

MATERIALS TO SUPPORT KINESTHETIC ASTRONOMY™ LESSONS

Dear Educator,

The materials here support the Kinesthetic Astronomy lesson that can be downloaded from the Space Science Institute web site [click on “K-12 Curriculum” at <http://www.spacescience.org> and look for the “Kinesthetic Astronomy” icon.] The resources here include:

1. The instructions for making east (“E”) and west (“W”) cards that students can hold in their hands as physical and visual reminders of their “eastward” and “westward” directions.
2. The season’s signs. These signs add landmarks in the learning environment for students to reference the time of year. Laminating the signs is critical to extend the lifetime of their usefulness.
3. The instructions for making the zodiac signs and the instructions for placing them in the learning environment. These signs add landmarks in the learning environment for students to reference the time of year and constellations that can be seen from Earth at different times of day and year.

Cherilynn Morrow
Mike Zawaski

Boulder, CO
15 October 2002

('E' & 'W') Cards for Kinesthetic Astronomy™ Lessons

The below pages are used to create optional cards for your students to hold during Kinesthetic Astronomy™ lessons. The 'E' and 'W' (east and west) cards are beneficial because they serve as reminders to help students remember which hand is “toward their east” and which hand is “toward their west.”

Listed below are the directions and pages to photocopy that make our suggested cards. Following these directions will yield enough E-W pairs for 31 students and 1 educator.



MATERIALS NEEDED: Photocopier, paper cutter, glue stick, and 64 popsicle sticks.

1. Print one copy of the two pages below (the pages covered with the letters “E” and “W”).
2. Make four (back to back) copies of each page. This will yield **eight** 2-sided pages, plus the two originals.
3. Cut out the letters. Leave at least $\frac{1}{4}$ inch borders along the top and both sides. **Leave maximum space below each letter to allow room for attaching the popsicle stick (see photo above).**
4. Using a glue stick, glue a popsicle stick to the base of each letter.
5. The result is 32 double sided E’s and 32 double sided W’s, each with a popsicle stick handle.

E W E

E W E

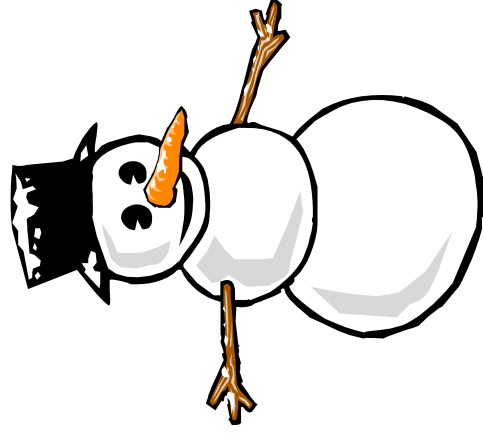
E W E

W W W W

W W W W

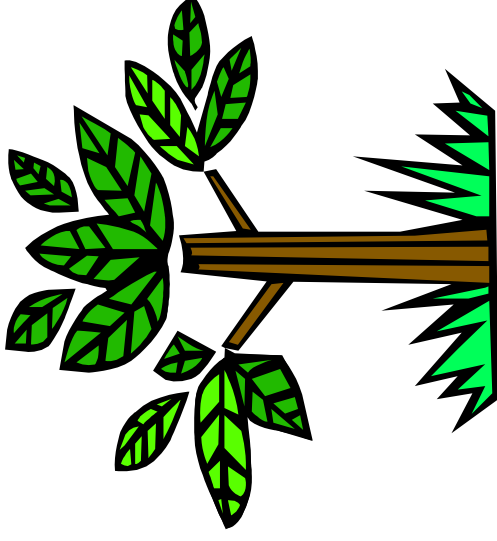
E W E

WINTER SOLSSTICE



21 Dec.

SPRING EQUINOX



21 March

SUMMER SOLSTICE



21 June

FALL EQUINOX



21 Sept.

Placing of the Zodiacal Constellations for the Kinesthetic Astronomy™ Lessons

CONSTRUCTION OF SIGNS: Once printed, laminating the twelve pages, each with a constellation of the zodiac on them, is critical to extend the lifetime of their usefulness. Next, punch holes in each sign along the top edge with a 3-hole punch and tie a loop of string (36 inches in length) through each sign. This will assist you in hanging them so they are easier to see in the learning environment.

