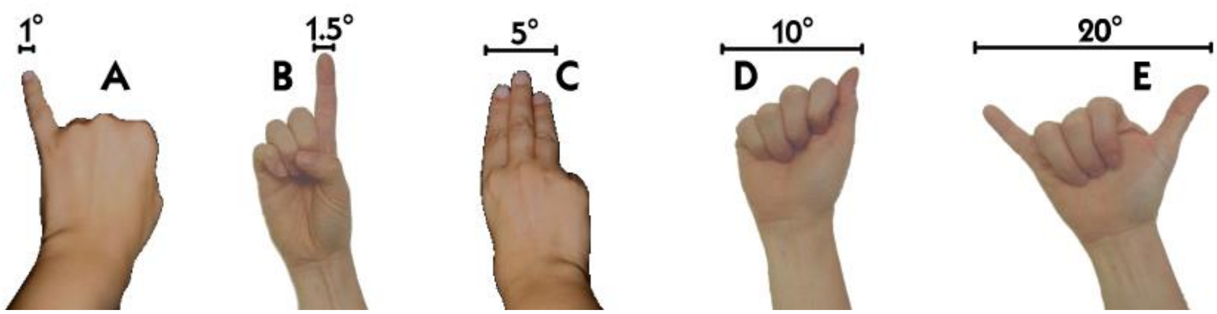
SESSION SIXTEEN: SKY LITERACY

USING FINGER ANGLES TO MEASURE THE SKY

(5 points)

Introduction: The day or night sky that we see above our heads is called the celestial sphere, and as such, measurements made against it must be described as angles—degrees, minutes, and seconds of arc. The horizon is viewed as a circle which contains 360^{o}. The angular measure of an arc extended upward from the horizon and passing through the zenith to the opposite horizon equals 180^{o}. You cannot say with any accuracy that the bright meteor which you have just seen was about "two feet in length" because there is no conversion between feet and degrees. Besides, who carries a ruler and flashlight with them in their hip pockets and how far away was the arm held when the measurement was taken? When making angular measurements, you are always carrying a "handy" pocket device which will allow for relatively accurate results. It is your fingers and fist held at arm's length that can do the trick. As an example, if you make your hand into a loose fist with your thumb on top, the angular distance that your fist and thumb will subtend at arm's length is about 10 degrees (D in the diagram below). Nine fists should make it from the horizon to the zenith. You can stack one fist on top of the other, but just make sure that the fist that is being stacked upon does not "hammer down" the fist on the bottom. The lower fist must remain stationary, while the other fist is being placed on top of it. In addition, you can stretch you thumb and pinky finger into a wide "V" or rabbit ears with the three middle fingers folded down to obtain an angular measurement of 20 degrees (E below). Again, your fingers would be at arm's length. Hold your three middle fingers side by side to obtain an angular measurement of just five degrees (C). Finally, the pinky held at arm's length (A) represents an angle of just one degree, while the index finger stretches that to 1.5 degrees (B). Try measuring the angular size of that great big full moon in the sky with just your pinky finger. Guaranteed, you'll be amazed by the result.



Procedure: On the next two pages you will find star maps for the fall and spring semesters. The angular distance between the stars to be measured will be designated in separate tables for each semester. The angles created by your fingers and hand are noted above and on each star map**. It is always important to measure the angles with your arm fully extended. If you are making a fist, position the thumb on top.** As you and your partner measure the angular distance between two stars, take the average of your measurements and mark the answer at the appropriate location on the back page of this exercise. Choose one of the two appropriate star maps which are designated for the current term. Measure each of the paired stars in the table. Your answers must be within plus or minus 10 percent of the correct angular distance to receive credit. In order to obtain the full credit of five points for this exercise, you and your partner must only obtain correct answers for five of the nine star angles to be measured.

Name ______________________________ Date ____________ Moravian University

Name ______________________________

Fall Term (North)

Stars to be Measured	Measurement
Deneb—Sadr	**5—6º—7**
Deneb—Vega	
Vega—Altair	
Altair—Deneb	
Scheat—Markab	
Markab—Alpheratz	
Sheliak—Sulafat	
Delta Cygni—Gienah	
Gienah—Albireo	
Tarazed—Alshain	

Fall Term (Overhead)

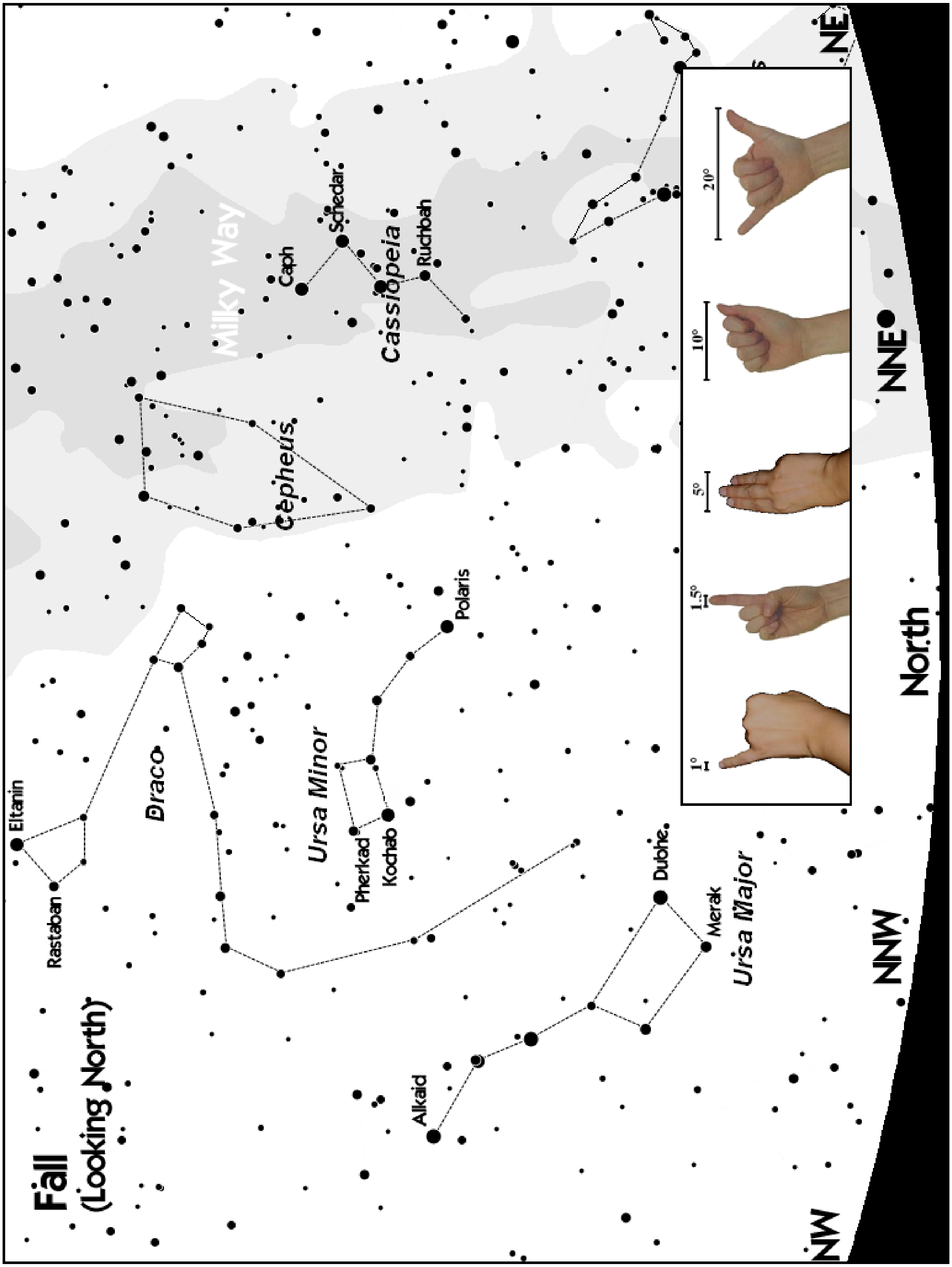
Stars to be Measured	Measurement
Kochab—Pherkad	**2.5—3º—3.5**
Dubhe—Merak	
Dubhe—Alkaid	
Dubhe—Polaris	
Polaris—Kochab	
Kochab—Alkaid	
Caph—Schedar	
Schedar—Ruchbah	
Eltanin—Rastaban	
Eltanin—Polaris	

