe dies, his spirit becomes a dolphin. They believe the dolphins in the ocean span the physical and spiritual world to guide and protect their brothers and sisters who have chosen to go through this life in human form. In their deepest meditation, their "dolphin dreamtime," the dolphins give them the answers to all of their tribal questions and decisions. Also, to kill a dolphin is seen as sacrilege, and will invoke the wrath of Gornge, the "executioner."

How to find Libra (best seen: June – July)

Libra is located directly right of Scorpius, with the constellation Virgo (see Spring Sky) on its right. The ancient Greeks did not recognize Libra, but considered it part of Scorpius (Libra made up the two claws). Romans, Egyptians, Chinese and Indians saw a set of scales in this constellation, the Egyptians seeing scales in which the human heart was to be weighed after death. It is the only constellation in the zodiac that is non-living.

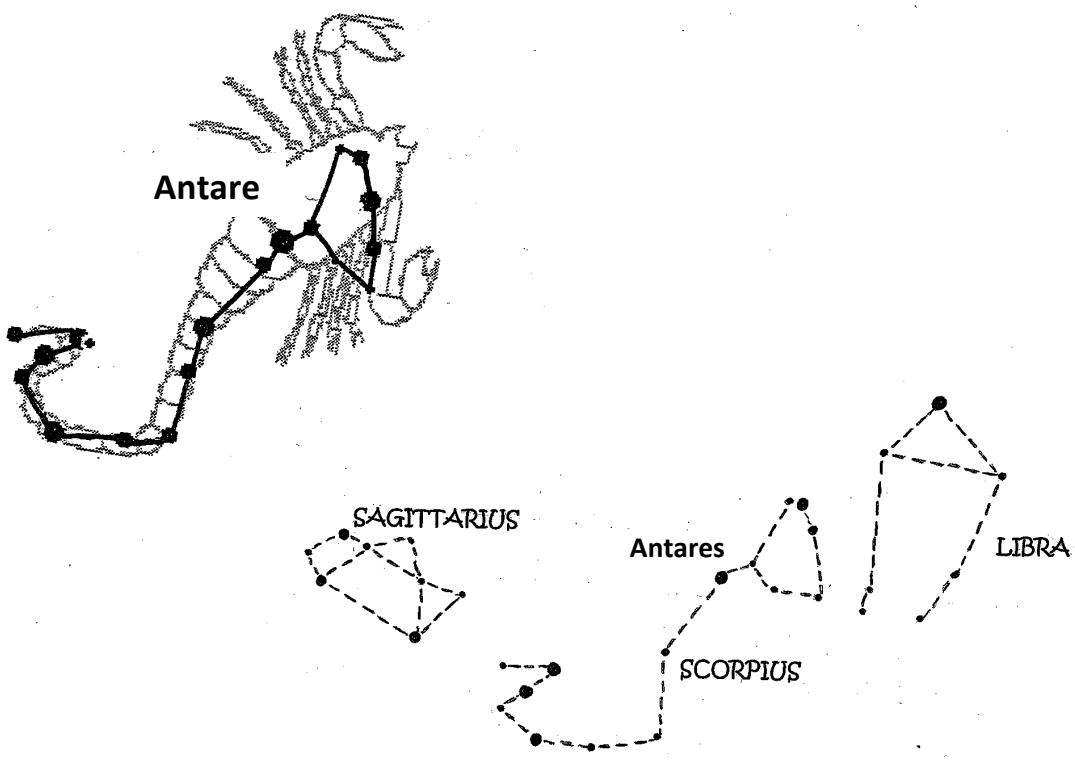


Libra: Roman Myth

During the Golden Age, the legendary first period of human existence, Astraea, the Roman Goddess of justice, lived on the earth, mingling among the many mortal beings. In the pans of her great golden scales, she heavily weighed the good and evil deeds of men and women, thereby deciding their many different fates. As Astraea became increasingly offended by the wickedness of her citizens, she decided to flee from the corrupt civilization, and returned to the heavens, joining Demeter as the constellation of the Virgin Goddess. Astraea abandoned civilization so hurriedly that she left behind her golden scales of justice. The Romans, in fear of her judgment, created the constellation of Libra from the ancient Scorpion's claws so that The Scales would always be nearby in the sky.

How to find Scorpius (best seen: July – August)

Scorpius is a long constellation that you can usually see stretched out to the south. It is positioned to the right of Sagittarius, it's great sweeping and curving tail threatening to sting the Archer. The sting of his tail is close to the horizon, and rises up to the body of the scorpion. The Greeks saw Libra as an extension of Scorpio's claws. The "heart" of Scorpius is a reddish star named Antares.



Scorpius: A Greek Myth

While on a hunting expedition with Artemis, Goddess of Wild Animals, Orion boasted that so great was his might and skill as a hunter that he could kill all the animals on the face of Earth. Artemis was alarmed at such a boastful and inappropriate statement, as was Hera, Goddess of Earth.

After considering what a sad and lonely place Earth would be without all of its many kinds of animals, Hera decided that Orion must be killed just in case he might one day decide to carry out his boast. So Hera sent a giant scorpion to Orion and ordered the beast to sting Orion. As mighty as Orion was, after only a brief battle, the scorpion managed to deliver the hunter a deadly sting. Both Orion and the scorpion were given honored places in the sky, but they were placed at opposite ends of the great sky dome so that they would never engage in battle again.

Scorpius: A Polynesian Story

The Polynesians of Tahiti tell the story of the boy Popiri and his sister Rehua. Their mother, who was quite harsh and short tempered, went fishing for the evening meal. It was not until late at night that she caught enough fish for the family dinner. By the time she returned home her husband and children were asleep. They had gone to bed hungry.

She awakened her husband and cooked a wonderful meal. He suggested that she awaken the children who had been quite hungry. She refused despite her husband's insistence and put the children's portion away until the following day. Pipiru and Rehua were awakened by their discussion and were hurt by their mother's lack of sensitivity and decided to run away.

Later that night after their parents were asleep they crept out of the house and ran and ran until they reached a tall hill. They climbed the hill and sank to the ground exhausted. They wept because of leaving their home, but they were determined not to return. Their tears flowed until they actually formed a small pool.

Meanwhile just before sunrise their mother awakened, saw their bed stained by their tears and immediately awakened her husband to find the children. She saw their tracks barely visible in the early light and followed their small footprints and trail of tears until they reached the top of the hill where the tracks ended. They were looking around, confused for the children were nowhere to be seen – until their father looked up and saw Pipiru and Rehua rising to the stars. They decided to follow.

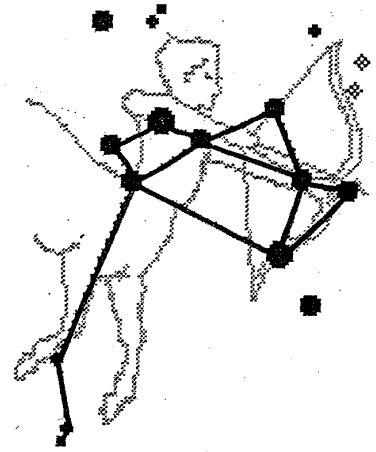
When the children saw their parents getting close to them Pipiru asked a giant stag-beetle to help them escape. He placed the children upon his back and with tremendous speed flew up to the stars where they can be seen in the two bright stars in the tail of Scorpius. The giant stag-beetle went to its home in Antares, the bright star in the body of Scorpius. In the South Pacific when parents are unfair or too harsh, children sing a song about Pipiru and Rehua.

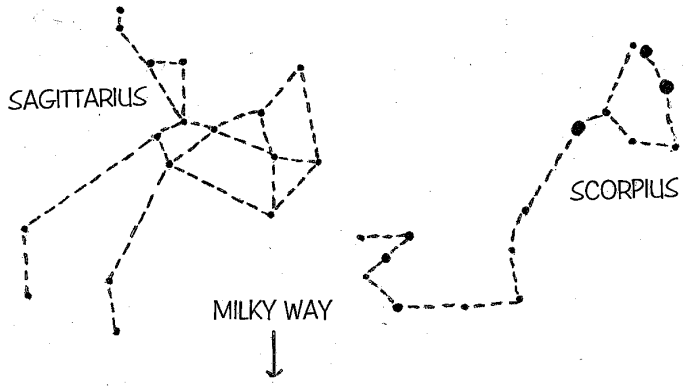
Scorpius: Native American (Pawnee Tribe)

It is interesting to note that not all cultures are led to see a smooth bend in the tail of Scorpius: some separate the string of stars that forms the body of the Scorpion from the ones that form the tail and stinger. The Skidi Pawnee saw a snake formed by the front part of Scorpius, but the stars of the stinger were, for those people, a pair of ducks. When the "Swimming Ducks" appeared in the twilight before sunrise, the Pawnee recognized that it was time to begin the ceremonies that continued through the planting, hunting and harvest seasons. The Swimming Ducks were the primary stars used to set the Skidi ceremonial calendar.

How to find Sagittarius (best seen: July – August)

Sagittarius is a large constellation, though there is often little of it clearly visible in the night sky. To many, Sagittarius looks like a teapot. To find this part of Sagittarius, first locate the Milky Way. Follow the Milky Way towards the south, and when you get close to the end, look to the east. The Milky Way appears to be steam escaping from the spout of the teapot. The spout is marked by a single star. Go a little to the east and you will see four stars, roughly forming a square. Above the top edge of the square, in the center, there is one star marking the lid. In the middle of the left edge, there is a star that marks the handle.





Sagittarius: Greek Myth

Centaurs were creatures that are half-man and half-horse. They were rude, not all that bright, and they loved to get into fights and arguments. However, there was one exception. His name was Chiron and he was very smart, very nice, and always thought things through before making a decision. He was a friend of many people, including Hercules.

One day when Hercules was carrying out one of his twelve labors, he stopped by the centaur Pholus' house. He knocked on the door and Pholus answered. He was in awe to see Hercules standing at his door. I mean, this was the strongest guy in the world and Pholus thought it was an honor to have him there.
Since Hercules had traveled far that day and was very thirsty. He asked Pholus if he could have a drink. Pholus went and got him a glass of water, which Hercules gulped down. He asked if Pholus had anything else, something a little stronger, as he had a particularly hard day. Hercules looked around the room and spotted a bottle of wine on the shelf. He asked Pholus if he may have a glass. Pholus explained that the wine belonged jointly to all the centaurs; that he mustn't open it without their agreement – it was for special celebrations only. However, Hercules begged and begged, and eventually Pholus gave in.

As soon as he opened the bottle, the aroma of this fine wine flowed out over the countryside. Having smelled it, the other centaurs furiously galloped up to Pholus's house and demanded to know how he had dared open the wine without first consulting them. Before poor Pholus could explain matters the other centaurs began to attack him and Hercules.

Hercules, being the strongest man, had no problem fighting off the centaurs. He kicked this one, and pushed that one, until all the centaurs were on the ground in pain, or had taken off. Then, out of the corner of his eye, Hercules saw a centaur standing by a tree in the distance. He thought he was waiting to jump on him as soon as he left. What Hercules didn't know, is that it was his friend Chiron. He too had smelled the wine and wanted to know what was going on. When he saw the scene before him he decided not to go near the house, but watch from a safe distance.

Hercules could not recognize his friend so he shot one of his poisoned arrows. Hercules thought he would stroll over and check that he had hit him. As he got closer, he began to recognize the centaur he had shot. It was Chiron.

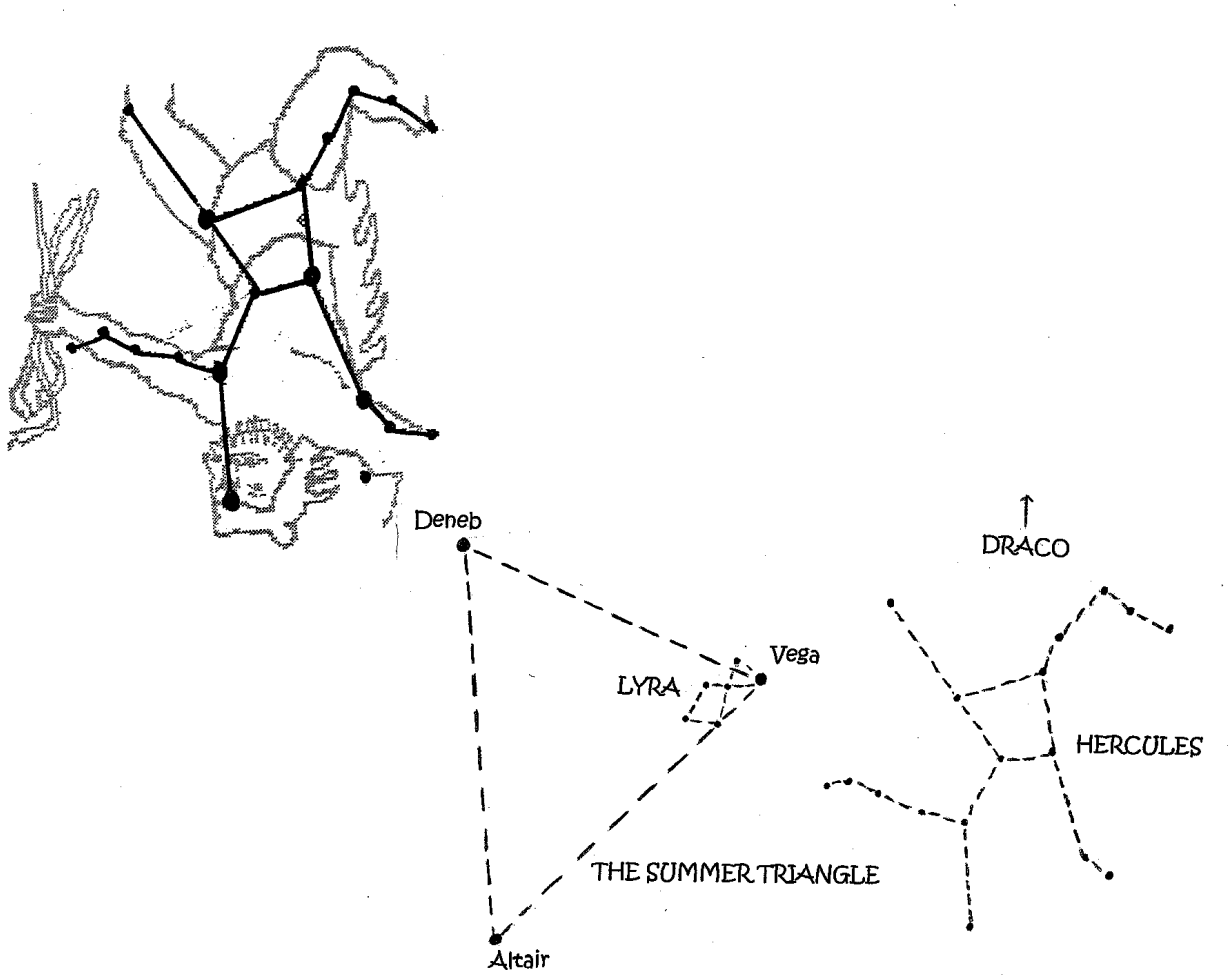
Now Chiron was immortal and could not die. When the poison took effect it pained him so much that he was nearly mad. Hercules was the son of Zeus, so he went to

him and pleaded that he take away Chiron's pain. Zeus took pity on Chiron and granted him his wish. He decided that the best way for him to be remembered would be to give the good centaur a resting place among the stars as the constellation Sagittarius, the Archer.

According to another myth, Sagittarius is poised and ready to shoot an arrow through the heart-star of Scorpio if he tried to do harm to anyone.

How to find Heracles (best seen May – October)

Heracles (also known as Hercules) lies to the right of tiny Lyra. It is a giant but faint constellation, made up of twenty or more stars. Finding Draco (see the North Polar Sky) will help you find Heracles since one foot is resting on Draco's head. Heracles is almost a robust-shape, with "limbs" extending from each corner.



Hercules: Greek Myth

Greatest and strongest of the Greek demigods, Hercules was the son of Zeus and a mortal woman, Alcmene. For this reason he was much hated by Zeus's wife, Hera. He began his life on heroic violence by strangling two snakes while still in his crib that she had put in there.

When still a boy, Hercules reached a height of more than six feet and had become an expert in wrestling, shooting with bow and arrow, and spear-throwing. His great strength was discussed far and wide. Hera was still outraged and jealous over Hercules and would not rest until he was dead.