MATERIALS NEEDED FOR SET UP: Planisphere, Central object to represent the Sun, 12 laminated cards labeled with the names of the constellations of the Zodiac, 4 signs labeled with titles and dates of two equinoxes and two solstices on Earth.

BACKGROUND AND INTRODUCTION: The planets orbit the Sun in almost exactly the same plane [except for Pluto which has an orbit inclined significantly (17°) to the plane]. The Zodiac is a band of constellations (e.g. Leo, Aries, Pisces, etc.) made of distant stars that lie in the same plane as the Sun and planets. These stars are far outside the Solar System, but still within the Milky Way Galaxy. Looking out in space, we see these constellations as the backdrop for the apparent motions of the Sun, Moon, and planets. When people ask ‘What is your sign?’ they are referring to the constellation of the Zodiac that the Sun appears to be “in” during the time you were born.¹ This constellation is called your Sun Sign because if you blotted out the light of the Sun, the stars of your zodiacal constellation would be visible. As you will soon see, your Zodiacal constellation is NOT among the constellations you will see during the night on your birthday.

In the “Sky Time” lesson, we use 8.5 x 11” laminated cards to represent the 12 constellations of the Zodiac (see the Figure and Table on next page). We place these constellations outside the circle of students who are representing Earth’s position around the Sun at different times of year. Students can then perceive what constellations will be in the night sky at different times of year, and also what constellation the Sun will be “in” at a particular time of year. The procedure below describes how to set up this circle of the Zodiac.

PROCEDURE:

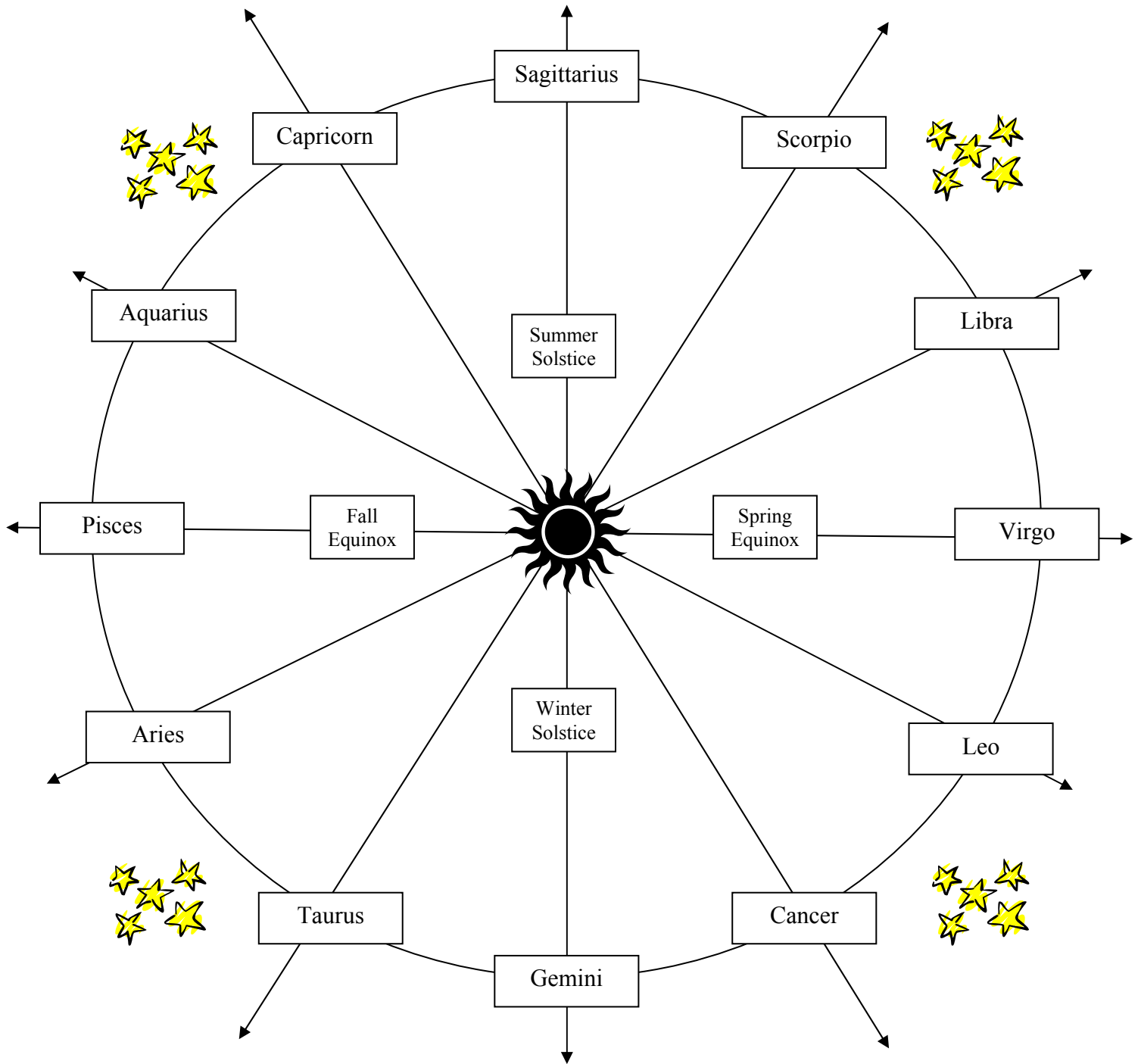
1. Determine where you will set up the “Sky Time” circle with the “Sun” at the center. Determine where the lessons “North Star” will be located (see steps 13-15 in “Sky Time” lesson). This in turn will tell you where the months of the year belong for the lesson.
2. Stand in the circle facing the Sun. Find Earth’s position on 21 June, the summer solstice. This is the place in the circle where tilting toward Polaris results in your upper body leaning directly towards the Sun.
3. Turn your back to the “Sun” to represent midnight and tune the Planisphere to midnight on 21 June.
4. Look along the dashed line labeled “Ecliptic” and find the constellation Sagittarius (There are many zodiacal constellations visible in the window of the planisphere). Note that Sagittarius is the one halfway between the east and west horizons.
5. Place the Sagittarius card out in front of you. [This could be on the ground, hung from a chair, or taped to a wall beyond the student circle around the “Sun.” If possible, having the cards propped up will make them more readable.]