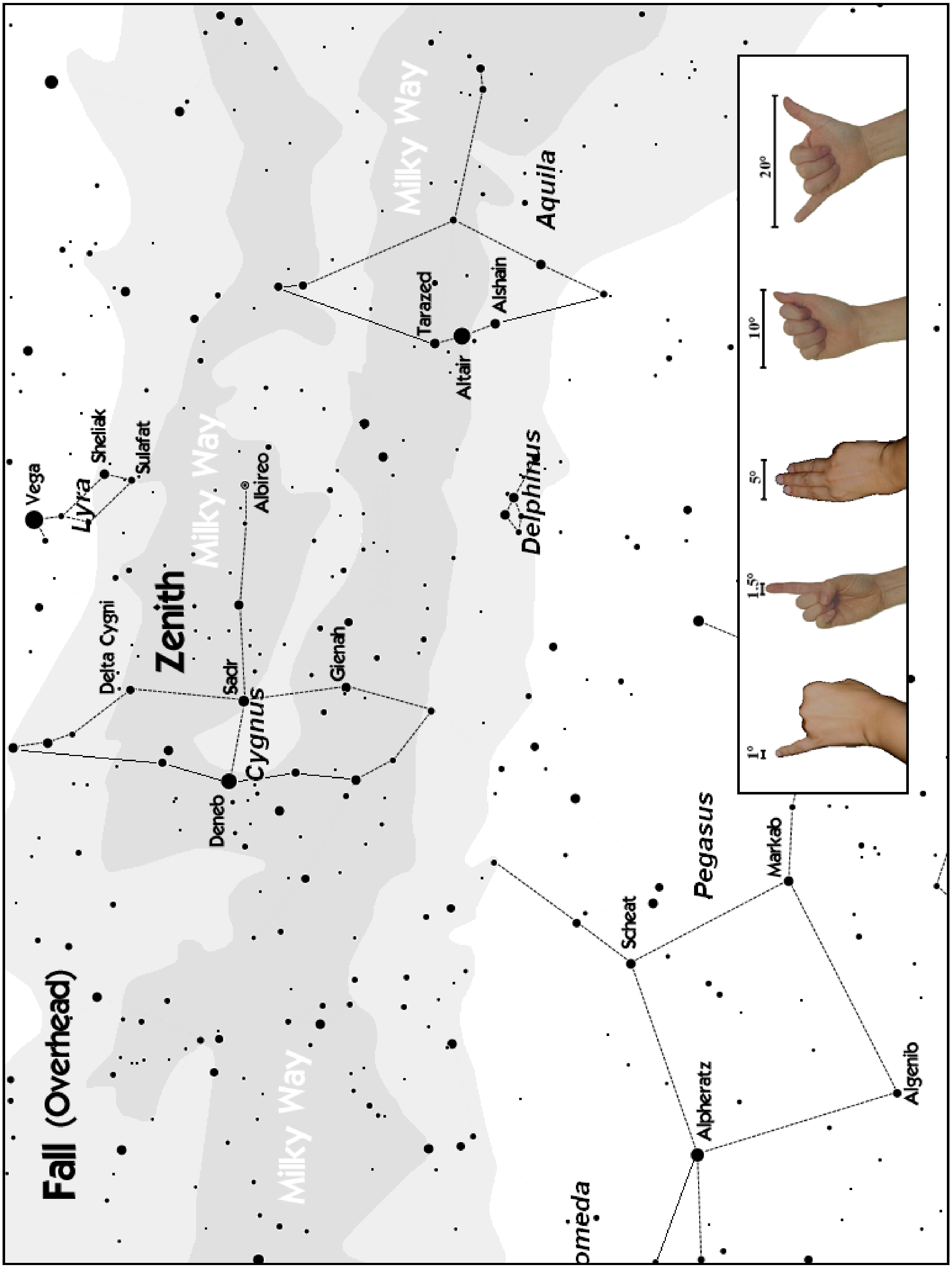
Spring Term (North)