When he became an adult with children of his own, jealous Hera tried to destroy Hercules again, this time by driving him insane. Out of his mind, Hercules mistook his sons for ferocious wild animals and killed them. When Hercules recovered his sanity and realized the awful thing he had done, he left his homeland in deep sorrow, telling himself he was not fit to live among his people anymore. He sought help from the Oracle of Delphi. The Oracle told him he must serve his cousin, King of Argos, for 12 years. The King also hated Hercules and, hoping to destroy him, gave him 12 supposedly impossible tasks.

The first task was to kill the Nemean Lion. This beast had such a thick skin that no weapon could pierce it. Hercules fought the lion for thirty days and finally squeezed it to death. Then Hercules skinned the lion and made himself a cloak no weapon could pierce. When he finished, he hurled the lion into the sky, where it is to this day.

The king was not pleased. He set a harder task for the second labor – to kill Hydra in the marshes of Lerna. This creature was a dreaded nine-headed water snake that was so poisonous people died by inhaling its stench. Hercules took a deep breath and charged at Hydra with his wife. But every time he cut off a head, two more grew in its bloody neck. So Hercules set the end of his club on fire and burned each neck stump to stop the heads from growing back.

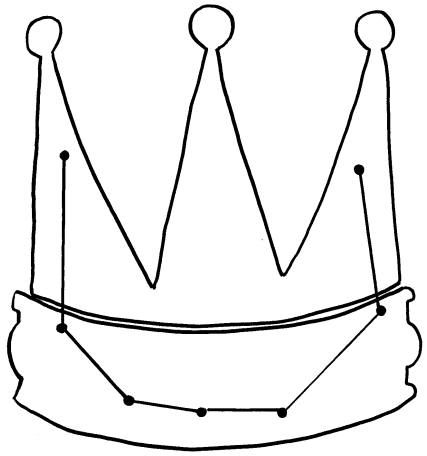
When Hera saw that Hercules was about to defeat Hydra, she sent a giant crab to harass him. But Hercules trampled the crab at the same time that he cut off the last of Hydra's heads. Victorious, Hercules dipped his arrows in Hydra's blood. Now, with poisoned arrows and his lion skin cloak, the strongman was more invincible than ever.

Hercules died when his second wife accidentally poisoned him. She thought that Hercules was being unfaithful and poured a magic potion on his robe that was meant to restore his love for her. Instead it burnt his skin and soaked into his blood. Zeus honored his son by making him a god and placed him in the sky forever.

How to find Corona Borealis (best seen: June - September)

Corona Borealis lies directly between Bootes and Hercules. It is a semi-circle of stars and is noted in many cultures:

- In Celtic mythology, Corona Borealis is known as Caer Arianrhod, or the Castle of Arianrhod, the place where the mythical Lady Arianrhod lived.
- The Arabs know the constellation as “the poor people’s bowl” or Alphecca, which means “broken up.”
- The Cheyenne called the constellation the Camp Circle because its shape was similar to the way they arranged their camps, in a semi-circle.
- In Australia, Corona Borealis is known as Woomera, the Boomerang.
- The ancient Chinese called it Kwan Soo, meaning “a cord.”



Corona Borealis: Greek Myth

This constellation is generally associated with Ariadne, the daughter of King Minos of Crete. His wife had borne a hideous monster, half-man and half-bull, and Minos had it shut up in a labyrinth designed by the famous architect Daedalus. The maze was so complex and confusing that Daedalus "was himself scarcely able to find his way back to the entrance"

Periodically, the Minotaur needed to be fed, and a number of Athenians would be put into the labyrinth for it to eat. When Theseus came to Crete, he was chosen to be one of the people put into the labyrinth for the Minotaur to find and eat.

Ariadne, Minos' daughter fell in love with him, and offered to help if he would take her away with him when he escaped. He agreed, and she gave him a thread to unwind behind him to mark his passage. He killed the Minotaur, followed the thread out of the labyrinth, and sailed from Crete with Ariadne.

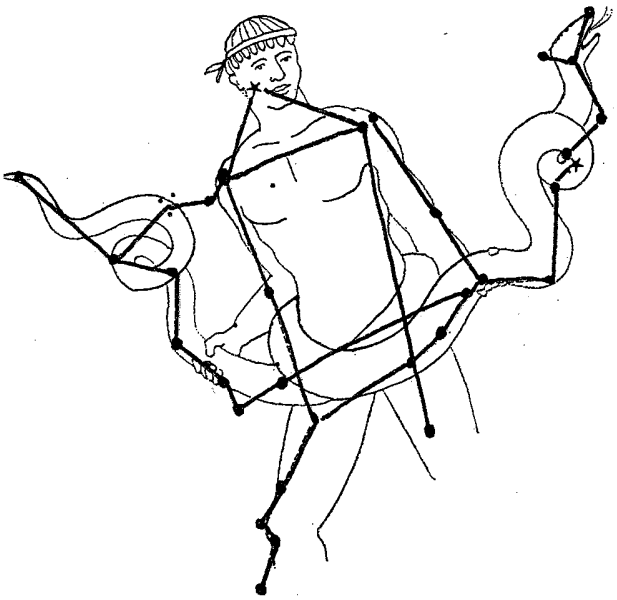
But he soon abandoned her on the island of Naxos. The god Dionysus saw the princess weeping, fell in love, and the two were soon married. Ariadne wore a crown made by Hephaestus at the wedding and, once the ceremony was over, she tossed it into the sky, where the jewels turned into stars and the crown became the constellation Corona Borealis.

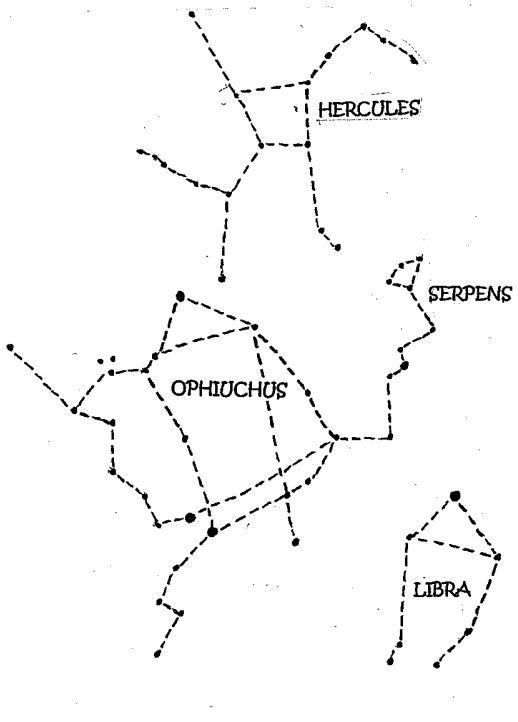
How to find Ophiuchus and Serpens (best seen: July – August)

These two constellations are considered together because they can be seen as a single constellation once you have had some practice in finding them. They rise immediately behind Libra.

There are no especially bright stars in Ophiuchus, although you should not have too much trouble finding the star marking Ophiuchus's head, and below, the two pairs of stars that mark his shoulders. A fairly straight line of three stars marks his right arm, and another line of about five stars marks his right leg. To the right of Ophiuchus's head is a triangle of stars marking the head of the serpent. Then with some practice you should be able to trace the long winding trail of stars marking the twisting body of the serpent, which Ophiuchus firmly holds in both hands.

If you are good at finding Hercules, just remember that the heads of these two powerful men are side by side, Hercules being seen in the upside down position.





Ophiuchus and Serpens: A Greek Myth

Aseculapius, we are told, was the first doctor of medicine, and his expertise led to his downfall in a very strange way. His career seems to have begun when one day while visiting a friend he saw a snake in the room and killed it. Then, to the great surprise of both, a second snake carrying an herb in its mouth crawled into the room. It gave the herb to the first snake, which immediately recovered. It was this herb, which Aesculapius took from the revived snake that taught him the great powers certain herbs have over life and death.

He traveled far and wide over the land, always learning more about the medicinal uses of herbs, and before long his reputation as a saver of lives had become widely known. So expert had he become that Hades, God of the Underworld, complained to his brother Zeus that fewer and fewer souls were being sent down to the Underworld. Hades, of course, was worried about losing his important position.

Eventually Hades' patience ran out. He demanded that Zeus stop this wholesale restoring of life. After all, only the gods were immortal. If Aesculapius were permitted to increase his skill in bringing the dead back to life, mankind, too, would have attained immortality.

Zeus agreed with his brother and hurled a thunderbolt at Aesculapius, killing him on the spot. However, Zeus could not help but admire the skill of Aesculapius, and so raised him among the stars as Ophiucus, along with the serpent from which he had learned his skills.

Aesculapius, as the God of Medicine, is always shown with a serpent. You may have seen the symbol in hospitals and doctors' offices.

Section 6 - The Autumn Sky

The autumn sky is not as crowded with constellations as the summer sky is, but there is still a lot to see. At the beginning of the fall season at TOS, the constellations of the summer sky will dominate. As the months pass, you will have to familiarize yourself with the constellations of the autumn night sky. The main feature to look for in the autumn sky is the Great Square of Pegasus. This will lead you to a few other constellations. The constellations of the Autumn Sky included here are (zodiac are in bold):

<u>Group 1:</u>

- Pegasus (the winged horse)
- Andromeda (the Chained-Woman)
- Cetus (the Whale)

<u>Group 2:</u>

- **Capricornus (the Sea-Goat)**
- **Aquarius (the Water-Carrier)**
- **Pisces (the Fishes)**
- **Aries (the Ram)**

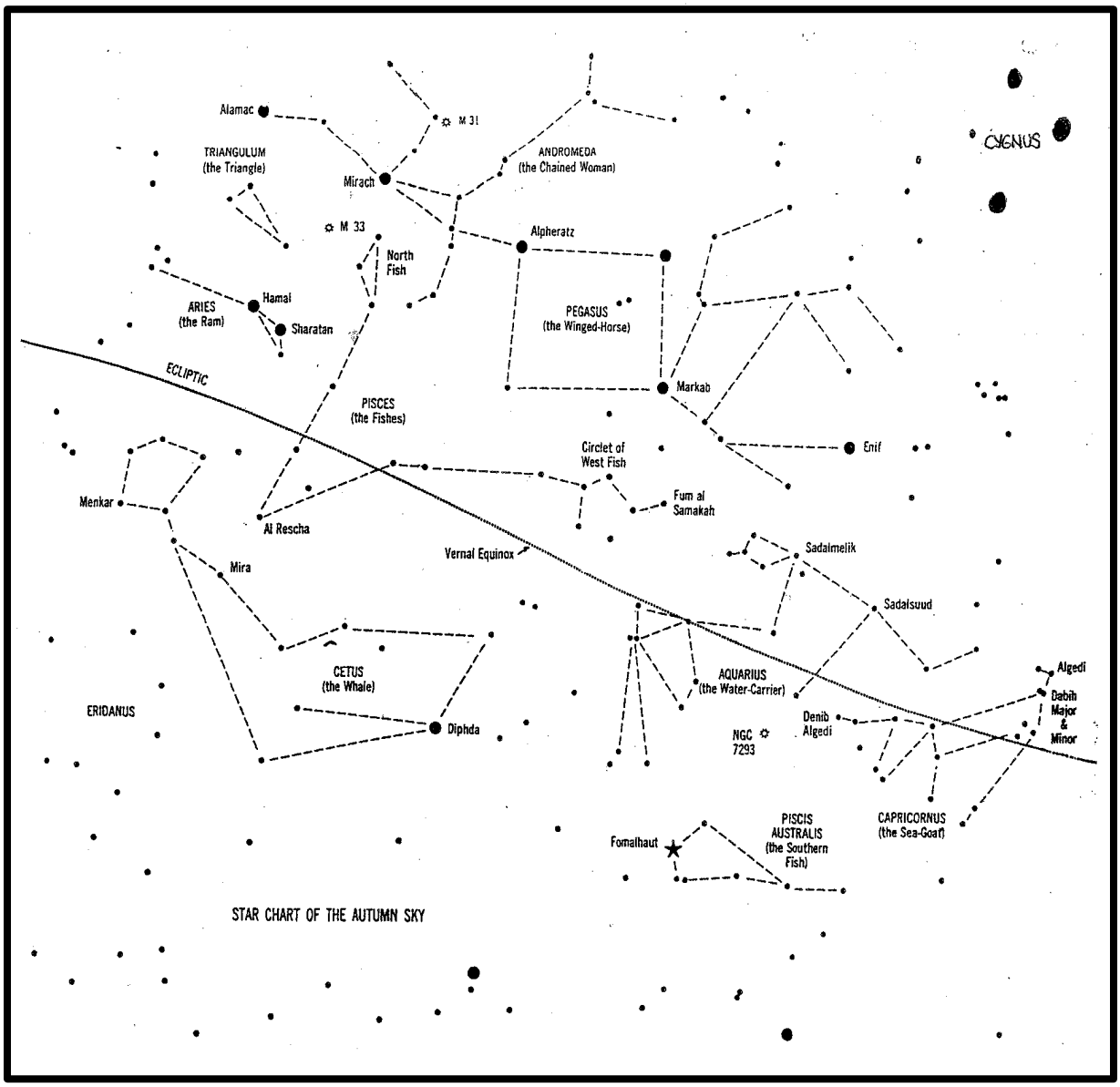
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Quick Reference Guide to the Autumn Sky

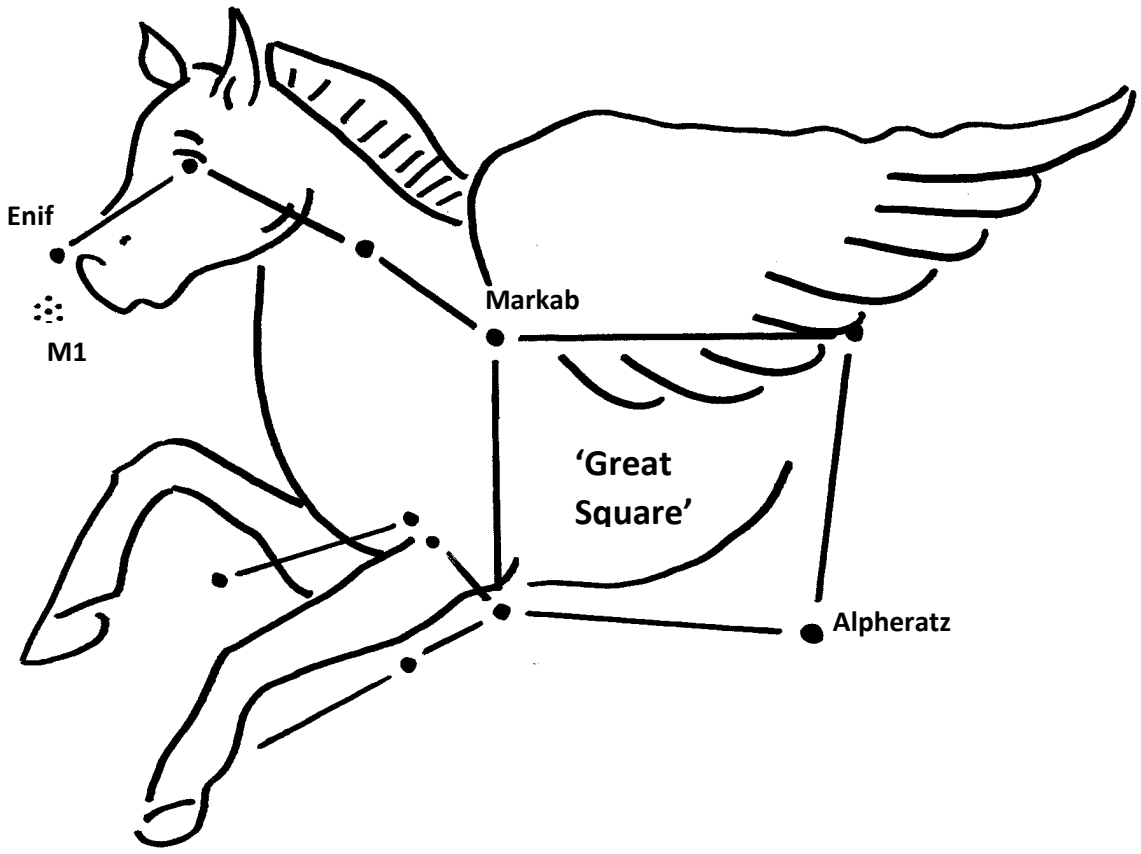
Constellation Name	Nickname(s)	What it looks like	How to find it	Notable Stars
Pegasus	The Flying Horse, The Great Square	A square with two pairs of "legs" coming off of it and a long neck/head	Between the Summer Triangle and Pisces.	Enif (muzzle of Pegasus)
Andromeda	The Chained Princess	Long "V"	Pegasus's back legs.	Almach, Mirach, Alpheratz
Cetus	The Whale			
Capricornus	The Goat	A triangle	You will find it below Aquarius and next to Aquila. It is very dim.	
Aquarius	The Waterbearer		Above Capricornus and below Pegasus.	
Pisces	The Fish	Giant "V" with a tail and head.	Fish #1 is south of Pegasus's body. Body goes east and then Vs north towards Andromeda. Fish #2 is next to Andromeda/ Pegasus's front knees.	
Aries	The Ram			

A Map of the Autumn Sky



How to find Pegasus (best seen: August – October

Pegasus is the easiest constellation to identify in the fall skies. Look for four stars that form an almost perfect square that are about the same brightness. This is the "Great Square of Pegasus." The "Great Square" forms the body of the Winged Horse. To connect the rest of Pegasus, you'll need to use the west side of the square. Pegasus is flying south across the sky. From Markab (lower right corner) extends the head of the horse. The two front legs of Pegasus can be found off the star Scheat (upper right corner). Andromeda comes off the rear of Pegasus.