¹ Although astrology is not considered a proper science, it has done a lot to popularize the names of the zodiacal constellations – patterns of stars that mark the path of the Sun as the seasons progress (the ecliptic).

6. Move 1/12 of the way counter clockwise around your circle, this position corresponds to 21 July. Tune your planisphere to midnight on 21 July. You will now see Capricorn along the ecliptic, halfway between the east and west horizons. Place the Capricorn card out in front of you. [This will be to the left of Sagittarius if you have your back to the “Sun.”]
7. Continue in this fashion counterclockwise around until all 12 cards have been placed.
8. When you are finished you will have 12 cards evenly spaced around the circle. This circle of cards is outside the circle where the students (Earths) would be standing around the “Sun” (see Figure below).
9. You can check your Zodiac set-up by standing at the 21 June location and tuning to NOON. As you face the “Sun,” you should see the Gemini card directly across the circle.
10. The backs of this set of Zodiac cards has been labeled 1-12 starting with Sagittarius (1) and Capricorn (2). This will make it easy to place them in the future. Going through steps 1-9 helps you understand the basis of what you are doing.

Table: Constellations of the Zodiac

Constellations of the Zodiac (with the date on which you see it midway between the east and west horizons at around midnight)	Animal or Character
Sagittarius (21 June)	Archer
Capricorn (21 July)	Goat
Aquarius (21 August)	Water Carrier
Pisces (21 September)	Fishes
Aries (21 October)	Ram
Taurus (21 November)	Bull
Gemini (21 December)	Twins
Cancer (21 January)	Crab
Leo (21 February)	Lion
Virgo (21 March)	Virgin
Libra (21 April)	Scales
Scorpio (21 May)	Scorpion