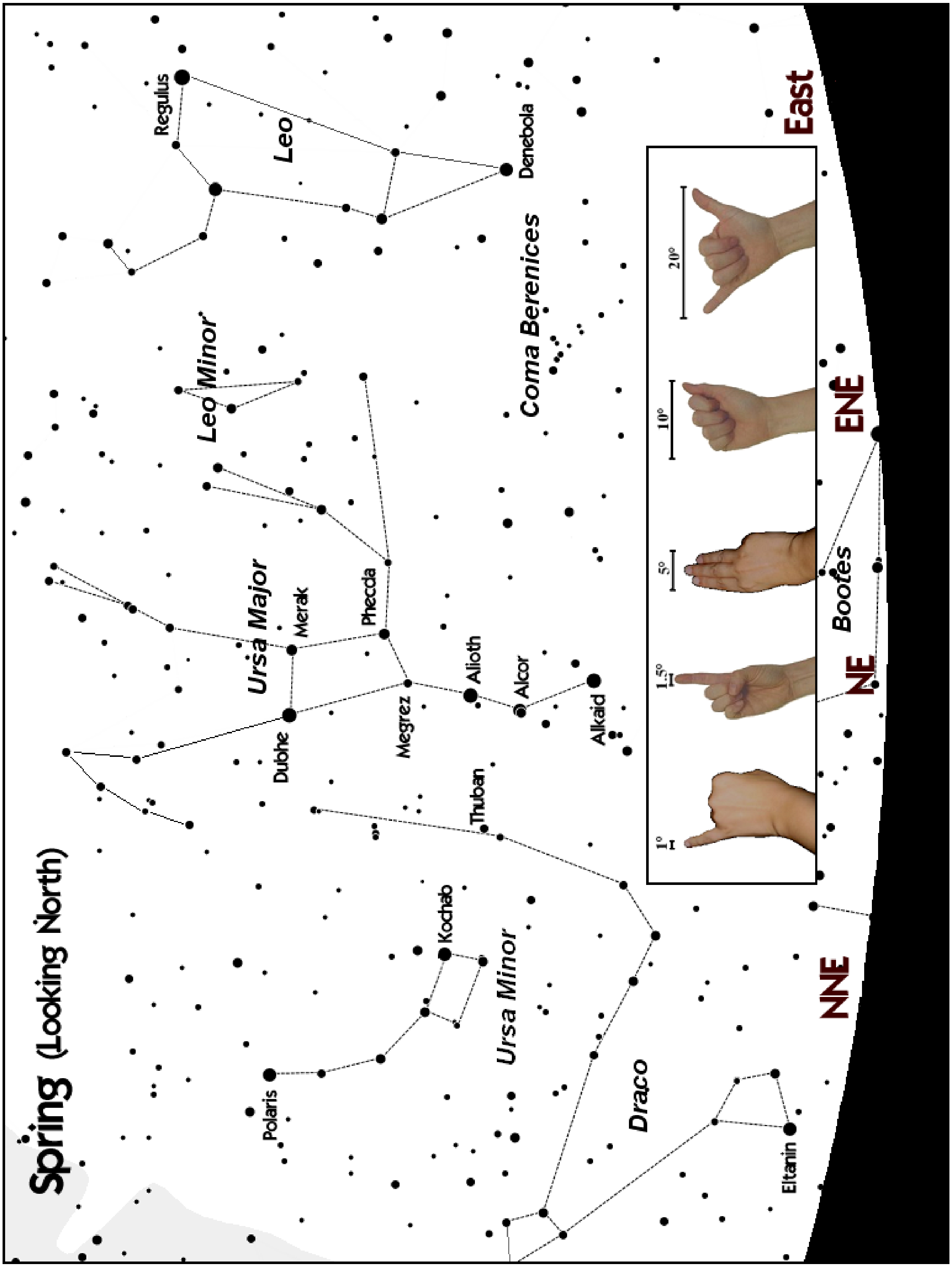
Stars to be Measured	Finger/Hand Measurement
Polaris—Kochab	**15—16.5º--18**
Polaris—Dubhe	
Dubhe—Alkaid	
Dubhe—Phecda	
Merak—Regulus	
Regulus—Denebola	
Alcor—Alioth	
Alioth—Thuban	
Dubhe—Regulus	
Merak—Phecda	

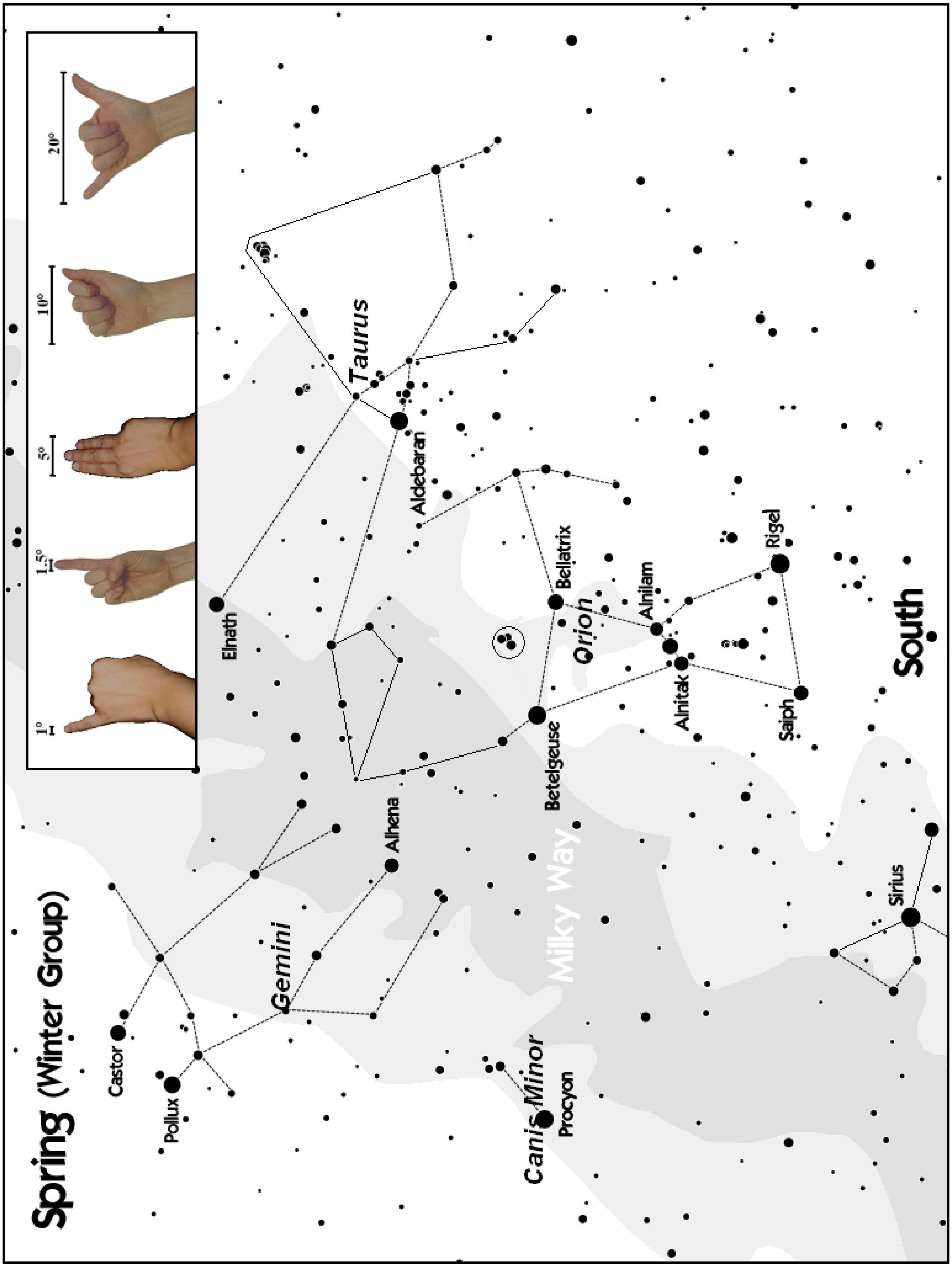
Spring Term (Winter Group)