Pegasus: Greek Myth

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

Medusa was once a beautiful woman with long and flowing hair. So proud was she of her beauty that she dared compare herself with Athena, the Goddess of Arts, Crafts, and War. On hearing of the woman's boastfulness, Athena turned her into a hideous monster. Where her long beautiful hair had once hung were now writhing and hissing serpents. So hideous was the sight of her that any human or animal that looked at her was instantly turned to stone.

On hearing of the loathsome creature, Perseus's mother asked her son to go and kill the dreaded Medusa. Perseus was a favorite of Athena and the wing-footed Hermes. To aid him in battle with the Medusa, Athena lent Perseus her bright shield and Hermes lent him his winged shoes. Fully equipped, Perseus set out and flew over sea and land to where the Medusa lived.

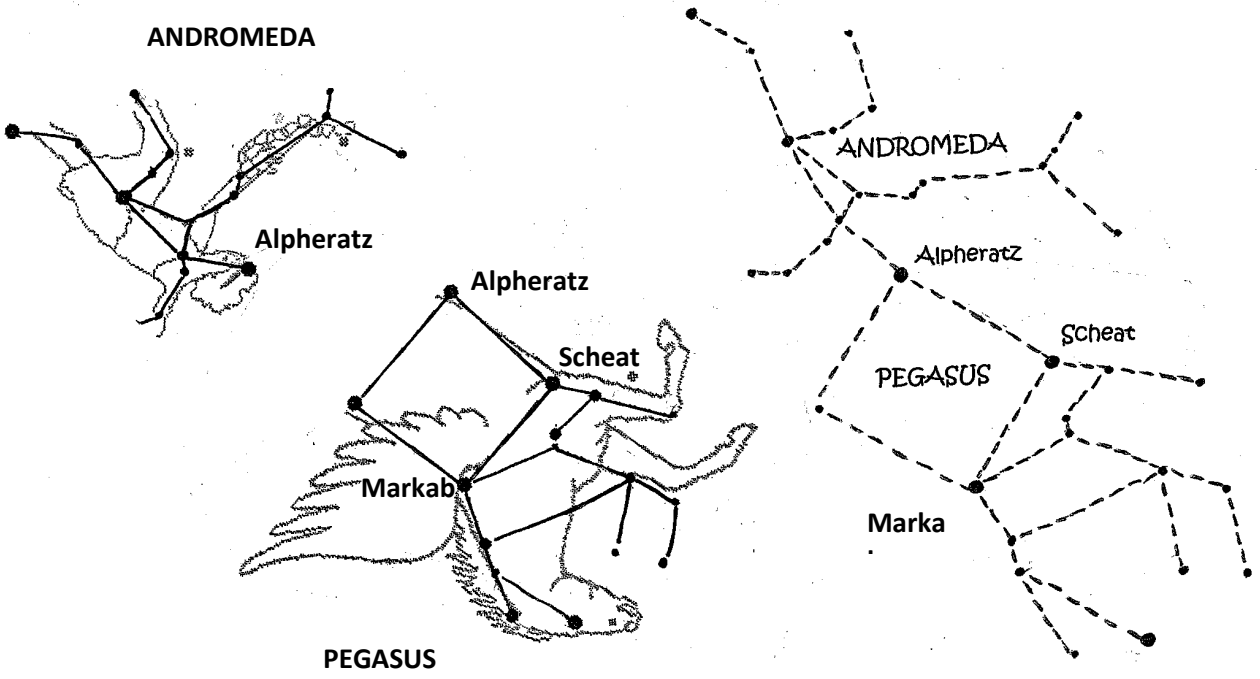
The Medusa was sleeping when Perseus arrived. Silently he crept toward her, while not looking at her directly. So bright was Athena's shield that he could clearly see the Medusa's reflection in it and so he backed toward her and with a mighty blow cut off her head. Then with his eyes closed he grabbed it and stuffed it into the special sack he had brought along.

Triumphant, Perseus set out on his journey home. On the way some of the blood from the Medusa dripped out of the sack and fell into the sea. Poseidon (God of the Seas) felt the drops, recognized them as the Medusa's blood, and was deeply moved. For Poseidon had been in love with the Medusa when she was a beautiful maiden. Remembering how she had once been, he raised her drops of blood from the sea. Then he mixed them with white foam of the dancing waves and with white sand of the beach and out of them he created the Winged Horse, Pegasus.

One fated day, Athena gave Pegasus to the warrior Bellerophon to aid him in defeating the Chimaera, a dreadful monster which was part lion, part serpent and part goat. Bellerophon was so proud after his successful conquest that he boldly attempted to ride Pegasus to Mount Olympus, home of the Gods, where mortals do not dwell. Zeus became infuriated at Bellerophon's self-importance and caused the flying horse to throw his rider. Alone, Pegasus soared to the heavens where he became the Thundering Horse of Zeus and carrier of the divine lightning.

Andromeda (best seen: September - January)

The star Alpheratz is shared by two constellations, Pegasus and Andromeda. The star is actually considered to be part of Andromeda. Andromeda extends in two lines outwards from Pegasus.

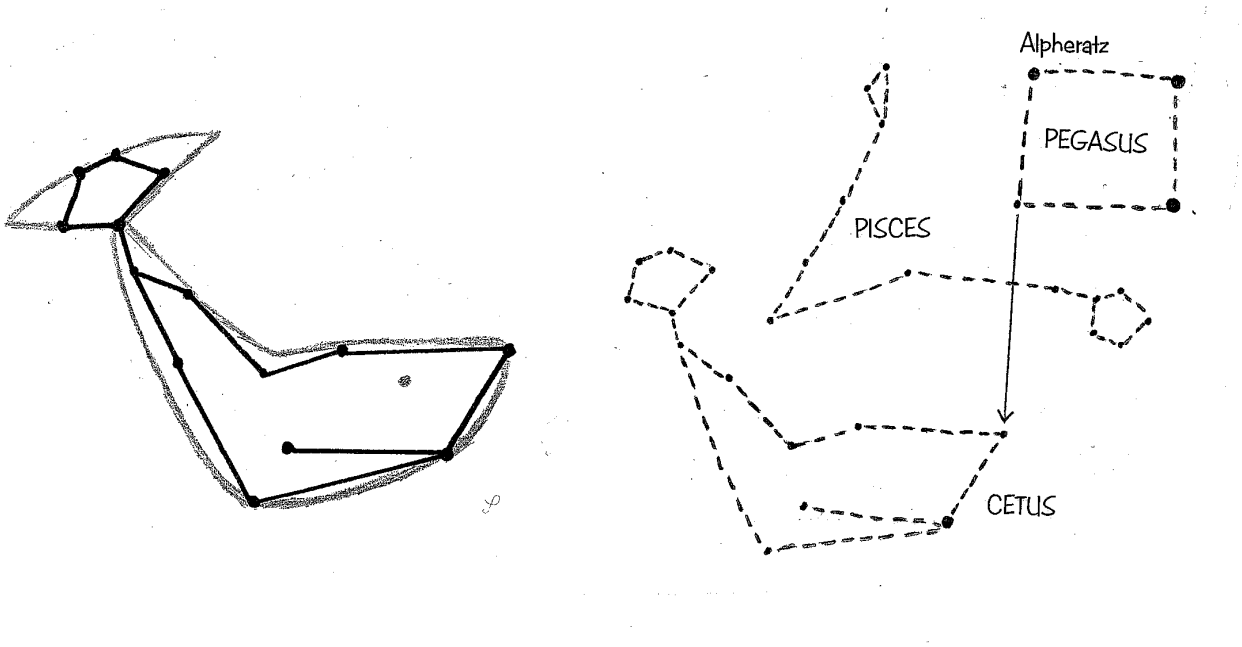


Andromeda: Greek Myth

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

How to find Cetus (best seen: October – January)

To find the constellation Cetus, locate the Great Square of Pegasus. Connect a line from Alpheratz down the side of the square and through Pisces. You'll come to the star that forms the snout of Cetus, the Whale. The rest of the whale can be found to the left of the snout.

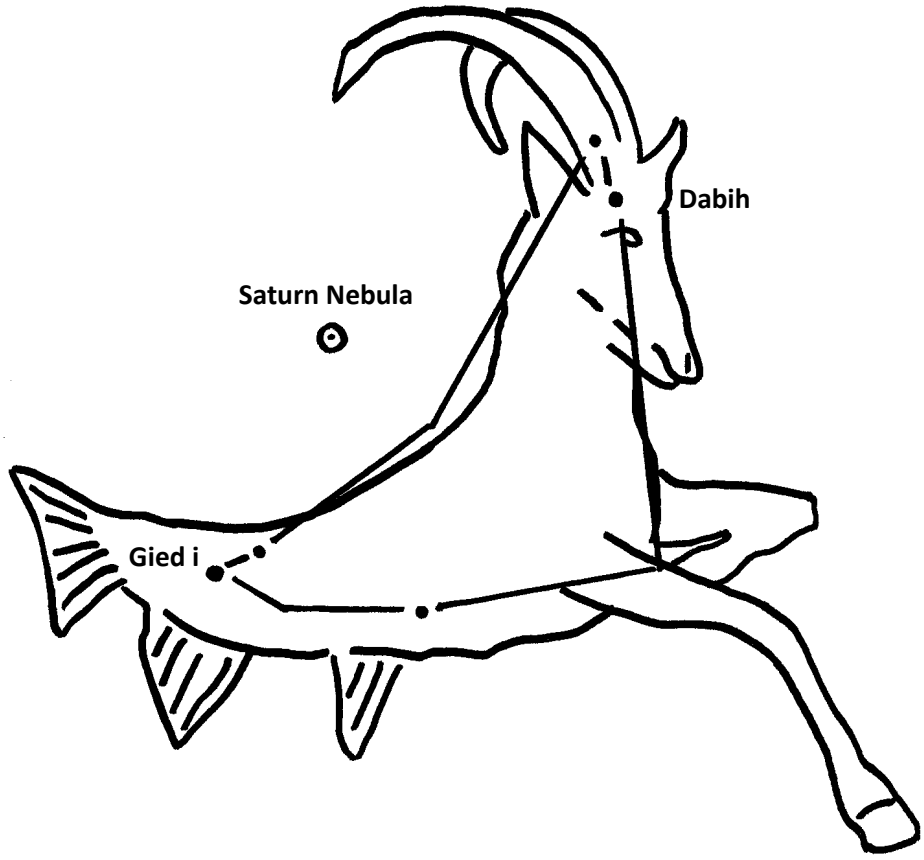


Cetus: Greek Myth

This is a long and winding tale involving Cassiopeia, Cepheus, Andromeda, Cetus, Pegasus and Perseus. You can find parts of the story in Cepheus (North Polar Sky), Pegasus (Fall Sky), and Perseus (Winter Sky).

Capricornus (best seen: August – October)

Capricornus is found to the right of Aquarius. It is a dim constellation which is hard to find and hard to see. Its importance is not in its stars or shape, but in the fact that it occupies an important position along the zodiac.



Capricorn: Greek Myth

The story behind the Capricorn zodiac sign begins with the sea-goat Pricus. Pricus is the father of the race of sea-goats, who are known to be intelligent and honorable creatures who live in the sea near the shore. They can speak and think and are favored by the gods.

Pricus is tied to Chronos (Greek mythology), the god of time. Chronos is the creator of the immortal Pricus, who shares Chronos's ability to manipulate time.

The legend that ties Pricus to Capricorn mythology begins when the younger sea-goats, Pricus's children, find their way onto the shore. The sea-goats seem to be naturally drawn to the shore. They can use their front goat legs to pull themselves onto the beach and lay in the sun. The longer they stay on shore, though, the more they "evolve" from sea-goats into regular goats. Their fish tails become hind legs and they lose their ability to think and speak, essentially becoming the goats that we know today.

This upsets Pricus a great deal. As the father of the sea-goat race, he is determined to make sure that his children never get to the shore. If they do, he fears they will become mindless animals who can never return to sea.

After losing several of his children to the land, Pricus decides to use his ability to reverse time to force his children to return to the sea. During this time reversal, everything on earth, except Pricus, reverses itself to where it was previously, thus the goats revert back to the time to before they returned to land.

Pricus, being unaffected by the time shift, is the only one who knows what is to become of the sea-goats. He tries to warn them, even forbid them from setting foot onto the shore, but no matter what he does, or how many times he reverses time, the sea-goats eventually still find their way onto land and become regular goats.

The pivotal moment in Capricorn mythology occurs when Pricus finally realizes that he cannot control the destiny of his children, and that trying to keep them in the sea will never work, no matter how many times to tries to "start over". He resigns himself to his loneliness, and chooses to no longer reverse time, instead letting his children live their lives out to their own destiny.

In his misery, Pricus begs Chronos to let him die, as he cannot bear to be the only sea-goat left. Chronos instead allows him to live out his immortality in the sky, as the constellation Capricorn. Now he can see his children even on the highest mountain tops from the stars.

Capricornus: Greek Myth

There is confusion over how Capricornus came to be. Some say that he was a god named Aegipan. Aegipan had transformed himself into an animal to escape detection by the evil Typhon. He had jumped into the river when Typhon approached. But he was already halfway submerged before he thought of what form of animal he be. He decided to be a goat. So a goat he became, but only from the waist up. From the waist down he took the form of a fish.