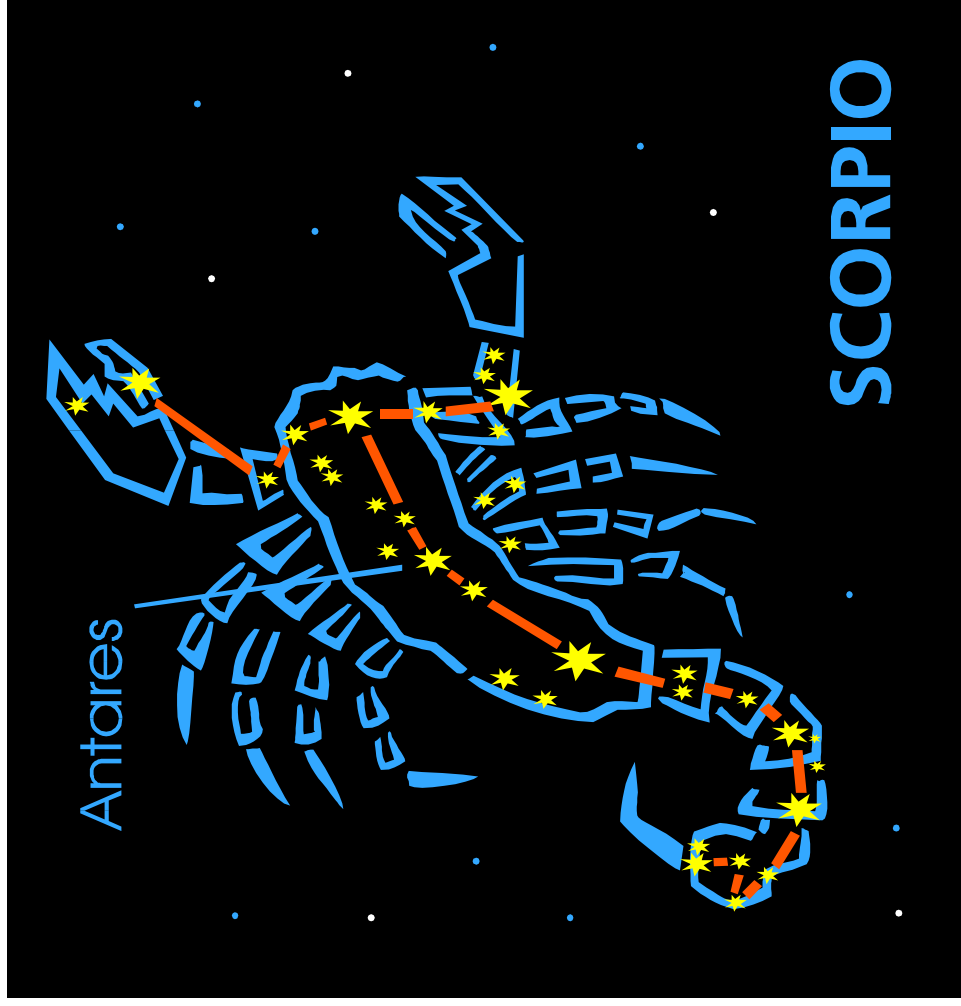


The Figure above depicts the order of the zodiacal constellations relative to the Sun (not to scale). Earth's orbital locations at the two solstices and two equinoxes are also indicated. If you were on Earth on the summer solstice at noon, can you see how the Sun would be "in" Gemini?