Stars to be Measured	Finger/Hand Measurement
Saiph—Rigel	**6.5—7.5º—8.5**
Castor—Pollux	
Pollux—Alhena	
Betelgeuse—Bellatrix	
Betelgeuse—Rigel	
Betelgeuse—Aldebaran	
Betelgeuse—Saiph	
Mintaka—Alnitak	
Alnitak—Sirius	
Mintaka—Aldebaran	


Fall
(Looking North)
Milky Way
Caph
Schedar
Cassiopeia
Ruchbah
Cepheus
Polaris
Eltanin
Rastaban
Draco
Ursa Minor
Pherkad
Kochab
Dubhe
Merak
Ursa Major
Alkaid
NW
NNW
North
NNE
NE
1°
1.5°
5°
10°
20°


Fall (Overhead)
Zenith
Milky Way
Milky Way
Milky Way
Vega
Lyra
Sheliak
Sulafat
Albireo
Delta Cygni
Sadr
Gienah
Cygnus
Deneb
Tarazed
Altair
Alshain
Aquila
Delphinus
Pegasus
Markab
Scheat
Alpheratz
Algenib
omeda
20°
10°
5°
1.5°
1°

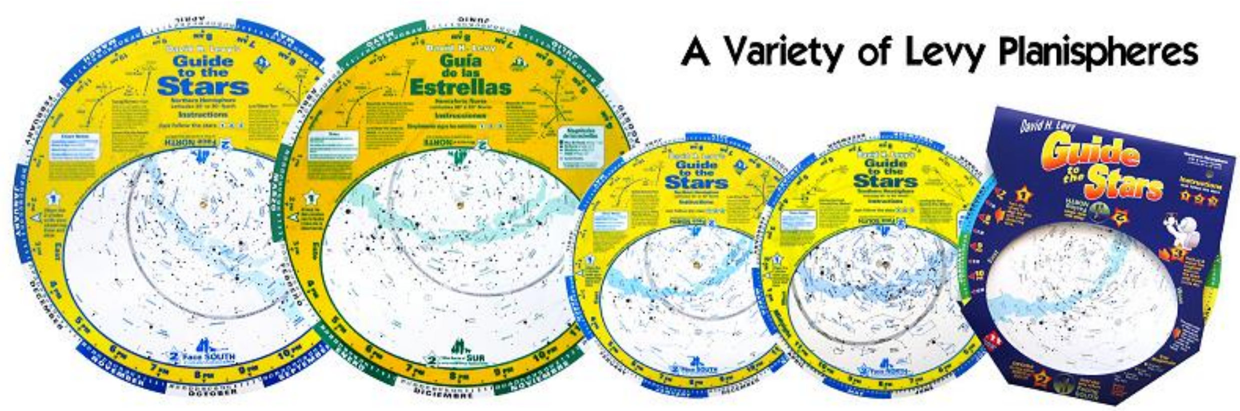

Spring (Looking North)
Regulus
Leo
Denebola
Coma Berenices
Leo Minor
Ursa Major
Merak
Phecda
Dubhe
Megrez
Alioth
Alcor
Alkaid
Thuban
Kochab
Ursa Minor
Polaris
Draco
Eltanin
Bootes
East
ENE
NE
NNE
20°
10°
5°
1.5°
1°


Spring (Winter Group)
1°
1.5°
5°
10°
20°
Taurus
Aldebaran
Elnath
Bellatrix
Orion
Alnilam
Alnitak
Rigel
Saiph
Betelgeuse
Milky Way
Alhena
Gemini
Castor
Pollux
Canis Minor
Procyon
Sirius
South

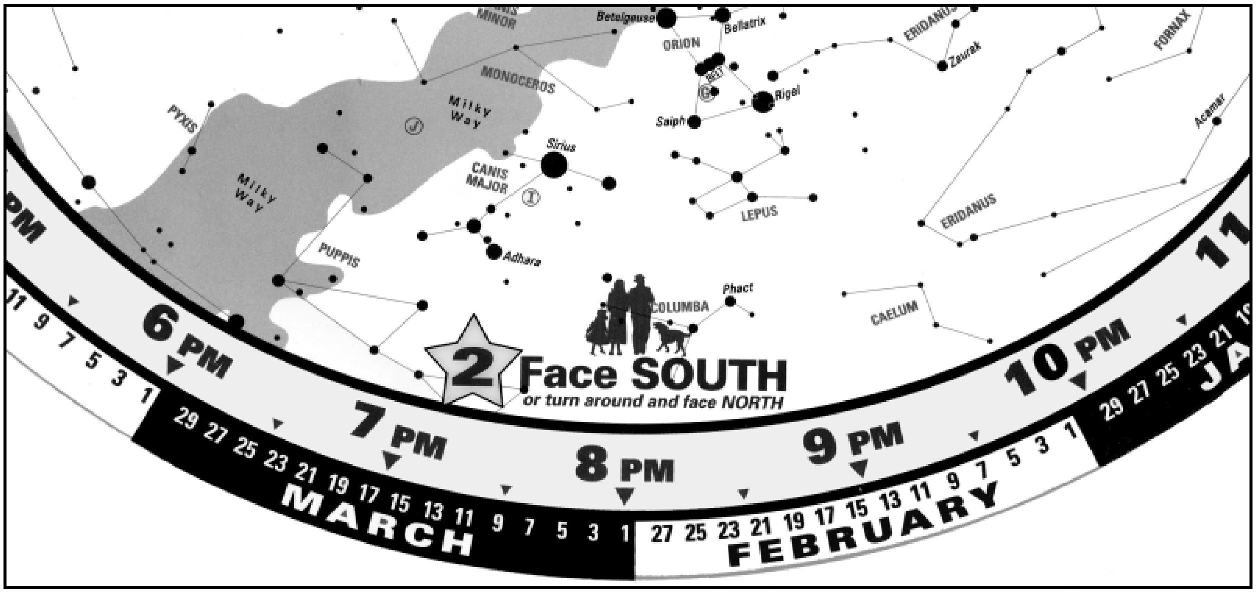
LEARNING TO USE THE HANDY PLANISPHERE

(5 points)