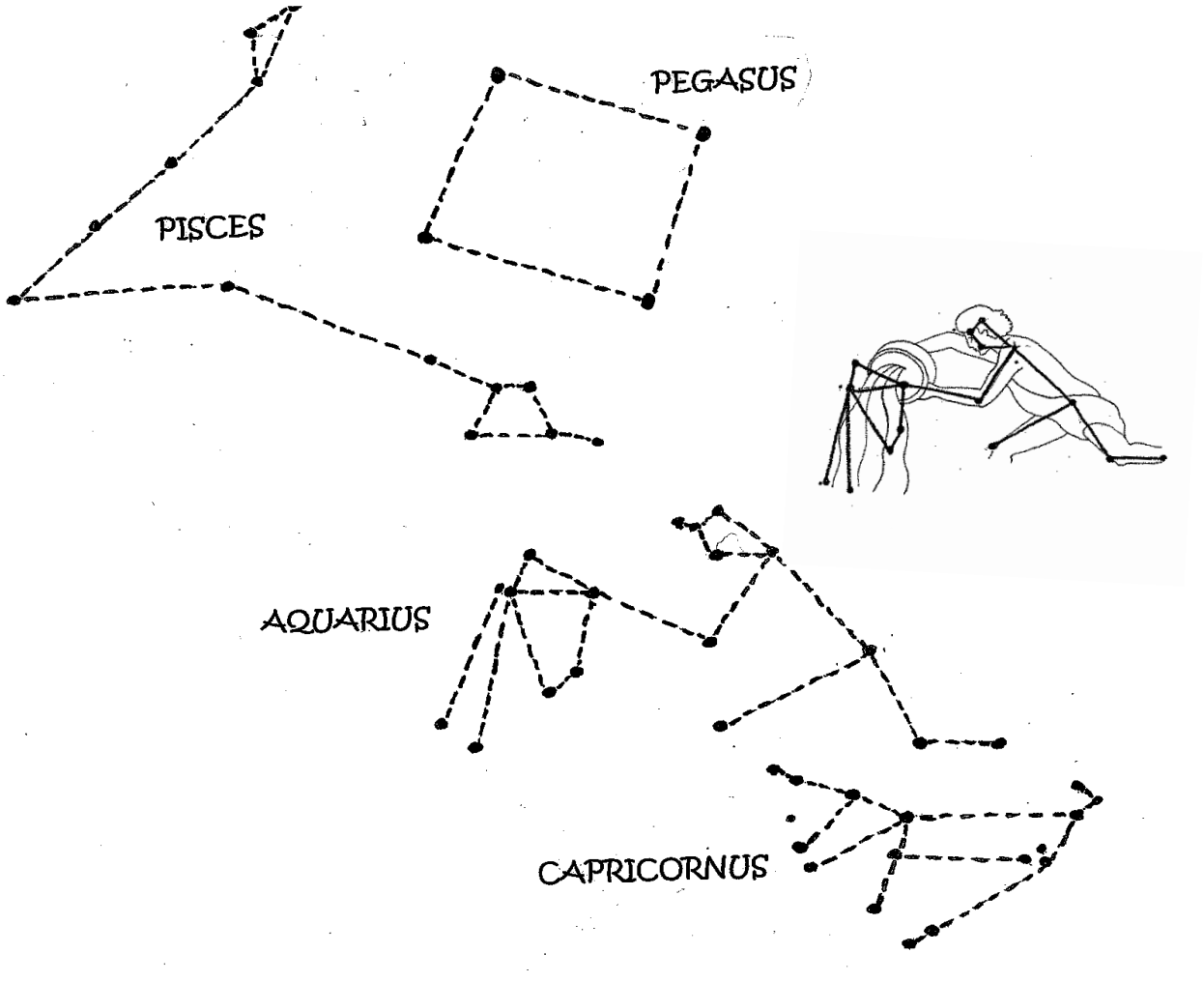
Zeus, the King of the gods, had also changed into an animal. However, when he reappeared in his own form to do battle with Typhon, Zeus was defeated. Typhon took the muscles from Zeus's hands and feet so he couldn't move. He then hid the muscles in a cave and selected the dragon-woman Delphyne, half-serpent and half-woman to guard them. Now Delphyne wasn't a very good guard and Aegipan managed to steal them. He returned them to Zeus, making Zeus once again as fit as ever. His strength regained, Zeus unleashed all his fury and killed the monster Typhon by hurling thunderbolts at him. For Aegipan's role in this battle against the Giants, Zeus gave him an honored place in the sky as the constellation Capricornus.

How to find Aquarius (best seen: September – November)

You will find Aquarius almost directly beneath the Western fish in Pisces and to the west of Cetus, the Whale. It is fairly easy to make out the shape of the Water-Carrier and the pail of water he is emptying onto Earth.

Aquarius, the God of the Waters, was regarded as a good god by some and an evil god by others, depending on the prevailing climate of their region. To the Egyptians, Greeks, and others who lived in lands plagued by a dry climate, Aquarius was looked on as a kindly god who brought rain when they were most needed during the planting season. In Egyptian mythology, he pours water into the Nile River at the season when the Nile usually overflows its banks, bringing much needed water to the bordering farmlands.

The Babylonians looked on Aquarius as an evil god and referred to the month when the Sun was in Aquarius as the month of “the curse of rain.”



Aquarius: A Greek Myth

This story is similar to the Greek Myth about Aquila in the "Summer Sky" section.

One day Ganymede, a young prince, was off tending to his father's sheep in a grassy area on Mount Ida when he was spotted by Zeus. Ganymede was the most handsome young man in Troy and Zeus found him irresistibly beautiful and decided that he wanted him in his kingdom.

Zeus transformed himself into the shape of a giant eagle and swooped down from Mount Olympus to Mount Ida. He grabbed Ganymede in his talons and carried him back to Mount Olympus. Now, normally in these kinds of relationships the older man would serve as a sort of mentor to the younger one, but this was Zeus, and he pretty much got whatever he wanted. So Zeus decided that Ganymede

would become his personal cup-bearer, basically bringing him drinks whenever he pleases.

Since Ganymede was now essentially Zeus's slave, Zeus offered Ganymede's father a herd of the finest horses in the land as compensation for taking his son away. This apparently appeased the father, though it's doubtful that he had much of a say in the matter either way.

One day Ganymede decided he'd had enough, and he poured out all of the wine, ambrosia, and water of the gods, refusing to stay Zeus's cup bearer any longer. The water all fell to Earth, causing inundating rains for days upon days, which created a massive flood that flooded the entire world.

At first Zeus wanted to punish Ganymede, but in a rare moment of self-reflection, Zeus realized that he had been a bit unkind to the boy, so he made him immortal as the constellation Aquarius.

Aquarius: Greek Myth

In one Greek myth, there was a man and his wife known as Deucalion and Pyrrha. According to the myth, in 1500 B.C. Aquarius caused a great flood to wash over Earth. Deucalion and wife decided to build a great boat and stock it with provisions. They did and the two floated in the world-sea for nine days and nine nights.

Eventually they ran aground on a mountain. Safe but lonely, the two sole survivors of Earth walked about as the waters became lower and exposed more and more of the land. What were they to do? They appealed to an oracle (a wise man) and were told to "…throw over your shoulders the bones of your mother."

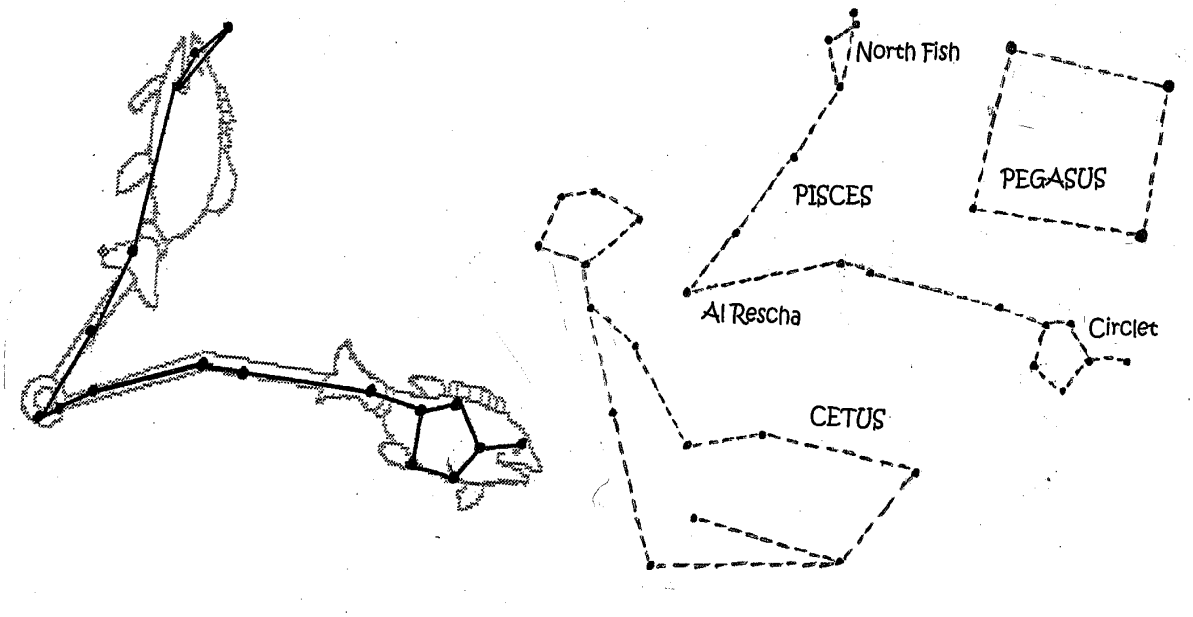
"But what does that mean?" Deucalion asked of his wife. Pyrrha didn't know either. At first she said that she refused to dig up the bones of her mother. But Deucalion guessed that the key to the message was different. "The bones of Mother Earth," said Deucalion, "must be stones." So as the two walked along they picked up stones and kept tossing them over their shoulders. After a while they looked behind them

and there were people. The stones that Deucalion had thrown had become men, and those thrown by Pyrrha had become women. Aquarius, therefore, became known as the taker of life and the giver of life.

How to find Pisces (best seen: October – January)

Pisces is not an easy constellation to find and it is spread out over a large section of the sky. It is found just beneath the Great Square of Pegasus. It might be helpful for you to imagine the constellation as two fish-lines joined by a knot, at each end of which hangs a fish.

The Northern fish is formed by a small triangle of stars found to the east of the northeast star in the Great Square (Alpheratz – the same star that Pegasus and Andromeda share). To find the Western fish, follow the fishline south and to the east toward Cetus. When you come to the greenish star called Al Rescha, which forms the knot joining the two fishlines, turn west to follow the other branch leading to the Western Fish. This fish forms what is called the Circlet, a pentagon of five stars lying right under the Great Square.



Pisces: Greek Myth

According to Greek myth, there was a monstrous god named Typhon, who was determined to overthrow Zeus and his entire group of gods. So terrifying and powerful was this evil god that the immortal followers of Zeus fled to Egypt for safety. Zeus alone remained behind to do battle and eventually conquer Typhon.

Years later, Aphrodite and her son Eros were walking along a riverbank when they sensed the presence of Typhon. Quickly they plunged into the river where they took the form of fishes and escaped. To this day we see them as the Northern Fish and the Western Fish of Pisces.

Pisces: A German Story

This story illustrates the wealth-giving power of fishes and points out a moral for greedy humans. It describes how Antenteh and his wife lived in a cabin by the sea. They were very poor and their only possessions were the old cabin and a tub. They had filled the tub with down and feathers from swans and geese so that they had a place to sit and rest.

One day Antenteh caught a fish, which pulled and tugged so much at the net that he decided to let the fish go back to the sea again. To the amazement of Antenteh, the fish started to speak to him. The fish told him that he was an enchanted prince and, in return for his release, Antenteh could ask for anything he desired. But Antenteh was a simple soul and felt so honored at having rescued a person of such nobility that he would not accept anything.

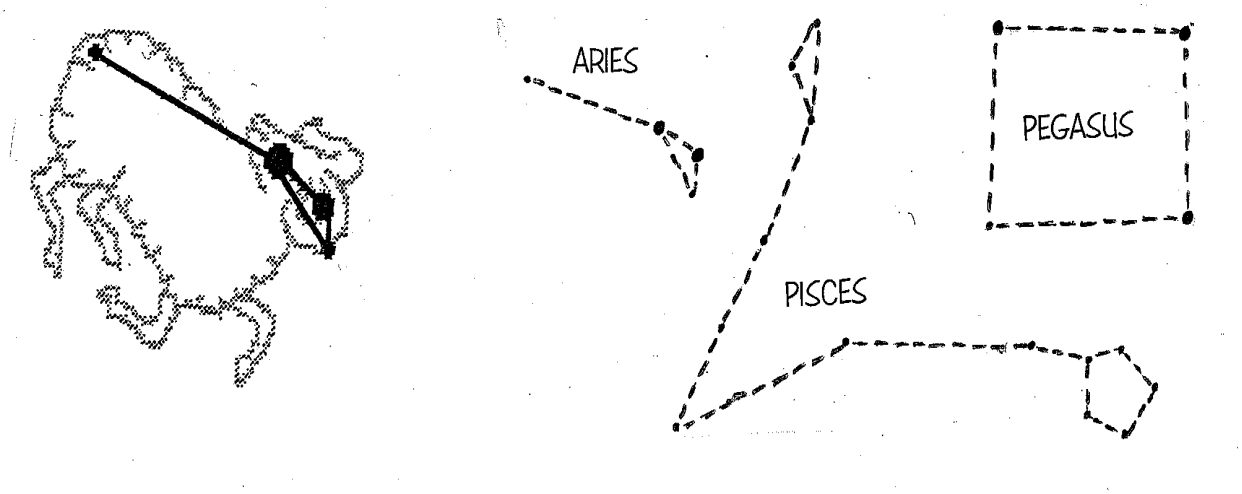
However, when his wife heard the story, she became extremely angry with him for letting such an opportunity pass. She nagged Antenteh until he went back to the shore, where he called for the fish, who instantly came swimming towards him. Rather embarrassed, Antenteh told the fish of his wife's wish for a house with furniture in it. The fish told him to leave everything to him and to return to his cabin. Antenteh did so where, instead of his cabin, he found a splendid house.

If Antenteh's wife had not been so greedy, all might have ended well, but after a while she wanted more. She wanted to be queen and have a palace. Her wish was granted. Still not satisfied, she demanded to become a goddess.

That was the end of it all. The fish was furious at the insatiable desires of this woman. With one flip of his mighty tail he made everything Antenteh had been given disappear, and in its place there stood again the tub with feathers in the little cabin by the sea. A warning for those who have plenty, not to dare the gods and be too greedy.

How to find Aries (best seen: October – November)

Aries, the Ram, is found just above the tail of Cetus, and to the left of Pegasus and the Northern Fish of Pisces.



Aries: Greek Myth

Athamas, King of Orchomenus, married Ino. She was a jealous woman and was extremely envious of Phrixus and his sister Helle, Athamas's two children by his first wife. So evil was she, that she plotted to poison them. Now the god Hermes was aware of the death plot against the boy and at the last minute sent down from heaven a beautiful and powerful ram with golden fleece.

The two children climbed onto the ram's back and were carried off through the air. Poor Helle was unable to hang on and fell to her death. Phrixus managed to hang on and was carried by Aries to a land near the Black Sea. Because the young man had been brought by the gods, Phrixus was welcomed by its King.

Now that the golden ram's work was done, the ram commanded Phrixus to sacrifice him to the gods and remove his golden fleece. Phrixus did and presented the

golden fleece to the King who was delighted with the gift. The King hung the fleece and asked a dragon that never slept to guard the golden fleece. We are told that so brilliantly did the golden fleece shine that by night it bathed the surrounding countryside in a warm golden light. The brave and generous ram was given an eternal place in the sky as the constellation Aries. It is said that this constellation is dim because at the time the ram was immortalized it no longer had its brightly shining fleece.

Section 7 – Other Information

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Pre-Astronomy Games

Before the star-gazing part of astronomy begins, we generally need to kill a little time waiting for the skies to get dark enough. So we take the first 30 minutes of Astronomy to play a game of some sort. The games are listed out by age appropriateness, so please pick one that works best for the school you are working with.

Just so you know, 5th grade and younger schools that have been coming to TOS for years expect Alien Abduction to be played. So if you don't play it, you may have some negative feedback from teachers. As a result, we **strongly** recommend that is the one you pick (hint, hint!)

Games:

1. Alien Abduction
2. Objectification
3. Constellation Stories

Alien Abduction

Age Appropriate = 5th grade and under.

Some 6th grade if the students are "younger".

This is a great game to introduce astronomy. You need an open, lighted area to play, such as the basketball court. Have the kids sit on the sideline to explain the rules.

In Alien Abduction there are a series of commands that you call out. The kids have to follow these commands correctly and within 5 seconds. This game should be played in 30 minutes or less, so you can introduce as many commands as you can/want in that time frame. Explain 2 or 3 commands and then play a round using those commands. Explain 2 or 3 more and then play another round. Introduce "Alien Abduction" during the last round; using that command ends the game.

Since this is an educational class, you should ask the kids questions and add in the educational information as you are explaining the commands (e.g. What planet is the largest in our solar system?)

There are lots of commands listed here, **too many to explain to the kids in one game**, so just pick your favorites. Also, every season instructors come up with new ideas and you're welcome to use those too.

<u>Remember!</u>

- Wog don't run!
- Do NOT body slam onto the ground during meteorite and alien abduction.
- Once you have got to the correct position, be quiet so you can hear the next command.

Begin the game by explaining the locations in space.

Locations in space:

1. **Sun**: We celebrate and yell when arriving at the sun.
    - It is a 4.5 billion year old star in the center of our solar system.

- The hot ball of glowing gases provides light and heat, allowing life to thrive on Earth.

2. **Jupiter**: We cover our noses and get grossed out from the gases.
    - Jupiter is the largest planet in our solar system, the 5th from the sun.
    - It is referred to as a gas giant, primarily made of hydrogen and liquid matter.
    - It has 63 known moons and the Great Red Spot, a massive storm.

3. **Pluto**: We get cold and freeze at Pluto.
    - Pluto used to be classified as a planet, but is now a dwarf planet.
    - It is the farthest body orbiting our sun.
    - It is made of frozen nitrogen, ice and rock.

Then give them 2 or 3 (ONLY) ways to move from one location to another.