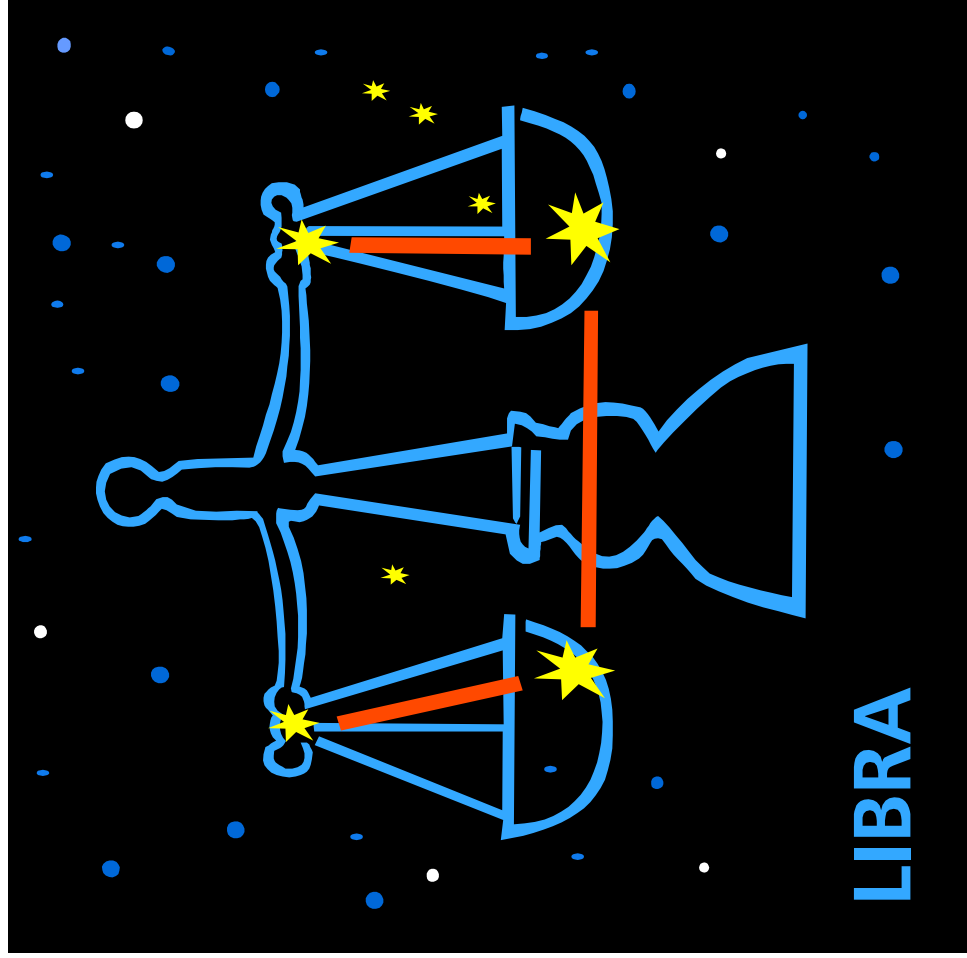
SAGITTARIUS



SCORPIO



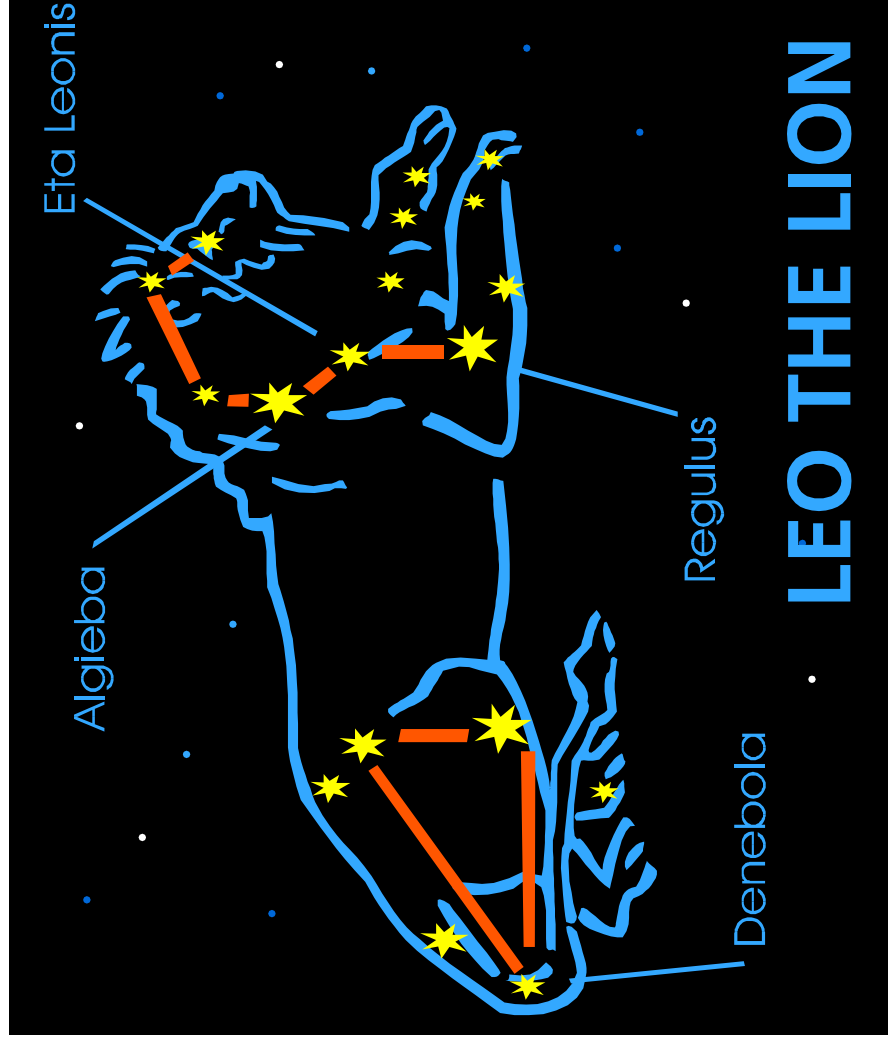