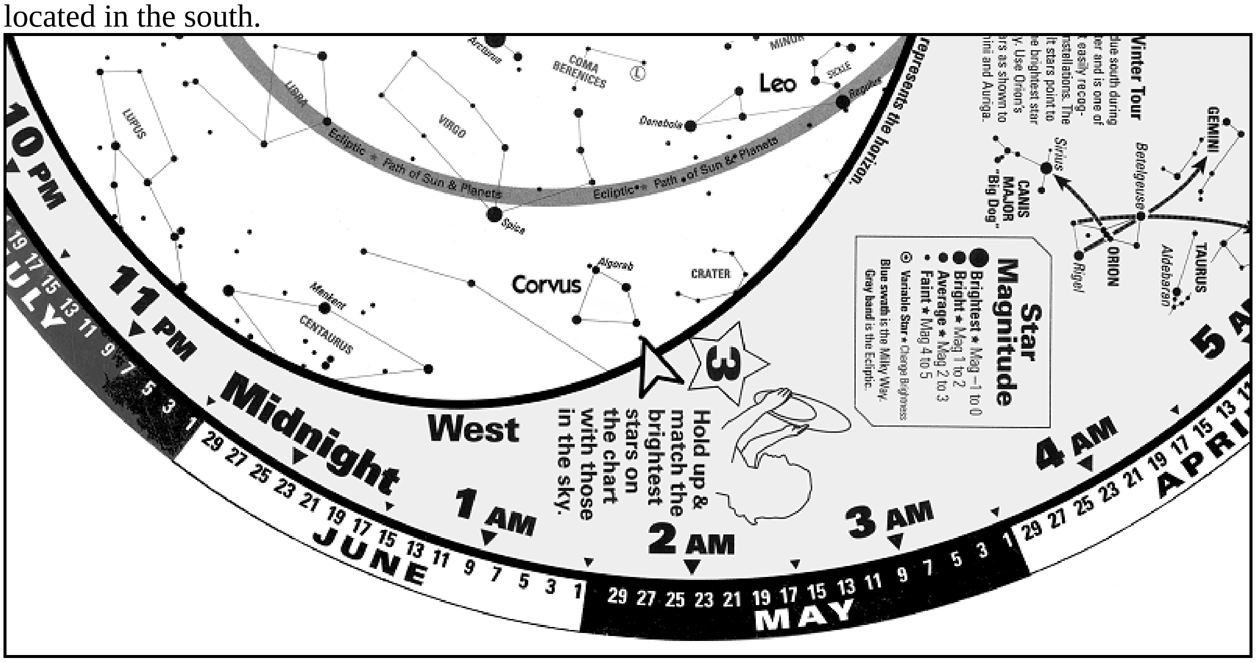
<u>Introduction</u>: I would like to suggest a practical little gadget that will make your sojourns under the starry heavens more enjoyable. The device is known as a planisphere, and it is the most efficient, non-computerized way to create a personalized portrait of the heavens for your travel destinations or for simply the backyard. Planispheres are inexpensive, about $10-$20; many come in plastic versions so they will not get ruined by a dewy summer night; and most importantly, they are flat, so they will pack well or store efficiently on a bookshelf. Here is how they are constructed and how they work. A circular disk containing the months and days of the year, as well as the night sky, is set over another circular disk which contains the 24 hours of the day. One of the disks rotates, allowing the changing sky to be revealed through an oval-shaped area. If you match the hour of the night with the date of the year, a correct representation of the sky is revealed for that moment. To use a planisphere out-of-doors, simply look down upon it, keeping the direction in which you are viewing consistent with the direction closest to you on the planisphere. The heavens in front of you will be mimicked on the planisphere, but will appear much smaller in size than the real sky. Planispheres always give a standard time representation of the firmament. Since over half of the year we are on daylight saving time, subtract one hour on the planisphere to achieve the correct time and the most accurate results. As an example if it is 11 p.m., EDT, set the planisphere for 10 p.m. which would be the correct EST (Eastern Standard Time). Planispheres are also designed for specific latitudes and cannot be altered. If you are planning a trip to Australia, a planisphere purchased for 40 degrees north latitude would be useless in Oz. Also forget about planispheres with glow-in-the-dark stars because they do not work very well, and you will still need a flashlight for illumination. Bookstores like Barnes and Noble always carry a few planispheres on their science shelves. A good online source for planispheres is eBay. My favorite is the huge plastic blue and yellow Levy planisphere, 16 inches in diameter, and can be seen below in the photo to the left. It has black stars against a white background which makes it easier to use at night.



You do not have to purchase a Levy planisphere to be able to dial in the heavens; however, they are considered one of the best planispheres on the market. The four circular planispheres above (one in Spanish) are 16 inches and 11 inches in diameter respectively, and are constructed from rugged plastic. They contain a variety of useful observing information, both on the front side and on the reverse side. The advantage of the larger planisphere is that the information is presented in a larger format; and therefore, it is more readable under nighttime conditions. The larger units, however, are also more difficult to store.



In the picture of the Levy planisphere above, the sky is set for 8 p.m. standard time on March 1 or 9 p.m., February 14, or 10 p.m. January 30. It is also set for 7 p.m. standard time on March 16; however, since most of the US is on daylight saving time by that point, and have jumped ahead by one hour, the sky which the planisphere is representing is really set for 6 p.m. daylight saving time. One hour would have to be subtracted from 7 p.m. daylight saving time to obtain the standard time. Keep in mind that although the sky is being correctly represented for March 16, the stars will not be out since the sun will still be visible in the western sky. **To use the planisphere**, face south and hold the planisphere with the south direction in front of you. Orion the Hunter, Canis Major the Big Dog, and other constellations of the Winter Group would be located in the south.