Moves to change locations:

4. **Sputnik:** Have kids put up their solar panels (arms) and rotate from side to side making a "boop" noise. This is done slowly and is a nice way to calm students after an energetic action.
    - The name of the first launched human-made object to orbit the Earth.
    - Built by the Russians, the launch took place on October 4, 1957.
    - The Russian word *sputnik* literally means "co-traveler," "traveling companion," or "satellite."

5. **Taurus:** Put fingers on head as bull horns; stamp your foot and charge.
    - It is a constellation, or picture made of stars in the sky.
    - Taurus is Latin for "bull."
    - In Greek mythology, Taurus was a white bull who fell in love with a princess. He also is permanently fighting Orion.

6. **Scorpio:** Make a scorpion tail with one arm curved above your shoulder; point the other arm outward as your head. Make a stinging noise while shuffling side to side.
    - It is a constellation, or picture made of stars in the sky.
    - It is Latin for “scorpion.”
    - In Greek mythology, Orion the hunter boasted that he could kill all the animals, but the scorpion killed him. Zeus put Scorpio in the sky.

7. **Cancer:** Put up your crab pinchers, squat down and say “Cancer” as you shuffle to the next place.
    - It is a constellation, or picture made of stars in the sky.
    - The fourth astrological sign in the Zodiac.
    - According to an ancient Greek legend, the figure of a crab was placed in the nighttime sky by Hera to form the constellation Cancer in her pursuit to kill the most famous Greek hero, Heracles.

8. **Ursa Major (Big Dipper):** Students do the bear crawl by walking with their hands and feet on the ground, making growling bear noises as they go.
    - It is a constellation, or picture made of stars in the sky.
    - It is circumpolar, or always visible in the northern hemisphere.
    - In Greek mythology, Zeus puts Callisto and her son Arcas into the son as Ursa Major and Ursa Minor after a tragic accident.

9. **Draco:** Roar and fly like a dragon!
    - It is a constellation, or a picture made of stars in the sky.
    - Draco is Latin for “dragon.”
    - It is circumpolar, or always visible in the northern hemisphere.

10. **Canis Major**: Get on all fours, pant like a dog, bark and move to the next place.
    - It is a constellation, or a picture made of stars in the sky.
    - Canis major means “greater dog” in Latin.

- The big dog follows Orion the hunter, and includes Sirius, the brightest star in the sky.

Then introduce the moves that make up the bulk of the game. Remember to introduce Alien Abduction in the very last round and as the very last command to end the game.

The game moves:

11. **Meteor:** Stand up with hands above your head and yell "whoosh."
    - A meteoroid is a sand- to boulder-sized particle of debris in the Solar System.
    - The visible path of meteoroid that enters Earth's (or another body's) atmosphere is called a meteor, or colloquially a shooting star or falling star.

12. **Meteorite**: Squat down and yell "boom."
    - If a meteoroid reached the ground and survives impact, then it is called a meteorite.

13. **Saturn:** 1 person stands still as the planet while 3 people join hands to form the rings of Saturn and rotate around the planet.
    - Saturn is one of the gas giant planets.
    - It has three main rings (nine rings total) made of ice, rock, and dust.

14. **Man on the Moon:** Put your flag in the moon, hand on your heart, and hum the Star Spangled Banner.
    - Neil Armstrong was the first man to set foot on the moon.
    - It was the Apollo 11 mission in 1969.
    - He said, "That's one small step for man, one giant leap for mankind."
    - He placed an American flag on the moon's surface.

15. **Gemini:** Find a partner, link arms and wave to your other twin friends.
    - It is a constellation, or a picture made of stars in the sky.

- Gemini is Latin for “twins.”
- The twins are Castor and Pollux from Greek mythology.

16. **Spaceships:** Kids group up depending on the number you call out and sit in a line with legs stretched out in a “V”. Then you countdown to launch. T minus 10 seconds…Blastoff! In orbit. Look at the Earth. Turn right, turn left. Crash!
    - A machine designed for space flight.

17. **Leo:** In The Wizard of Oz, there is a lion that lacks courage. We will pretend to fight saying “Put ‘em up!” but back away and hide.
    - Leo is a constellation, or a picture made of stars in the sky.
    - It is Latin for “lion.”
    - Hercules fought Leo as one of his twelve labors, and was put in the sky.

18. **Black Hole:** Find a partner. Partner one spreads legs as partner two crawls through.
    - A region of space from which nothing, not even like, can escape.
    - It is called “black” because it absorbs all the light that hits it.
    - A black hole is similar to a vacuum cleaner, cleaning up debris left behind in outer space. It is not suction power that makes things fall into a black hole, it’s the power of gravity that is used to pull things towards it.

19. **Asteroid Belt:** Children link arms and rotate in a circle.
    - The region of the Solar System located roughly between the orbits of the planets Mars and Jupiter.
    - It is occupied by numerous irregularly shaped bodies called asteroids or minor planets.

20. **Lyra:** Rock out on your air guitar!

- Lyra is a constellation, or picture made of stars in the sky.
- It is Latin for “lyre” or a stringed musical instrument.
- It includes the star Vega, one of the brightest.

21. **Sagittarius:** Sing “I’m a little teapot.”
    - Sagittarius is a constellation, or a picture made of stars in the sky.
    - It is Latin for “archer.”
    - It is a centaur, or a half horse – half man, drawing a bow.
    - In the sky it is recognizable as a teapot.

22. **Orion*:*** Put your belt on, pull your sword from it and hunt your imaginary lion or scorpion.
    - Orion is a constellation, or a picture made of stars in the sky.
    - Orion is The Hunter in Greek mythology.
    - Orion has a “belt” made of a line of stars and a sword made of another line of stars.

23. **Star Burst:** The children must jump out, spreading their arms and legs to form a star shape.
    - In astronomy, starburst is a generic term to describe a region of space with an abnormally high rate of star formation.
    - A starburst galaxy is a galaxy in the process of an exceptionally high rate of star formation, compared to the usual star formation rate seen in most galaxies.
    - Galaxies are often observed to have a burst of star formation after a collision or close encounter between two galaxies.

24. **Hercules (or Heracles)**: Have the kids show you their muscle poses. Basically pose like a bodybuilder.
    - Hercules is a constellation, or a picture made of stars in the sky.

- Hercules is the Roman name for the Greek demigod Heracles. He's the son of Jupiter (the Roman equivalent of Zeus) and the mortal Alcmena.
- He's famous for his strength and being a hero-figure.

25. **Mush the Martian:** Put one hand on the ground and spin around it as if you are squishing a little creature from Mars.

26. **Big Bang:** Define Big Bang to children and tell them that after "Big Bang" is called out they must all walk backwards, spreading out so that they are far away from all other classmates. As they move backwards they slow down since they are "cooling." This is a precursor to Alien Abduction and is a great way to have the kids spread out so they are less likely to injure another kid while being abducted by the aliens. (However, be wary of doing this with religious schools as the term 'big bang' can be controversial).
    - The Big Bang was the event which led to the formation of the universe.
    - The universe was originally in an extremely hot and dense state that expanded rapidly. It has since cooled by expanding to the present diluted state and continues to expand today.

27. **Alien Abduction:** The name of the game! Put one hand up over your face as if it is an alien stuck to your face. Scream and lie on the ground to die.

Objectification

Age Appropriate = 6th grade and older.

For this activity you want the students to be in their teams. Each team will be given an object (conceptually, not an actual physical object) that they must create 3-Dimensionally as a team: A rocket ship, for example. Each of the objects will be space related since we're doing this as an astronomy activity. Give them about 15 minutes to figure out how to create their object. Then have each team perform their object and let the other teams try to guess what it is. Every team member must be used in some way. Fabulous activity for collaboration/cooperation and it can be tremendously fun.

Ideas for objects:

- Rocketship/spaceship/space shuttle
- A rocket launch
- International Space Station
- The Mars Rover
- Apollo 11 landing on the moon/Neil Armstrong walking on the moon
- The Solar System
- The asteroid belt (lies in between Mars and Jupiter)
- The moon being hit by an asteroid and forming a crater
- The Milky Way
- Any number of constellations
- A solar flare
- Anything else you can think of that involves space!

Constellation Stories

Age Appropriate = any age.

Every constellation has a story, and this story tells how it was created, the celestial beings associated with it, and ends with showing the constellation itself. You can involve the kids in this in two ways:

1. Have the kids come up with a constellation and its story. It can either be a real constellation (you'll have to show them the constellation – use your cards – and tell them the story) or they can make one up on their own. This should be presented in skit format, each team providing a constellation and skit. Be excited about the task you're giving them! This activity should fill most of the time, so ask them to be creative, APPROPRIATE!!, and detailed. You will need an instructor with each group to help with the skit making process, especially with younger or more immature groups. Remember the more creative the better… you'll be surprised at what they can come up with! Remember safety issues (don't pick people up, etc.). Finish by having each group perform their skit and show off their constellation.

2. The second option is to tell a group story. This is accomplished by sitting in a circle and then the group tells a story. The first person tells one sentence of the story and then the next person can build on that or be completely random with their sentence. Again you should stress that this story should be APPROPRIATE! Be excited and use your instructor-ness (if you have to) to bring things back down to Earth, or steer it in the right direction. This works best by team with an instructor with each team, rather than with the entire school in a circle. Have fun with it!

Cloudy Nights

There are times when it just isn't clear the entire time a school is here. And they may decide that they want to do an astronomy alternative. Our most popular option is called Team of the Universe and has its own section. But there are a few other options that are listed here.

Options:

1. Team of the Universe!
2. Solar System in Steps
3. Solar System on a String
4. Solar System in Fruit
5. If Earth Were a Golfball…

Team of the Universe

If it is cloudy on the night we do astronomy, we often play "Team of the Universe." This is a quiz based around facts on the Moon, stars and planets.. You will take a team somewhere quiet for 20-30 minutes and prep them on the Team of the Universe information (we'll give you the information sheets that night). It is important to make this part as fun for the kids as possible – watch for the ones that are falling asleep and do your best to liven it up for them! Avoid telling the information outright, and instead try and initiate a discussion that will lead to them guessing or telling you the answers.

After the allotted time we will collect together and have the kids sit with their teams. The instructors, however, will be switched to another team to avoid cheating!

A quizmaster will be assigned. They will call out a question, which may have more than one part, and the kids will confer in their teams to come up with an answer. They will then tell their new instructor the answer they (hopefully!) agree on. After a minute or two, the quizmaster will ask each instructor what answer the team came up with. Once everyone has given a response the quizmaster will call out the correct answer. This continues for approximately 30-45 minutes. The scores are then added up - the winning team usually get evening snack first!

Here is the information:

The Moon

- Astronauts landed on a plain called the Sea of Tranquility.
- Gravity is 1/6 of that on Earth (so a 120lb person on Earth would be 20lbs on the Moon).
- The 1st person on the Moon was Neil Armstrong in 1969. The mission was called Apollo 11.
- The craters on the Moon are formed by meteorites (some peak at 8 miles).
- The Earth is 5x as big as the moon (if Earth was a soccerball, the Moon would be an orange).

- We always see the same side of the moon (the moon is rotating at the same rate as it takes to orbit the Earth - this is called synchronous rotation).
- The Moon is moving away from the Earth at a rate of 1 inch/year.
- A "Blue Moon" occurs every 2.7 years. It is when there are 2 Full Moons in one month.
- Superstitious stuff - sleeping in moonlight causes insanity = lunatic.

Jupiter

- Jupiter is the largest planet in our solar system (bigger than all others combined - can fit all other planets in our Solar System TWICE over). If you had a ball the size of a dime representing the Earth, Jupiter would be the size of a basketball.
- It has a gaseous surface that is poisonous to humans (atmosphere is mostly hydrogen and helium) - it is so gaseous that no spacecraft can land on it.
- On the top layer of Jupiter's atmosphere is a swirling pattern of clouds (makes bands of different colors - looks different each night) bright bands formed by higher clouds, dark bands by lower clouds.
- Jupiter produces more heat than it receives from the Sun.
- Jupiter has at least 63 moons (4 are visible from Earth through our telescope) — through studying these Galileo came up with his Theory of Revolution (that the Earth revolves around the Sun).
- The Great Red Spot is a swirling high-pressure storm that is 3 Earths wide. It has been raging for at least 300 years! Cassini discovered it.
- A day on Jupiter is only 9 hours and 55 minutes, but its year is 11.9 Earth years.
- Earth would fit inside Jupiter over 1318 times.
- Jupiter is a dangerous place - it acts like a powerful magnet and traps radiation from the Sun that forms belts around the planet - this radiation is 100,000 times stronger than the amount needed to kill a human.

Saturn

- Saturn is made up mostly of gas and some liquid (so gaseous that no spacecraft can land on them). Its atmosphere is mostly hydrogen and helium.
- Saturn has 3 main rings, containing thousands of separate ringlets. The rings are more than 170,000 miles wide, but are only 60-100 feet thick. They consist of millions of bits of dust and chunks of ice (range from tiny particles to lumps 7 miles across) orbiting the planet.
- The space between A ring and B ring is called the Cassini division (discovered by the astronomer, Cassini). It is a space as large as the Atlantic Ocean.
- The high reflectives of these ice particles (rings) explain Saturn's luminosity in the night sky.
- The measurement across the main rings equals the distance from the Moon to the Earth.
- Saturn is so light that it would float on water!
- Saturn has at least 62 moons. One of Saturn's moons (Titan) is the only moon in the Solar System with an atmosphere and clouds. The atmosphere is freezing and is made up of nitrogen and methane (humans can not breathe this stuff).

Venus

- Venus is the 2nd planet from the Sun.
- Venus is the hottest planet in the solar system (almost 900 degrees F… more than hot enough to melt lead) – it is hotter than Mercury because it has a thick layer of clouds – they trap in the heat (like a car on a hot day—Greenhouse Effect).
- Venus is the same size as the Earth so it is often called our sister planet.
- Because of heat and pressure, no probe has survived more than an hour - its atmosphere is sooooo heavy it would crush you.
- Venus has mountains higher than Earth's and valleys longer and deeper than the Grand Canyon.

- Lightning flashes on Venus 25 times every second.
- Venus is often mistaken for a star (it is the brightest object in the night sky after the Moon).

Mars

- Mars' axis is tilted - thus it has seasons (warm summers 68 F, long cold winters –284 F).
- There are continuous winds of 125 mph on Mars.
- Due to the high iron content in its surface dirt and rock, Mars appears to be a red color in the night sky.
- Mars has the largest mountain in the Solar System (Olympus Mons is the tallest mountain on Mars - 15 to 17 miles high - base is 370 miles across [could cover the state of Arizona]).

Asteroids, Meteors and Comets

- Most asteroids are positioned between Mars and Jupiter (the Asteroid Belt) - this defines inner and outer planets.
- The largest one is Ceres – 623 miles wide and orbits 260 million miles from the Sun.
- Many asteroids resemble peanuts - like two chunks of rock glued together.
- Meteroids are small pieces of dust and rock (range from dust to 10meters).
- The scientific name for a shooting star is a meteor (they burn up with a flash as they rush through the Earth's atmosphere).
- Meteors become meteorites when it hits the ground (can leave craters—like on the Moon).
- The most famous meteorite crater on Earth is in Arizona - it is one mile wide.
- Some scientists think a large meteorite caused the dinosaur extinction.
- Comets are usually found in the outer Solar System - past all planets.
- They are "dirty snowballs" lumps of frozen gas and rock.
- As a comet nears the Sun, it warms up – the ice evaporates and forms a cloud - the solar energy and solar wind pushes cloud away from the sun = glowing tail.

- Halley's Comet - we see it once every 76 years (last seen in 1986 - will be seen again in 2062).

The Sun and Stars

- The Sun is the nearest star to Earth - it is only a middle-sized star, but it looks soooo big because it is only 93 million miles away.
- The Sun was formed from a nebula 5 billion years ago - it will burn another 5 billion years.
- It takes more than a million years for energy from the Sun's core to reach the surface - but from there it takes only 8 minutes to get to Earth!
- Although the Sun appears yellow when seen from Earth, it is actually white. We see sunlight after it has been filtered through the Earth's atmosphere. Air scatters the blue component, making the sky appear blue and the sunlight yellow.
- Stars look small because they're far away - they are actually HUGE.
- Stars are glowing ball of gases that are held together by gravity.
- Chemical reactions cause heat to be released - this makes stars shine.
- Stars are different colors depending on their surface temperature.
- Stars are born in clusters called Nebula (cloud of gas and dust).
- The North Star (real name: Polaris) is NOT the brightest star in the sky. Sailors use it to find north.
- When you are looking at the sky at night, you are also looking back in time. The light from stars takes so long to reach Earth that what you see is how the stars looked when their light began its journey to Earth centuries ago.