LIBRA



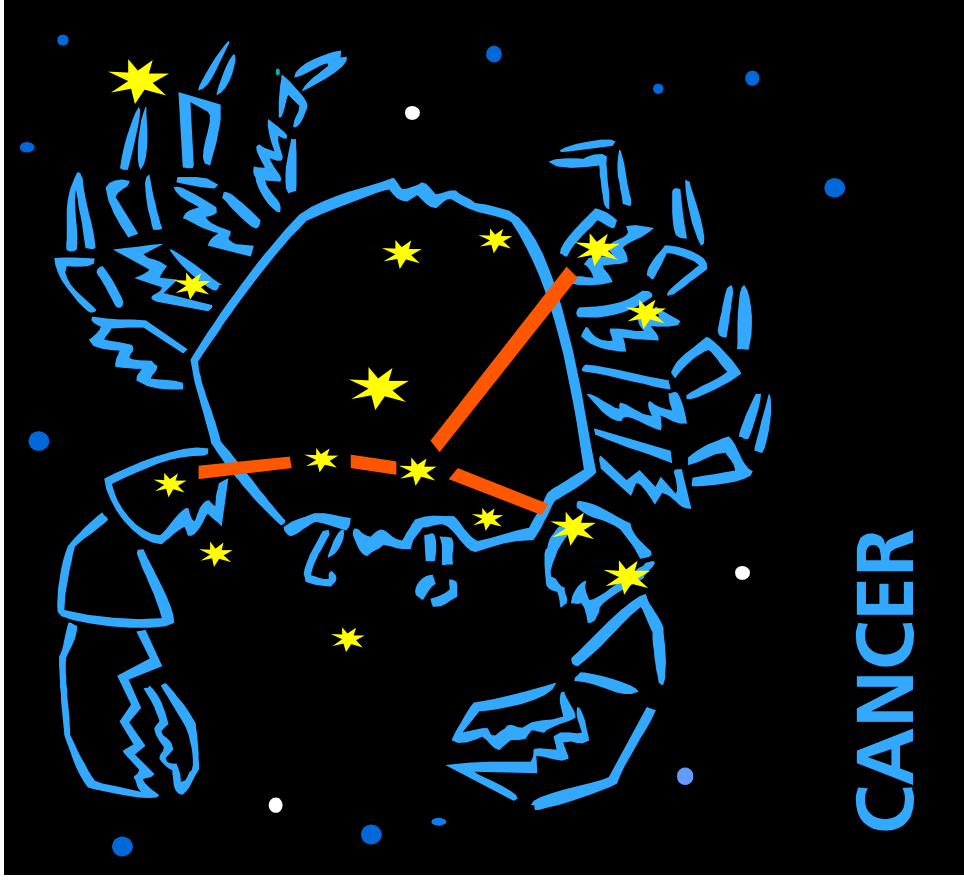
VIRGO



LEO