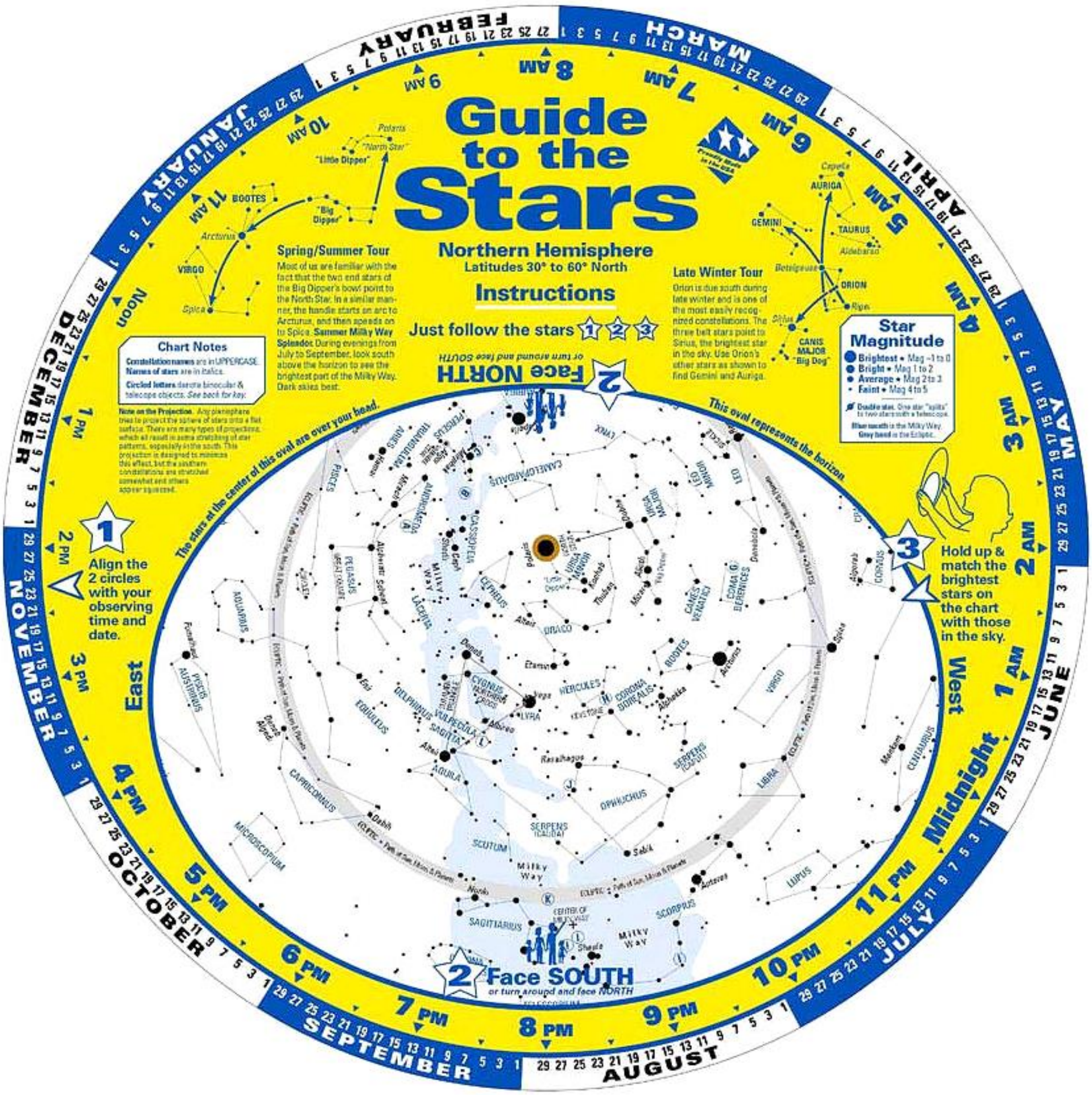


What time will the Corvus the Crow and Leo the Lion be setting? On May 24, as well as any of the dates and times noted, the correct setting time will be one hour before the designated time on the planisphere because virtually all of the United States will be on daylight saving time.

Procedure: On the large Levy planisphere that is pictured below, pick five dates and times when the same sky depicted on the map would be visible to an observer using the device. Note that it does not matter whether it is day or night. For the purposes of this exercise, daylight saving time begins on March 10 and ends on November 30.

1. _February______________ 2. _April_________________ 3. _June__________________

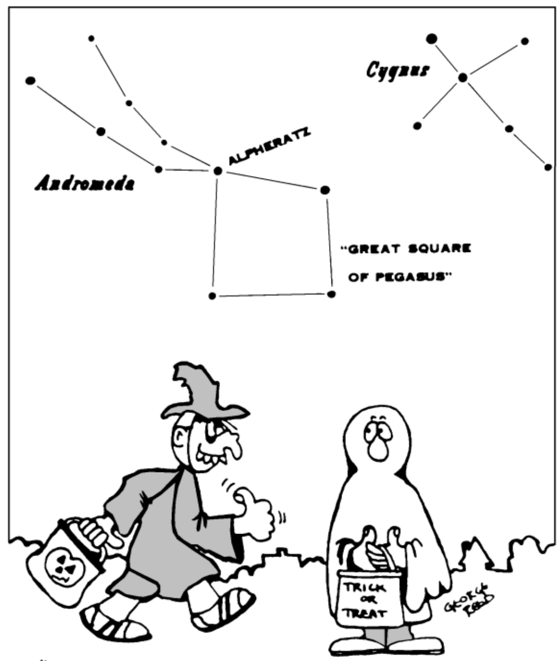
4. _September____________ 5. _December_____________



CONSTELLATIONS: SIGNPOSTS OF THE HEAVENS

Astronomy is one of the few sciences that allows for active participation by the nonprofessional. The night sky is accessible to most individuals, and it is here that an enjoyable start can be made to comprehend the beauty, as well as the history of this oldest science. Unfortunately, in many urban regions the glow of civilization has caused a dimming of our senses toward nature and a decrease in our enthusiasm to look skyward and enjoy the majesty of this natural phenomenon.

The ability of humans to realize that the rhythmic frequencies of the heavens could serve as an accurate time monitoring device allowed for the establishment of agriculture on a more orderly basis, a division of labor among the populace, the functioning of governments, and the eventual blossoming of our technological society. The consistency of the sky, however, has had even greater ramifications than just our own personal refinement. Philosophically, it is our link to the past, for everyone who has lived within the time frame of recorded history has gazed upon the same stars and planets that we can observe today. That is an amazing amount of time by human standards, and because the sky changes so gradually, the stars and their patterns will remain a unifying element to the history of humankind tens of thousands of years into the future.



"SKIP THAT PLACE. HE WANTS TO SHOW YOU CONSTELLATIONS!"

The ancients organized the starry firmament into a series of regions—constellations—representing creatures, deities, and inanimate objects. Knowledge of some of these figures date back almost 5000 years. Many of these divisions were arbitrary in nature. Areas of the sky were marked off to honor a special deity; then attempts were made to produce a representative picture artificially. Even with this capricious attitude, an amazing number of constellations visible to northern hemispheric observers bear striking resemblances to the figures which they are supposed to portray.

And, of course, there was great entertainment value in the sky. Consider the starry firmaments as the original TV set, simple to operate, and requiring no electricity. It had one channel, could only be seen on clear nights, and its program took one year to cycle through in its entirety. Yet its story potential seemed endless as witnessed by the continuation of the use of mythologies today. Consider the popular television programs of *Hercules* and *Xena* (Xena is not a constellation) or movies such as *Clash of the Titans,* and it is obvious that good stories endure.

Unfortunately, the same cannot be said for the southern sky. These regions were unknown to the ancient civilizations and were first delineated by European explorers beginning in the sixteenth century. Many of the star figures deal with items familiar to the technology of that era, such as furnaces (Fornax), compasses (Circinus), air pumps (Antlia), pendulum clocks (Horologium), and telescopes (Telescopium) among others. Needless to say, the people who originated these star patterns did not possess the same richness of imagination as their predecessors, and this may be, in part, one of the reasons why the southern sky does not hold the same appeal as its northern counterpart.

The most important group of constellations known to the ancients were those through which the seven principal deities moved: the sun, the moon, and the five naked eye planets. The Greeks named this region the zodiac (circle of animals), and it was most likely the first zone of the sky to be formalized. Astrology had its origin with the movements of the sun, moon, and planets within this tract, and much of the drama of western mythology, as it is related to the sky, was formulated around these objects.