Random

- Distances in space are too vast to be measured in miles, so scientists measure in light-years. A light-year is 5.88 trillion miles – the distance traveled by light in one year.
- A nebula is a cluster of gas and dust where new stars are born.
- Orion's nebula is 35 trillion miles across and is 1500 light years away

- Betelguese (the star which marks Orion's right shoulder) is 20 times bigger than our Sun.
- The brightest star in the night sky is Cirius.
- Pluto was found in 1930 – its so far away that if you went non-stop in a car at 55 mph, it would take 9500 years to get there!
- Pluto lost its status as a planet in 2006 and was reclassified as a Dwarf Planet.
- Neptune has 1500 mph winds (fastest winds in the Solar System).
- Mercury is the fastest planet around the sun - it moves at 30 miles per second.
- The closest galaxy to us is Andromeda.
- We are in the Milky Way galaxy.
- A constellation is a group of stars that forms a picture.
- Galileo almost discovered Neptune. He saw it while observing Jupiter's moons - but a month later it moved and he never followed up on it.
- Gravity is what holds us to the earth. Astronauts become a little taller in space. There is less gravity, so their bones are less squashed together.
- Methane is what makes Uranus look green from Earth.
- An observatory is a location used for observing terrestrial or celestial events. The biggest one in Texas is the McDonald Observatory located near Fort Davis in west Texas.
- The Hubble Space Telescope is a telescope carried into space in 1990. Its orbit outside the distortion of Earth's atmosphere allows it to take extremely high-resolution images with almost no background light.
- The first satellite was Sputnik I, launched by the Soviet Union in 1957. Its launch started the "Space Race" between the Soviets and the United States, each trying to out-do each other in both travel and research.

Team of the Universe – Questions and Answers

What part of the Moon did the astronauts land on?
The Sea of Tranquility (10)

How many pounds would a 240 pound person on Earth weigh on the Moon?
40 pounds (10)

Who was the 1st person on Moon? What year? What was the mission called?
Neil Armstrong (5) 1969 (5) Apollo 11 (5)

If the Earth was a soccerball, what fruit would the Moon be?
An orange (5)

How many moons does Jupiter have? How many can we see? Who discovered them? What did he conclude based on their rotation?
63 (5) Only 4 are visible from Earth (10) Galileo (10) That the Earth revolves around the Sun (10)

What are Saturn's rings made out of? What is the space between the A ring and the B ring called? It is the same size as what object on Earth?
Dust and ice (10) Cassini division (15) The Atlantic Ocean (10)

True or false—Saturn is so light it can float on water.
True (5)

Pluto's distance from the Sun means that a car driven nonstop at 55 mph would take how many years to get there?
9500 years (10)

What is the name of Saturn's moon that has an atmosphere?
Titan (15)

Distances in space are too vast to be measured in miles, so scientists use what unit of measure?

Light years (10)

Air scatters the blue component of light—it makes the sky blue and the sun yellow…what is the REAL color of the sun?
White (10)

Venus has a thick layer of clouds that trap in the heat (like a car on a hot day). What is this effect called?
The Greenhouse Effect (15)

The most famous meteorite crater on Earth is in what U.S. state? How big is it?
Arizona (10) One mile wide (5)

On what planet does lightening flash 25 times every second?
Venus (5)

Between which planets is the asteroid belt?
Mars and Jupiter (10)

What causes the craters on the Moon?
Meteorites (10) If meteors, then 5

What is the scientific name for a shooting star?
Meteor (5)

If Neptune had been named after the astronomer who discovered it, what would it be called?
Galileo (10)

What substance makes Uranus look green from Earth?
Methane (10)

What is a comet made out of? What makes the tail of a comet glow?
Ice/dirty snowballs (5) The ice evaporates as the comet nears the sun (15)

How often can we see Halley's comet? When was the last time? What will be the next time?
Once every 76 years (5) 1986 (5) Again in 2062 (5)

If you had a ball the size of a dime representing Earth, Jupiter would look be the size of what?
A basketball (5)

What is the nearest star to Earth?
The Sun (10)

Why are stars different colors?
Because they are different temperatures (10)

What is a nebula?
A cluster of gas and dust where new stars are born (10)

How far away is the Sun from the Earth?
93 million miles (5)

Which planet is most often mistaken for a star?
Venus (5)

How big is the Orion nebula and/or how far away is it?
35 trillion miles across (10) 1500 light years away (10)

At what rate is the moon moving away from the Earth?
One inch per year (10)

What year did Pluto lose its status as a Planet?
2006 (10)

What is a meteor called when it hits the ground?
A meteorite (5)

What galaxy are we in? What is our closest neighbor galaxy?
Milky Way (5) Andromeda (10)

How long is a day on Jupiter? A year?
Day is around 10 hours (5) A year is around 12 Earth years (5)

What is a constellation?
Stars grouped together that form a picture (5)

What is the real name for the North star?
Polaris (5)

What IS Jupiter's Great Red Spot?
A swirling high pressure storm (10)

What is the fastest planet around the Sun? How fast does it go?
Mercury (5) 30 miles per second (10)

Can a spacecraft land on Saturn? Yes or No.
No (5)

What is the tallest mountain/volcano on Mars? How tall is it?
Olympus Mon (10) 15 to 17 miles high (10)

Why is Mars red?
Because of the vast amounts of iron that is rusted on its surface (15)

What is it called when there are two full moons in one month?
A Blue Moon (5)

Which planet has the fastest winds in the Solar System?
Neptune (5)

The astronomer Cassini discovered what two things in outer space?
The Cassini division (space betweenn A ring and B ring of Saturn) (15) Jupiter's Big Red Spot (5)

How long does it take for energy from the sun to reach Earth?
8 minutes (10)

How do we know Mars has seasons?
Its axis is tilted (10)

The Moon rotates at the same time as it takes to orbit Earth—what is that called?
Synchronous rotation (15)

What is the name of the force holding us to Earth?
Gravity (5)

What is the name of a place that uses telescopes to research space and astronomy? Where is the biggest one in Texas?
An Observatory (5) McDonald Observatory in west Texas (near Fort Davis) (5)

What is the name of NASA's most famous space telescope?
Hubble (5)

What was the name of the first satellite? Who launched it? What year?
Sputnik I (5) Soviet Union (not Russia!) (5) 1957 (5)

Solar System in Steps

You can do this as a whole school (it may be difficult to keep their attention if it's a huge school) or by teams (it may be difficult to find enough room for lots of teams). Take them to a large area, preferably lit, and make sure you have bright flashlights for a few to use. Pick a student to represent the sun and 8 more to represent the planets (10 if you include the Asteroid Belt and Pluto). You'll start with the Sun and tell a few facts about it (make it interactive!!) and then place the planets the appropriate distance away from the Sun. The farther away you get,

you may need to give those “planets” a flashlight so that everyone can see them on a dark night.

1. **Sun:** stands at the edge of the area

   - It takes more than a million years for energy from the Sun’s core to reach the surface, but from there it takes just eight minutes for it to get to Earth.
   - Although the Sun appears yellow when seen from Earth, it is actually white. We see sunlight after it has been filtered through the Earth’s atmosphere. Air scatters the blue component, making the sky appear blue and the sunlight yellow.
   - The Sun (in fact, every star) would explode if gravity did not hold it together.

   Place the student representing the Sun at the far edge of the demonstration field.

2. **Mercury** = 1 meter from the sun (3.28 feet or approximately 1 step)
   Ask: “What’s the first planet from the sun? Yes, Mercury! Did you know…”

   - Mercury is the smallest planet in the Solar System, not much larger than our moon.
   - Mercury is the fastest planet to orbit the Sun – it moves at 30 miles per second and takes just 88 Earth days. However, a day on Mercury is 59 Earth days.
   - It is visible with the naked eye from Earth for only a few days each year.
   - Mercury and the Sun are 36 million miles apart.

   “How far do you think that is from <u>our</u> sun (the student)? It’s actually one meter (3.28 feet).”
   Have the student representing Mercury take one large step from the Sun.

3. **Venus** = 2 meters from the sun (6.56 feet or approximately 2 steps)

Ask: “What’s the next planet? Yes, Venus! Did you know…”

- Venus is the second planet from the Sun and is the hottest planet in our Solar System.
- This planet is the second brightest object in the sky, outshone only by the Moon.
- It is hotter than Mercury as it has a thick layer of clouds around it which trap heat (like a car on a hot day; this is known as The Greenhouse Effect).
- Venus is almost the same size as Earth (7200 miles across), and is sometimes called our Sister Planet.
- It takes 224 Earth days to orbit the Sun. However, as Venus takes 243 Earth days to spin once, a day on Venus is longer than its year!
- Even more strange is the fact that Venus rotates from East to West, which is the opposite of Earth and most of the other planets.
- It would be an unpleasant place to visit because there are constant thunderstorms, where winds blow hundreds of miles an hour and drops of sulfuric acid fall from the clouds.
- Venus is about 65 million miles from the Sun.

“How far do you think that is from <u>our</u> sun (the student)? It’s actually 2 meters (6.56 feet).”
Have the student representing Venus take 2 large steps from the Sun, or 1 from Mercury.

4. **Earth** = 2 ½ meters from the sun (8.2 feet or approximately 2.5 steps)
   Ask: “What’s the next planet? Yes, Earth! Did you know…”

   - Earth is the largest of the four inner planets.
   - It circles the Sun once every 365 days (a year) and one day on Earth is 24 hours.
   - The atmosphere is roughly 78 percent nitrogen, 21 percent oxygen, with trace amounts of water, argon, carbon dioxide and other gases. Nowhere

else in the solar system can one find an atmosphere loaded with free oxygen, which ultimately proved vital to one of the other unique features of Earth — us.
- It is 93 million miles from the Sun.

"How far do you think that is from our sun (the student)? It's actually 2 ½ meters (8.2 feet)."
Have the student representing Earth take 2 ½ large steps from the Sun or ½ step from Venus.

5. **Mars** = 4 meters from the sun (13.12 feet or approximately 4 steps from sun)
Ask: "What's the next planet? Yes, Mars! Did you know…"

- With a diameter of 4070 miles Mars is about half the size of the Earth.
- A day on Mars is about the same as Earth's (24.6 hours long), but its year is much longer at 687 Earth days.
- Due to the high iron content in its surface dirt and rock, Mars appears to be a red color in the night sky
- The red planet is home to both the highest mountain and the deepest, longest valley in the solar system. Olympus Mons is roughly 17 miles high, about three times as tall as Mount Everest, while the Valles Marineris system of valleys can go as deep as 6 miles and runs east-west for roughly 2500 miles, about one-fifth of the distance around Mars and close to the width of Australia or the distance from Philadelphia to San Diego.
- The dust storms of Mars are the largest in the solar system, capable of blanketing the entire red planet and lasting for months.
- Mars is about 140 million miles from the Sun.

"How far do you think that is from our sun (the student)? It's actually 4 meters (13.12 feet)."
Have the student representing Mars take 4 large steps from the Sun or 1 ½ steps from Earth.

6. **Asteroid belt** = 8 meters from the sun (26.24 feet or approximately 8 steps from sun)

   Ask: "What's comes after Mars but before Jupiter? Yes, the Asteroid Belt! Did you know…"

   - The Asteroid Belt contains billions — maybe even trillions — of asteroids
   - The Main Belt once contained enough material to form a planet nearly four times as large as Earth. Jupiter's gravity not only stopped the creation of such a planet, it also swept most of the material clear, leaving far too little behind for a planet of any size to form. Indeed, if the entire mass of the Main Belt could somehow create a single body, it would weigh in at less than half of the mass of the moon.
   - Most asteroids aren't quite massive enough to have achieved a spherical shape and instead are irregular, often resembling a lumpy potato.

   "How far do you think that is from <u>our</u> sun (the student)? It's actually 8 meters (26.24 feet)."

   Have the student representing the Asteroid Belt take 8 large steps from the Sun or 4 steps from Mars.

7. **Jupiter** = 13 meters from the sun (42.64 feet or approximately 13 steps from sun)

   Ask: "What's the next planet? Yes, Jupiter! Did you know…"

   - Jupiter, is the most massive planet in our solar system, and so huge that all the other planets in the Solar System could fit inside it twice! Had it been about 80 times more massive, it would have actually become a star instead of a planet.
   - Jupiter measures 85,000 miles in diameter, big enough to fit Earth into it 1300 times.

- A day on Jupiter is only 9 hours 50 minutes long, the fastest spinning planet in our solar system, but it's year (the time it takes to orbit the sun) is 11.9 Earth years (often the kids we get are about 11 years old, so you can tell them that if they lived on Jupiter, they would only be 1 year old right now!).
- Jupiter's Great Red Spot is a swirling tornado that has been raging for at least 300 years. It is about 25,000 miles long and 7,000 miles wide – that's more than three times the diameter of Earth!
- Jupiter is 483 million miles from the Sun.

"How far do you think that is from our sun (the student)? It's actually 13 meters (42.64 feet)."
Have the student representing Jupiter take 13 large steps from the Sun or 5 steps from the Asteroid Belt.

8. **Saturn** = 24 meters from the sun (78.72 feet or approximately 24 steps from sun)
   Ask: "What's the next planet? Yes, Saturn! Did you know…"

   - Saturn's most famous characteristic is its brightly shining rings. The beautiful rings are bands of ice and rock – they are not solid, but consist of billions of snowballs ranging in size from the snowball you would throw in winter, to ones that are bigger than a house!
   - The diameter of the planet is about 75,000 miles, almost ten times bigger than Earth. Including the rings this brings its size to 169,000 miles across!
   - A day on Saturn is 10 hours, 14 minutes long. Saturn takes 29.5 Earth years to orbit the Sun once.
   - Saturn has the lowest density of all the planets, and is the only one less dense than water – if there were a bathtub big enough to hold it, Saturn would float!
   - Saturn is about 887 million miles from the Sun.

"How far do you think that is from <u>our</u> sun (the student)? It's actually 24 meters (78.72 feet)."
Have the student representing Saturn take 24 large steps from the Sun or 11 steps from Jupiter.

9. **Uranus** = 49 meters from the sun (160.72 feet or approximately 49 steps from sun)
   Ask: "What's the next planet? Yes, Uranus! Did you know…"

   - Uranus was discovered in 1781.
   - It takes 84 years to circle the Sun, which is 1,780 million miles away. A day on Uranus is about 17 hours long.
   - Uranus is 32,300 miles in diameter and is made up mostly of hydrogen and helium, and a little methane. It is the methane that makes the planet look green from Earth, although it is very hard to see, even with binoculars or a telescope, as it is so far away.
   - Uranus has 13 rings around it, and at least 15 moons.
   - Uranus is about 1,800 miles from the Sun

   "How far do you think that is from <u>our</u> sun (the student)? It's actually 49 meters (160.72 feet)."
   Have the student representing Uranus take 49 large steps from the Sun or 25 steps from Saturn.

10. **Neptune** = 76 meters from the sun (249.28 feet or approximately 76 steps from sun)
    Ask: "What's the next planet? Yes, Neptune! Did you know…"

    - Neptune was discovered in 1846.
    - Neptune's day is about 16 hours long, and its year 165 Earth years.
    - Neptune is 30,000 miles in diameter and appears to be a blue-green color.
    - Neptune also has rings, as do all the "gas" planets.
    - It is 2,800 million miles from the Sun.

"How far do you think that is from our sun (the student)? It's actually 76 meters (249.28 feet)."

Have the student representing Neptune take 76 large steps from the Sun or 27 steps from Uranus.

11. Pluto = 100 meters from the sun (328 feet or approximately 100 steps from sun)

Ask: "What comes after Neptune that was recently reclassified as a Dwarf Planet? Yes, Pluto!

Did you know…"

- Pluto lost its status as a planet in August, 2006. About 2,500 scientists met in Prague and agreed that for a celestial body to qualify as a planet it must be in orbit around the sun, be large enough that it takes on a nearly round shape, and has cleared its orbit of other objects. Pluto was automatically disqualified because its highly elliptical orbit overlaps with that of Neptune. It is now classified as a dwarf planet.
- Pluto's surface is one of the coldest places in the solar system at roughly minus 375 degrees F (minus 225 degrees C).
- Pluto is 3,670 miles from the Sun

"How far do you think that is from our sun (the student)? It's actually 100 meters (328 feet)."