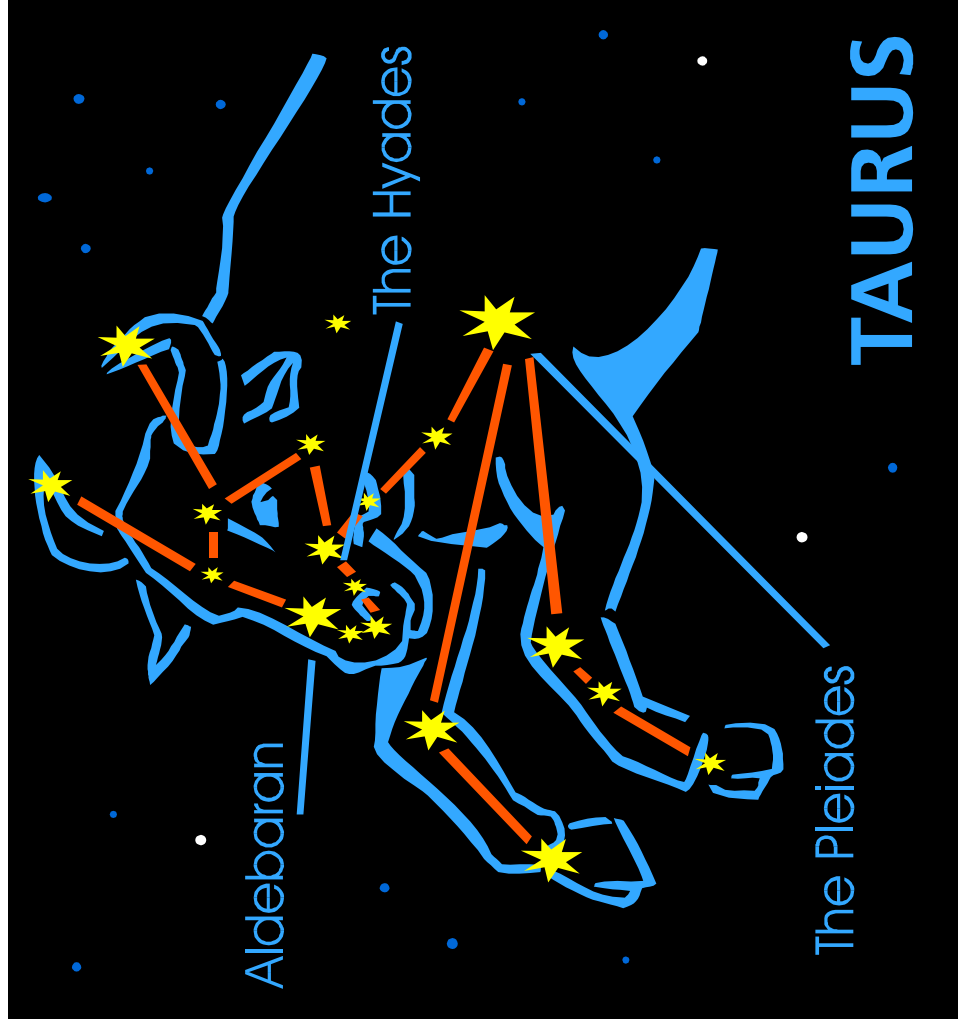
CANCER



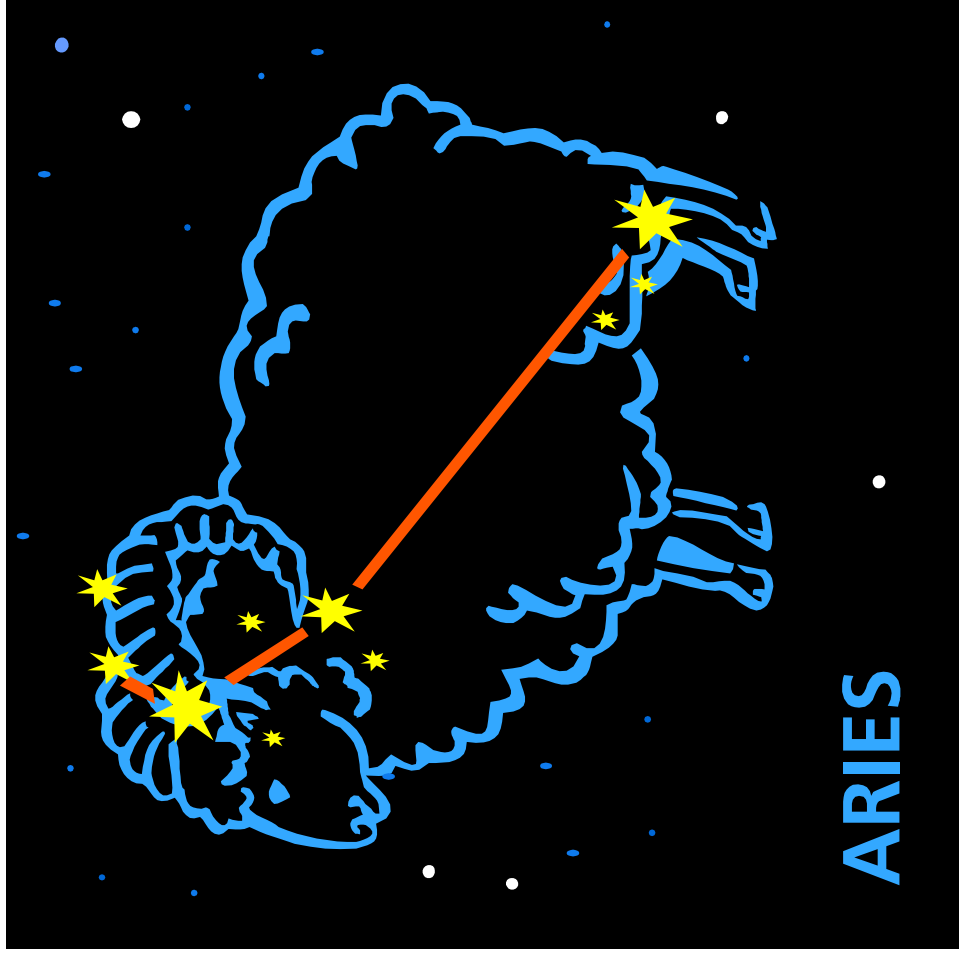
GEMINI