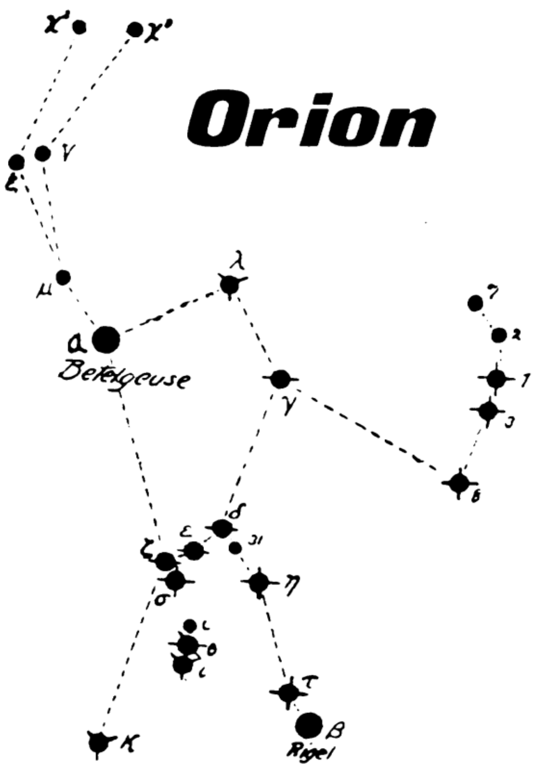
Eighty-eight constellation boundaries encompassing both hemispheres were officially sanctioned in 1928 by the International Astronomical Union, a worldwide congress of professional astronomers. All of the stars within a particular boundary are members of the same constellation, regardless of whether or not they are incorporated into forming the pattern. The constellation pictures have not been standardized which has led to a great deal of variations, depending upon the source. Most modern star atlases simply ignore the problem by only representing the boundaries and not the figures themselves.

To further complicate matters, there are numerous star groupings which are considered to be constellations by the general public, but are not recognized as such by the professional community. The pattern most frequently mistaken for a constellation by Americans is the Big Dipper. It is, in essence, composed of the brightest members of the Great Bear, the constellation of Ursa Major. Such unofficial groupings of stars are termed **asterisms**. The Little Dipper and the Pleiades are two other examples of well-known asterisms often mistaken for constellations.

The reason for standardizing the constellation boundaries has not stemmed from any incentive to memorialize their ancient lore, but rather as a means of rapidly identifying the region of the sky in which an object of interest is located. Since the constellation regions are large with respect to the position of individual objects, there exist more exact methods for accurately positioning a telescope so that an observer can identify a particular star or object. The primary coordinate system which is used by astronomers is termed right ascension and declination. It is earth’s grid system, longitude and latitude, projected into the sky.

Right ascension and declination allow for the precise location of everything in the heavens, and, at the very least, the numerical designation or naming of any celestial object. An example of this might be the location of a star at RA 023150.4; Dec +891551, better known to most individuals as the North Star or Polaris. Brighter stars, such as the Polestar, have proper names, usually Arabic translations, coming originally from the Greek language. There are also Greek and Latin exceptions, and Polaris happens to be one of them. It is an abbreviation from the medieval Latin, Stella Polaris or Pole Star.

With the ascendancy of Islam during the seventh and eighth centuries AD, and its near conquest of Europe, many of the Arabic translations were brought into more common usage by western medieval astronomers. These names have been unofficially adopted by professional and amateur observers. The brightest stars in any one particular constellation also have Greek letter designations as well as Arabic numerals. This really represents a combination of nomenclature systems.



The earliest identification system utilized upper case letters of the Greek alphabet introduced by Johannes Bayer (died 1625) in 1603. With few exceptions, stars received letters in order of descending brightness, followed by the genitive form of the constellation. Polaris, the brightest star in Ursa Minor, the little bear, was designated as alpha Ursa Minoris in Bayer's scheme. Once the 24 characters of the Greek alphabet were exhausted, Bayer repeated the procedure using first lower case letters, then the upper case letters of the Roman alphabet. John Flamsteed (1646-1719) devised an alternate method by which the positions of stars of any constellation were numbered, starting from their westernmost boundaries, in order of their increasing eastward position or right ascension. Today, it is common practice to list the brightest stars of a constellation with Bayer's Greek letters (lower case) and the fainter luminaries by their Flamsteed numbers. This can be seen in the figure of Orion, the hunter to the left.

All of this terminology can become rather confusing, especially when one considers the variety of other objects such as variable stars, galaxies, and clusters which must be properly symbolized and identified on star charts. For the purpose of ***Sky Literacy*** this extra information has been kept to a minimum.

The star maps selected for this unit contain only the brightest stars which are visible from an urban location, away from the direct view of distracting streetlights. The different sized dots are representative of the various magnitudes or brightnesses of the stars. Characteristic stars are designated with numbers on each chart. It should be noted that fainter stars have more positive magnitudes than the brighter stars. A star of the third magnitude is about 2-1/2 times fainter than a second magnitude star, which is about 2-1/2 times fainter than a first magnitude star. The change in light intensity between a first magnitude star and a sixth magnitude star, a difference of five magnitudes, is exactly 100. The average person can observe stars of the sixth magnitude in an environment which is not light polluted. In ***Sky Literacy***, essentially all of the stars plotted on the charts are brighter than fifth magnitude. Each chart is also provided with an approximate scale in degrees. For easy conversion to the sky, a 12-inch ruler held at arm's length is about 30 degrees in length.

For the moment, let us return to the nighttime sky and discover for ourselves the beauty and lore of a few prominent constellations, as well as some of the names of their brightest members. What others might be tempted to call the mysterious may then be revealed to be the same source of simple amusement and joy that once motivated earlier groups of skywatchers to look up and marvel.

CONSTELLATION GAZETTEER

CONSTELLATION	PRONUNCIATION	MAPS	REMARKS
Andromeda	an-DROM-eh-duh	3,4	chained lady
Aquarius	ack-KWAIR-ee-us	none	water carrier
Aquila	ACK-will-lah	2	eagle
Aries	AIR-eez	3	ram
Auriga	or-EYE-gah	4,5	charioteer
Bootes	bow-OH-tees	8	bear driver
Cancer	CAN-sir	7	crab
Canis Major	KAY-niss MAY-jer	6	big dog
Capricornus	kap-rih-CORN-nus	none	sea goat
Cassiopeia	kass-ee-oh-PEE-ya	4	queen of Ethiopia
Centaurus	sen-TOR-russ	none	centaur
Cetus	SEE-tuss	6	sea monster
Coma Berenices	KO-mah bear-en-EYE-sees	7	hair of Berenice
Corona Borealis	kor-OH-nah bo-ree-ALICE	8	northern crown
Corvus	Core-vuss	none	crow
Crux	KRUKS	none	southern cross
Cygnus	SIG-nuss	2	swan
Delphinus	del-FINE-uss	2	dolphin
Draco	DRAY-ko	1	dragon
Eridanus	eh-RID-uh-nuss	6	river
Gemini	GEM-in-eye	5,6	twins
Hercules	HER-kyou-leez	8	strong man
Hydra	HIGH-druh	7	water snake
Leo	LEE-oh	7	lion
Libra	LEE-bra	none	scales
Lyra	LYE-ruh	2	harp
Ophiuchus	off-ih-YOU-kuss	8	serpent holder
Orion	oh-RYE-un	5,6	hunter
Pegasus	PEG-uh-suss	3	flying horse
Perseus	PER-see-us	4,5	hero, rescuer
Pisces	PIE-sees	3,4	fish
Sagitta	sah-GEE-tah	2	arrow
Sagittarius	saj-ih-TAY-rih-us	9	archer
Scorpius	SKOR-pih-uss	9	scorpion
Serpens	SIR-pens	8	snake
Taurus	TOR-russ	5,6	bull
Triangulum	try-ANG-gu-lum	3.4	triangle
Ursa Major	URR-sah MAY-ger	1	great bear
Ursa Minor	URR-sah MY-ner	1	little bear
Virgo	VER-go	7	virgin