Have the student representing Pluto take 100 large steps from the Sun or 24 steps from Neptune.

Source: http://education.nationalgeographic.com/education/activity/planetary-size-and-distance-comparison/?ar_a=1

Solar System on a String

If you do not have enough space to do the activity above, you can modify it to have students create a string-and-bead solar system model in the classroom by converting astronomical units to a 10 centimeter/AU (4 inch) scale. Students will need a string 4 to 4.5 meters long. Have students tie beads in place to represent planetary distances.

What you will need:
1 string for each student (or each team if you want them to work as a team)
10 beads per string (does not matter what color, unless you have a preference)
Metric tape measures for kids to share.

Show them the model we have of the rope & knots. It is the same as the measurements below, only in inches instead of centimeters.

Show them the model we have of the string & beads. Then tell them they will get to make their own. The measurements are:

Sun	0.0 AU=	0 cm	
Mercury	0.4 AU=	4 cm from the sun	
Venus	0.7 AU=	7 cm from the sun	or 3 cm from Mercury
Earth	1.0 AU=	10 cm from the sun	or 3 cm from Venus
Mars	1.5 AU=	15 cm from the sun	or 5 cm from Earth
Asteroid Belt	2.8 AU=	28 cm from the sun	or 13 cm from Mars
Jupiter	5.2 AU=	52 cm from the sun	or 24 cm from the Asteroid Belt
Saturn	9.6 AU=	96 cm from the sun	or 44 cm from Jupiter
Uranus	19.2 AU=	192 cm from the sun	or 96 cm from Saturn
Neptune	30.0 AU=	300 cm from the sun	or 108 cm from Uranus

Source: http://education.nationalgeographic.com/education/activity/planetary-size-and-distance-comparison/?ar_a=1

Solar System in Fruit

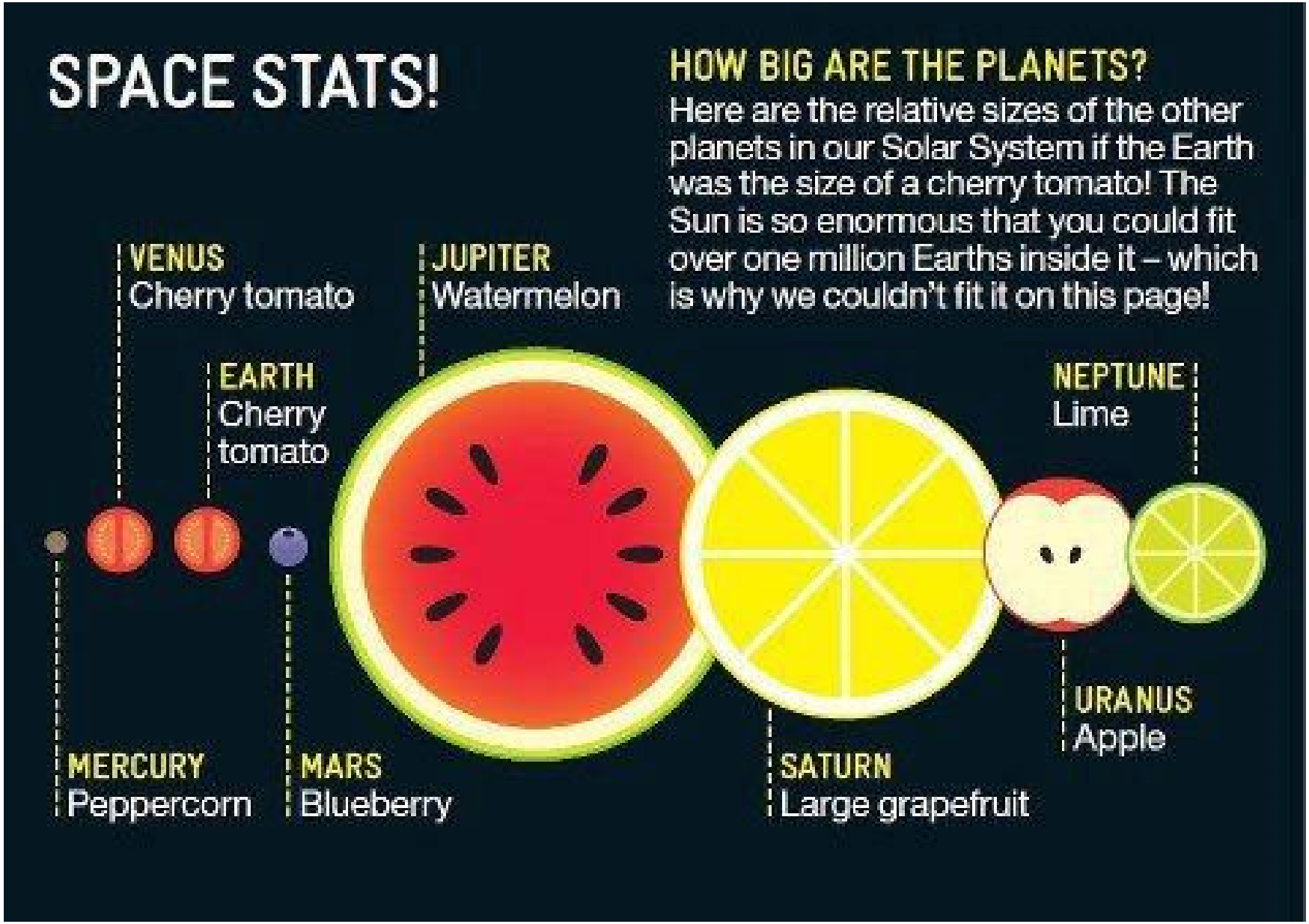
A quick illustration of the relative size of the planets can also be given. We don't actually have the fruit here, so kids will need to use their imaginations, or you can hold up the picture on the following page. It's just a nice way to see and understand how small some planets are compared with others.

Here are the items matched to their respective planets (from closest to farthest from the Sun):

- Mercury = Peppercorn (or a pea)
- Venus & Earth = Cherry tomatoes
- Mars = Blueberry
- Jupiter = Watermelon
- Saturn = Large grapefruit
- Uranus = Apple
- Neptune = Orange

So how big would the Sun be? If we had 3 large umbrellas opened and put together side by side, they would represent only ¼ of the Sun!

Source:
http://www.nationalstemcentre.org.uk/dl/83bf2fc5e452375d0d0579d5c190144f85e406a4/22770-KS2%20Fruit%20Solar%20System.pdf


SPACE STATS!
HOW BIG ARE THE PLANETS?
Here are the relative sizes of the other planets in our Solar System if the Earth was the size of a cherry tomato! The Sun is so enormous that you could fit over one million Earths inside it – which is why we couldn't fit it on this page!
VENUS
Cherry tomato
JUPITER
Watermelon
EARTH
Cherry tomato
NEPTUNE
Lime
URANUS
Apple
MERCURY
Peppercorn
MARS
Blueberry
SATURN
Large grapefruit

If Earth Were a Golfball…

This information was taken from a talk by a speaker, Louie Giglio, who gives a perspective about the size of space that is pretty incredible. It's written very much like he spoke it with only changes made to make it flow. (Some of the information that had nothing to do with space was deleted so it may seem a bit disjointed. AND it was a talk with pictures on a screen and that doesn't translate well to only the written word). It's a great perspective, though. Tailor it to your own language style, but it's stunning to think about the size of some of these stars!

"The Whirlpool Galaxy is called the Darling of Astronomy because it's sitting completely perpendicular to us on Earth. The Whirlpool Galaxy is 31 million light years away from where you're sitting right now. Light travels through the Universe at 186,000 miles a second. So a light year, therefore, is how far light travels in a year (5.88 trillion miles). We're using a ruler that is 5.88 trillion miles long, and if you'd like to go to the Whirlpool Galaxy be my guest. All you have to do is multiply 31 million by 5.88 trillion miles and that's the distance you'll have to cover. Or you can look at it a different way: you just have to travel 186, 000 miles a second for 31 million years and voila, you will arrive at the Whirlpool Galaxy. The second thing that's pretty stunning is that it contains 300 billion stars in that 1 galaxy. And it is one of hundreds of billions of other galaxies in the known Universe.

"We're going to talk about 4 stars. The first one is easy because there is just one star in our solar system and that is the Sun. 10,000 degrees F on the surface. It's 93 million miles away so when you look up in the sky, it's a pretty good pace out there. By the way, light traveling 186,000 miles a second, it's only taking 8 minutes to cover that 93 million mile journey to touch your skin. But what I want you to grasp is the size of it. It's like a million times the size of the earth. So here's a little perspective that sort of changed my life. If the earth were the size of a golf ball, the sun would be 15 feet in diameter. Look at a golf ball and find yourself. Imagine the size of the sun at 15 feet… now put your golf ball up to it. It's so big you could put 960,000 earths inside the sun. So if the earth were a golf ball and the sun were 15 feet in diameter you could put 960,000 golf balls inside that 15 foot diameter sun. That's enough golf balls, by the way, to fill a school bus with golf balls to fit inside that 15 foot diameter sun. It's a massive star and it's one of hundreds of billions of stars in the milky way galaxy, our cul-du-sac in the neighborhood called the cosmos. It's huge.

"The second star is called Betelgeuse. It's incredible. It's 427 light years away. So that's 427 x 5.88 trillion miles away from us right now. Betelgeuse is twice the size – are you ready for this? You think I'm going to say twice the size of the sun? Oh no… it's twice the size of the earth's orbit around the sun. It's crazy! If the earth were a golf ball, Betelgeuse would be the height of 6 empire state buildings on top of each other. Now, come on, have you seen the empire state building?! Maybe what you're going to have to do is gather the family, get a golf ball, get some plane tickets and fly up to New York. And you're going to go

into midtown, you're going to take your golf ball and put in on the sidewalk outside the Empire State Building (don't worry about people thinking you're crazy, they're not even going to notice you in New York), you're going to go across the street, you're going to look up at the Empire State Building and you're going to imagine 5 more Empire State Buildings on top of the Empire State Building. That's Betelgeuse, and your golf ball is the earth and somewhere you're on it! You could fit 262 trillion earths inside Betelgeuse. So if the earth were a golf ball, that would be enough golf balls to fill up the Superdome with golf balls. Three thousand times. When I heard that as a teenager that stumped me right there.

"The third star is called Mu Cephi. It's 3000 light years away. You know that at times when you look up at night, it's not just "Twinkle, twinkle little star how I wonder what you are?". I'm telling you what you are… what you are is intense, and massive, and huge, and ferocious. If the earth were a golf ball, Mu Cephi would be the width of 2 golden gate bridges end to end. Apparently you're going to need to go from New York to the west coast. Go to San Francisco with your family and your golf ball, place your golf ball at the beginning of the Golden Gate Bridge, go across the Bay into Oakland to a high place where you can see the entire Golden Gate Bridge, another second Golden Gate Bridge will be in your imagination, span all the way back the 2 Golden Gate Bridges to the very beginning and find your golf ball over there. That's the earth and somewhere you're on it! That's one of the stars in the Milky Way galaxy. It's so big you could fit 2.7 quadrillion earths inside this one star.

"Now quadrillion we have not talked about and I need to explain this just briefly. You need to understand a quadrillion. Because this star is crazy big. Let's do it this way… everyone knows a million, right? You can kind of get your head around a million. You know that a billion is a thousand million, and trillion is a thousand billion, and a quadrillion is a thousand trillion, right? Here's a perspective that changed my life. A million seconds ago? That's 12 days ago. Isn't that cool? But a billion seconds ago? How about 1975. A trillion seconds ago? 29,700BC. A quadrillion seconds ago? 30,800,000 years ago is a quadrillion seconds ago. We're talking about a really large number, and Mu Cephi is so big you could put 2.7 quadrillion earths inside this one star. But it's not even the biggest star we have found.

"I love science. And science has just brought us the largest star they have found. It's called Canus Majorus. I think that means the Big Dog star, and that's exactly what it is. If the earth were a golf ball, Canus Majorus would be the height of Mt. Everest. You may need to invest in plane fare from California to Khatmandu, Nepal. Almost 6 miles above sea level, the highest point on the planet… I just dare you to get up there and unzip the parka and pull out your golf ball. You could fit 7 quadrillion earths inside Canus Majorus. That's enough earths, if the earth were a golf ball, to cover the entire state of Texas with golf balls, 22 inches deep. Do you see the one you're on?"

From this point in his talk, he launched into another area, which is why it ends a little abruptly. If you'd like to hear his full talk, you can YouTube him. The name of the talk is "How Great is Our God." Obviously from the title, he's a Christian

speaker, so be prepared if his opinion (not the scientific facts) is one you do not share.

Nicole's Fun Filled Fall Astronomy Lesson (Fall Sky)

I. In the Beginning…

I love astronomy, and I especially love the fall sky. There is a TON to look at. When leaving the Pavilion it is important to set expectations about the evening. I usually start with introducing my 'Astronomy voice' which is simply speaking in a hushed tone and tell the kids I won't be talking any louder than that for the remainder of the class. It is also good to address night fears, and encourage kids that are fearful to walk near you or the chaperone. Also, tell them there are no boogie men or chupacabra on property that will be joining the lesson. Before we leave the pavilion, all flashlights are put away. Before sitting down, do make a quick sweep with your flashlight to make sure kids aren't sitting in a huge fire ant mound!

II. Introduction to the Night Sky

Hopefully at this point the kids are a little settled and ready to listen. For centuries humans have looked up at the night sky. Some ancient civilizations used the night sky to describe things they didn't understand; others used it to keep their traditions and stories alive. As time went on the stars became deities (Greek mythology), time keepers (ancient Egyptians used Sirius to tell when the Nile was going to flood), and even maps (celestial navigation on boats).

We are, of course, learning about astronomy (astro = start; nomos = culture) tonight. First, who knows what a constellation is? A constellation is a group of stars that forms a picture. There are currently 88 recognized constellations in the night sky throughout the year. Many of these constellations have their origins in ancient history and their stories have lasted to this day. We're going to look at several of these constellations and talk about their science and stories.

But first I want everyone to just look up. How many of you can see this many stars at your home? Why is it easier for us to see stars here than it is in Austin (or Houston, Dallas… wherever the kids are from)? Light pollution can

be so bad that it can blot out the entire night sky. We are super lucky to have such a great night sky, so let's get the party started!

III. Summer Triangle

The summer triangle is a great constellation because there are tons of things within it. Start with pointing out the three corners of the triangle: Altair, Vega, and Deneb. Then point out Cygnus the Swan which comes off Deneb. This leads into a great Greek myth about Apollo, his son Phaeton, and Phaeton's friend Cygnus. The head of Cygnus the Swan (Alberio) is also a double star, so you can chat about that for a bit as well.

IV. Scorpius and Sagittarius

Scorpius rises over the lake and is a HUGE constellation. Sagittarius is still over the lake but a little higher up in the sky. You can discuss the difference between Astronomy and Astrology and how they intersect in the Zodiac constellations. It's fun for the kiddos to see their astrological sign, so ask them if they are a Scorpio or Sagittarian! The Greek myth pertaining to Scorpio is pretty short, and involves Hercules, Artemis, and the giant scorpion. There is also a red super giant star named Antares in Scorpius. It is the brightest star in the constellation, and presents a good time to talk about star colors/temperatures.

Sagittarius looks like a teapot, and if the moon isn't too bright you can actually look at the 'steam' coming out of the spout. The steam is the Milky Way which I think is fascinating. Here you can talk about our galaxy's shape, what it is made up of, the size, and myths. I bring in some Native American mythology for this one, just to shake things up a bit.

V. The Moon and Planets

After looking at some constellations, it's nice to look at the moon. At least all the kids can find this one! Talk about why the moon shines and compare it to why stars shine. If you look at the moon in the telescope it is riddled with craters. You can mention the fact that earth is protected from constant impacts by our atmosphere while the moon is atmosphere-less (for

your own edification, search ‘Ahhh the atmosphere’ on YouTube for an in depth synopsis of what the atmosphere does for earth. It’s produced by the Discovery Channel). Speaking of… why do stars twinkle? Are they really blinking on and off? No! It’s the atmosphere!! All the dust and debris in between us and the vacuum of space gives the appearance of twinkling.

Check the star charts to see what planets are up. It’s always interesting to be able to point out something that looks like a star but is actually a planet.