TAURUS



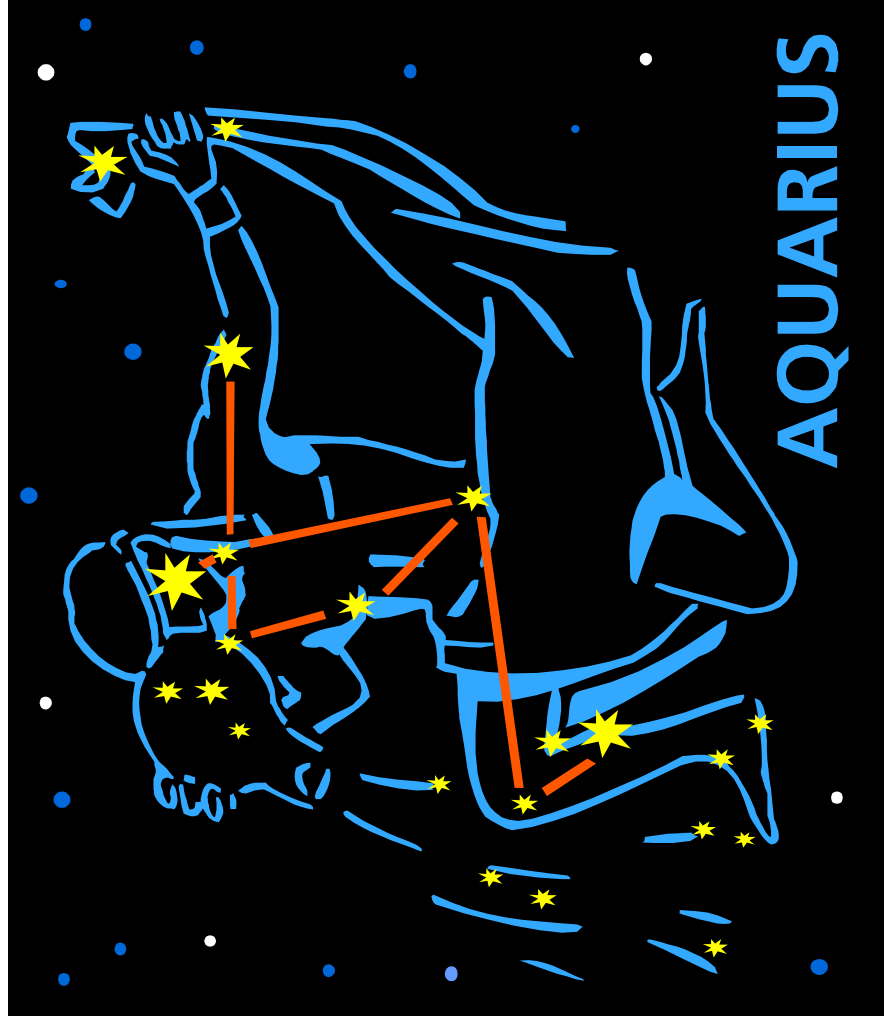
ARIES



PISCES



AQUARIUS



CAPRICORN