VI. The North Polar Sky

Another goldmine of constellations, stories, and science facts!! It’s always fun to have the kids point out where they think the Big Dipper is. They will be all over the sky! Show them where the Big Dipper really is, move to the Little Dipper and then talk about Polaris. I like the myth about Callisto for Ursa Major and Minor, but there are a lot of great stories tied to these constellations. This is also a good time to talk about how the night sky changes throughout the year but you can always find the five constellations of the northern sky.

VII. Conclusion

BEADS! I suggest never passing out beads while you’re in the dark. Kids drop them, can’t find them, and then cry. Instead, I charge them in my backpack (they glow in the dark), reveal them (still in a plastic bag) to the kids, and then hand them out at snack time. Have kiddos tell you about their favorite story, sight, or fact to get their bead.

VIII. Extra Notes

Make astronomy your own class… that’s the fun of it! You get to add stories, delete stories, use more science facts, use less… the power is yours! Kids really love this class, and for so many of them they are looking at things they have never seen before. There is a certain sense of awe that almost

everyone has while looking up at the stars on a dark night. Tap into that awe and the kids love it!

Deb's Astronomy Lesson Plan (Fall Sky)

Walk and getting settled – 10 minutes

Walk the kids over to a quiet and dark location. Sit them down so that they are all facing the same direction… this is one of the rare occasions that sitting in a circle doesn't work so well! If they are all facing the same direction then when you tell them to look for something, everyone's left and right, up and down will be the same and it will be easier for you to point to objects and constellations.

Once they are all sitting down, have them hand their flashlights to you. Explain that it's easy to accidentally turn them on and so you'll hold them until the lesson is over so that doesn't happen. We want our night vision to be in top form so we can see the amazing things we're about to see!

Let them know that what we will be doing for the next bit is finding constellations and telling stories about them. If they have questions about the night sky they are more than welcome to ask them, but we're not going to go in depth about facts about space… there's just too much to learn!

Also let them know that star-gazing can be very relaxing and fun, but not if everyone is talking at once. Explain that there are other groups sitting around us and that we need to be respectful of the other groups and talk in very quiet voices. Also acknowledge that Astronomy may not be the most exciting thing for some of the kids, but that they need to be respectful of their teammates so that those who <u>are</u> interested can hear what you have to say.

Ask the kids to lie back and look up at the sky and give them 2-3 minutes to just absorb what they see. Let them be excited by shooting stars and satellites and encourage them to see what they can find in the sky.

Constellation tour and stories – 45 minutes

Ask them what a constellation is (a group of stars that forms a picture). Ask them if they know of some constellations (let them call out various constellations). Explain that we will look at some of the constellations, but that some of them that they may know are not up this time of year so we won't be able to see all of them. (Orion is a great example of this)

Hint: When pointing out constellations or stars walk among the group and make sure that every child sees what you are pointing out.

PART I

<u>The summer triangle:</u> (5 minutes)

Point out the summer triangle, naming the stars that form the triangle. Have the kids repeat the names and point to the individual stars as they do, as you'll be referring to them some throughout the night.

<u>The Milky Way:</u> (5 minutes)

Show them the Milky Way and how it goes right through the summer triangle. Ask if anyone knows what the Milky Way is (our galaxy is a spiral galaxy and we are positioned so that we are seeing one of the "arms" of the spiral… it is millions of stars, and we're seeing their combined light).

<u>Cygnus the Swan:</u> (10 minutes)

Have them find Deneb. Cygnus' butt is Deneb and he flies along the Milky Way. **Tell the story of Cygnus.**

PART II

<u>Scorpio:</u> (10 minutes)

Have the kids spin around so they're facing south. Scorpio is big! Point out Antares and that it's red in color and about where Scorpio's hear would be. Scorpio is one of the Zodiac signs… you can ask if anyone in the group is a Scorpio, they like the attention! **Tell the story of Scorpio.**

Sagittarius: (5 minutes)
Just to the left of Scorpio is Sagittarius, another Zodiac sign. Show them the archer and then show them the teapot part of the constellation using the Milky Way as the steam from the teapot.

PART III

Big and Little Dipper: (10 minutes)
Have them spin so that they are facing north. See if they can find the big dipper and tell them about Mizar being a double star. Then show them how to find Polaris and the Little Dipper. **Tell the story of Ursa Major & Ursa Minor.**

You may have run out of time by now, but if you haven't…

Draco: (5 minutes)
Point out Draco, how he winds between the dippers. **Tell the story of Draco.**

Hercules: (5 minutes)
Point out Hercules (he's standing on Draco's head).

Wrap it up – 5 minutes

Show the kids the beads they'll be getting for Astronomy. It's fun to shine your flashlight on them and then turn off your light so they can see the beads glow in the dark. Tell them that you'll pass out the beads during snack so they don't accidentally drop them in the dark. Walk the kids to snack!

Sarah's Stellar Star-gazing Syllabus (Spring Sky)

Just to reiterate what you have already heard numerous times, the tone of your class is generally set by your expectations up front. Once I have my group at our 'spot', I have the kids put their flashlights in a pile- this prevents any 'accidental' flashlight-in-the-eye, strobe-light-happy-kid, or any other flashlight distractions from happening. They are allowed to use their flashlight when we walk to snack, but other than that, they stay in the pile. (I fill them in on how the light from their flashlights destroys their night vision and it can take about 30 minutes to build it back up). Then I give them a little speech about all the cool stuff that is up in the sky and that this astronomy lesson is for their enjoyment. I tell them to get comfortable and to please respect those that want to hear the stories and learn about the constellations. Those that want to make up their own pictures and stories are welcome to (as long as its with their inner voice), but they still need to respect those that want to hear what I have to say.

I. Random facts I like to kick-it-off with:
   - On a clear, dark night you can see approximately 1500 stars with the unaided eye. The sky that you see differs very little to that seen by our ancestors thousands of years ago.
   - <u>stars:</u>
     - Which star is the closest? That's right kids, the sun is the closest to us. It actually is only a medium-sized star but it appears much larger to us because it is so close.
     - Can stars be different colors? That's right kids, they sure can be- your eyes are not playing tricks on you. Their color is determined by how hot their surfaces are. But the colors associated with the temperatures are opposite of the colors we generally associate with hot and cold. What color do we associate with cold? (they answer blue) Correct, but with stars, the blue ones are the hottest. What color do we associate with hot? (they answer red)

Correct, but with stars, the red ones are the coolest. So from the hottest to the coolest, it goes; blue, white, yellow, orange, red.

II. I then like to ask the kids to point to what they think is the North Star. Almost every time, the majority of the students will point to Sirius- which is the brightest star in the sky. Some might point to Venus- which you can point out is the brightest OBJECT in the night sky (after the moon). So, Sirius is the brightest star and I then go on to point out the Canis Major (or Big Dog) constellation. (I tell them that we will come back to the North Star in a bit).

III. After telling them how Canis Major is one of Orion's hunting dogs, I just move right into showing them Orion. I always point out the belt first, talk about the nebula, then the major stars of Rigel and Betelgeuse. It helps if you pose a little yourself like Orion to help them better picture the constellation.

- After pointing out his figure, I then move into the story of Orion and Artemis. Key names to remember:
    - Apollo = Sun god and brother of Artemis
    - Artemis = Goddess of the Moon and sister of Apollo
    - Orion = one of the greatest hunters of all time

IV. Finish that story and then point out The Pleiades (aka The Seven Sisters). Talk about the Greek mythology of how six of the sisters married immortal men, as was expected of them. But one sister married a mortal man, and as a punishment, her star was dimmed- hence the reason you can only really see six of the seven stars in the cluster. I also mentioned the myth about Orion falling in love with all seven of them and Zeus finally took pity on them after seven years of being chased. He turned them into doves so that they could flee from Orion and always stay ahead of him- thus the reason they are just out of Orion's reach in the sky. And lastly, I mention how the Native Americans used The Pleiades as an eye test.

V. From here, I move onto the constellation of Taurus. I make sure to point out Aldebaran first and then point out the "V" (horns) from there. Then ever so smoothly, I begin to tell the story of "the Bull".

Key names to remember:

- Europa = princess of Ethiopia
- Zeus = king of gods, leader of the immortals

VI. Point out Saturn and constellation of Gemini. I'm not a big fan of the Castor and Pollux story, so I usually skip this one since I rarely have time to tell all the other stories I enjoy.

VII. From here, I bring them back to the North Star and show them the Big Dipper and Little Dipper (Ursa Major and Ursa Minor)- following it up with the story.

Key names to remember:

- Callisto = Beautiful woman who hunted in mountains a lot- was known for her long, silky hair
- Zeus = King of gods, falls in love with Callisto
- Hera = Zeus' jealous wife that turns Callisto into a bear
- Arcas = Callisto's son that almost shoots her until Zeus intervenes
- Oceanus = the Ocean god that Hera complains to and asks to punish Callisto and Arcas for having honorary spot in sky

VIII. After these constellations and stories, depending on time, I will quickly point out the constellations of Cassiopeia and Cepheus. And I like to end on Leo and the story of the great Lion.

Key names to remember:

- Nemea = city that was being terrorized by the ferocious lion
- Leo = the beastly lion that was slowly devouring the city of Nemea
- Hercules = the greatest warrior among the gods who was called upon to complete 12 tasks- first of which was to kill Leo the Lion.

VIIII. Closure

I just wrap it up with a short question and answer session of the constellations, certain stars, planets and stories. I have them tell me what was their favorite part and then head to snack. I pass out beads during snack.

Tara's Astronomy Lesson Plan (Spring Sky)

Intro and "quiet down" time (15 min):

Say: I know that we have been just had a chance to have some fun and run around, but Astronomy is more of a quiet time. We are going to have a chance in just a few minutes to look at some stars and to hear some really cool stories. But, as a team, we have to be respectful of each other, of me as I am telling stories, and of the groups that are spread out around us trying to listen to stories themselves.

Since the beginning of time, people have been fascinated by the night sky. Take a minute and just look at the sky (give them 30 seconds to a minute…let them talk and exclaim a little ☺). How many stars do you think that you can see? (let the kids give you numbers…but just a few, don't let them get carried away and get rowdy again). Actually, on a clear, dark night you can see about 1,500 stars! Can you see this many stars where you live? (let them answer)

- If they can't: Why not? (lead them to the answer "because of the lights of the city" if that is the case)
- If they can: Why? What if you lived in Austin? Or Dallas? Or New York City? Do you think that you would be able to see the same number of stars?

Think about how amazing the stars must have looked before the invention of the light bulb! The night sky would have appeared so much darker, and the stars so much brighter!

Have you heard of ancient civilizations such as the Ancient Greeks or Romans? (most of them have…if not, explain that they lived a long time ago and were a very advanced group of people for their time). They believed that a group of gods and goddesses ruled and controlled

everything that went on down on Earth. They believed that their gods and goddesses lived on a place called Mount Olympus…and from Mount Olympus, the gods and goddesses could look down and see EVERYTHING that was going on down on Earth. The Greeks used stories involving the gods and goddesses to explain things on Earth that they didn't understand…such as the changing moon, the setting of the sun, and the positioning of the stars.

Who knows what a constellation is? (let them answer) It is a group of stars that forms a picture in the night sky. Kind of like a connect-the-dot picture. Many times, the Greeks would make up stories related to these "star pictures," to help them explain these things they didn't understand. I would like to show you some constellations and tell you some of the stories that have been passed down from the ancient Greek civilizations.

A few things before we start…the constellations don't form perfect pictures, so you will have to use your imagination just a little! A few characters that you will need to remember are Zeus and his wife Hera. Now Zeus was the god of all gods…the top guy, and he could pretty much do whatever he wanted to, and he did... Hera, his wife, was of course the top goddess. Now you have to know that Hera is a bit of a jealous wife and she would get jealous of Zeus and his adventures quite often…

Ursa Major & Ursa Minor (15 min.):

Say: The first constellations I am going to show you are pretty popular. You might even have seen them before…but not everyone has, so let's be respectful of those who haven't had a chance to see these constellations before and listen and watch as I point them out.

The first constellation is Ursa Major, otherwise known as The Big Dipper. (Take time to **show** them constellation card so that they know what they are actually looking *for* - I use my flashlight covered with a red bandana so

as to not ruin their night vision. Then I have them all face one direction and point out the constellation with my flashlight).

The second constellation is known to the Greeks as Ursa Minor, but we often hear it called The Little Dipper (again, show the card, *and then* point out the constellation).

The characters you will have to know in this story are Zeus (remember him?) and Hera (the jealous wife). But you also need to remember the name Callisto, who was a beautiful young woman.

Tell: Ursa Major & Ursa Minor: A Greek Myth (found in your handbook)

Cepheus & Cassiopeia (15 minutes):

Say: Now we are going to look at a couple that you probably haven't heard of or noticed before. Now this is my favorite story, so the closer you pay attention while I am pointing out the constellations, the quicker we will be able to hear it!

Show: Cassiopeia and Cepheus (again, use the cards first…As I show them the card, I position it exactly how they will see it in the sky)

Tell: Cepheus and Cassiopeia: A Greek Myth (again, found in the handbook)

Orion (15 minutes):

Say: Does anyone know where the constellation Orion is? Let's reposition ourselves so that we are all facing the correct direction…

Okay, for this story you will need to remember a few new characters. There is Artemis, who is the goddess of Wild Animals and the Moon. Her brother is Apollo, who is the Sun God. And then there is handsome Orion…

Show: Orion

Tell: Orion: A Greek Myth

Closure (whatever time is left):

Remember that I said at the very beginning of our lesson that people have looked to the night sky from *way back* in order to explain things that they didn't understand? Well, tonight I told you some stories from just one civilization, the Ancient Greeks. However, civilizations all through time have created their own stories around the constellations in order to explain to them the things that they don't understand…the ancient Romans, Chinese, Egyptians, as well as Native Americans all have their own unique stories.

Then BEADS!! They LOVE this part…I like to shine my flashlight on the bag and then turn it off so we are just basking in the coolness of the glow-in-the-dark beads while they answer their bead question! But then I hand out the beads at snack.

Helpful Astronomy Sites

www.astronomy.com

- LOTS of information on here. A little twisty and difficult to navigate, but check out the "tonight's sky" box on the homepage that has information on the setting and rising of multiple celestial objects. There is also a running ticker along the bottom of things going on in the sky this week.
- The Star Dome is a helpful map of the night sky and refreshes itself every day. This is exactly like your planisphere except you don't have to spin it around yourself. Make sure when you use this to re-set your exact location by city, otherwise the stars will be a little off.

www.skyandtelescope.com

- Check out their "This Week's Sky at a Glance" page for interesting facts and observations for each day of the week.
- They also offer a free Interactive Sky Chart which allows you to print out sky maps for any place on earth at any time of day or night. You will need to sign up, but it might be helpful.

www.stellarium.org

- Stellarium is a computer program that is free to download, and is also on the Instructor computers. It's great for astronomy nerds, and has an amazing array of features. You will be able to set your location, fast forward, and rewind in time, and display constellations. You can click on individual stars, planets, clusters, and nebulas and get their names and some basic facts. Download it onto your personal laptop if you like! It tends to run pretty slow on the instructor computers.

pocket universe

- This isn't really a website, but if you have an iPhone, consider getting this app. It uses your phone's GPS and internal compass to figure out where you

are, and then display the night sky in real time. Users can hold their phone up to the sky and the app will automatically display that section of the night sky on the screen. If you move, the screen moves with you. Doesn't get any better than this! If you have an iPod Touch you can still download the app, but you will need to manually set the direction you are facing. Constellations, planets, and the moon are all displayed. In addition to the sweet real-time-location-oriented screenshots, the app alerts you to happenings in the night sky like meteor showers, lunar phases, and other objects in the night sky that are worth looking at. If you do download this to your Apple product, **do not use it during a class**… use it to teach yourself so that you can point things out by memory and look super smart!

Resources:

This information, as well as the myths, legends and stories come from many different sources. Some were cited correctly, and some were not. Unfortunately we don't have all the correct information, but anything cited in more recent updates has been included here.

The resources apply to all sections of the Astronomy manual.

- www.space.com
- www.astronomy.com
- www. dibonsmith.com
- www.dustbunny.com
- www.windows2universe.org
- www.iau.org
- www.astromax.org
- www.gods-and-monsters.com
- www.firstpeople.us
- home.comcast.net/~lsmch/starmyths.htm
- www.native-languages.org/legends-star.htm
- www.philsites.net/folklore/stories/legend5.htm
- The Constellations: How They Came to Be, Roy Al Gallant. Four Winds Press, New York
- 1000 Facts About Space, Pam Beasant. Kingfisher, New York.
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Written by: Becky Prentice, January 2001
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