STAR GAZETTEER

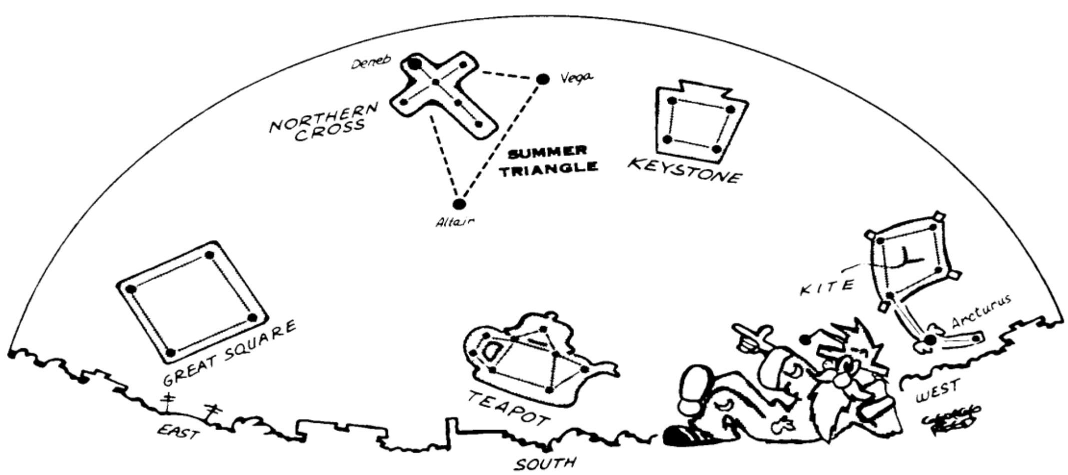
Star Name/ Meaning		Pronunciation	Bayer/Flamsteed Designation	Map(s)	Remarks
Achernar the end of the river	(A)	AK-er-nar	Alpha Eridani	none	9th Br, Dia-5 Dis-85, Lum-300 B5V
Albireo	(?)	al-BIRR-ee-oh	Beta Cygni	2	Double star for binoc. Optical or phy pair? K3II/B8V
Alcor	(A)	AL-cor	80 Ursae Majoris	1	Optical double of Mizar Dis-90, Lum-15, Sp Bin A5V
Aldebaran follower of the Pleiades	(A)	al-DEB-uh-ran	Alpha Tauri	5,6	13th Br, Dia-40 Dis-70, Lum-125 K5III
Algenib the side	(A)	al-JEE-nib	Gamma Pegasi	3	Var Dis-600, Lum-2000 B2IV
Algol demon's head	(A)	AL-gol	Beta Persei	4,5	Ecl Bin, Dia-3 Dis-100, Lum-100 B8V
Alnilam string of pearls	(A)	al-NIH-lam	Epsilon Orionis	6	Dis-1600, Lum-40,000 B0Ia
Alnitak the belt	(A)	al-NIH-tak	Zeta Orionis	6	Double, maybe triple Dis-1600, Lum-35,000 O9Ib
Alpha Centauri	(G)	cen-TAR-ee	Alpha Centauri	none	3rd Br, Double, Dia-1.0/0.9, Dis-4.2 Lum-1.1/0.5 G2V/K0V

Star Name/ Meaning		Pronunciation	Bayer/Flamsteed Designation	Map(s)	Remarks
Alphecca the broken or fractured one	(A)	al-FECK-uh	Alpha Coronae Borealis	8	Sp Bin, Var Dis-75, Lum-45 A0V
Alpheratz the horse's navel	(A)	al-FEE-rats	Alpha Andromedae	3	Sp Bin Dis-120, Lum-160 A0p
Altair the flying eagle	(A)	al-TAIR	Alpha Aquilae	2	12th Br, Dia-1.5 Dis-16, Lum-9 A7V
Antares the rival of Mars	(G)	an-TAIR-ees	Alpha Scorpii	9	15th Br, Dia-500, Red Dis-500, Lum-9000 MIIb
Arcturus the bear guard	(G)	ark-TOO-rus	Alpha Bootis	8	4th Br, Dia-25 Dis-36, Lum-115 K2III
Bellatrix the female warrior	(L)	bell-LAY-trix	Gamma Orionis	5,6	Dis-500, Lum-4000 B2III
Beta Centauri	(G)	cen-TAR-ee	Beta Centauri	none	11th Br, Dia-10 Dis-450, Lum-10,000 B1III
Betelgeuse the armpit	(A)	BETT-el-jews	Alpha Orionis	5,6	10th Br, Var, Dia-700, Dis-500, Lum-10,000 T-3100 M2Ia
Canopus	(G)	kah-NO-pus	Alpha Carinae	none	2nd Br, Dia-30 Dis-120, Lum-1500 A9II
Capella the little she-goat	(L)	kah-PELL-uh	Alpha Aurigae	4,5	6th Br, Spectrum Bin Dis-45, Lum-160 G0III/G0III

Star Name/ Meaning		Pronunciation	Bayer/Flamsteed Designation	Map(s)	Remarks
Castor mortal twin, horseman	(G)	KASS-ter	Alpha Geminorum	5	22nd Br, Sextuplet Dis-45, Lum-36 A1V
Deneb the hen's tail	(A)	DEN-ebb	Alpha Cygni	2	19th Br, Dia-60 Dis-1600, Lum-60,000 A2Ia
Denebola the lion's tail	(A)	de-NEB-oh-la	Beta Leonis	7	Dis-42, Lum-20 A3V
Dubhe the back of the greater bear	(A)	DUE-be	Alpha Ursae Majoris	1	Double, compan Sp Bin Dis-90, Lum-145 KOIII
Eltanin the dragon's head	(A)	el-TAY-nin	Gamma Draconis	1	Var Dis-110, Lum-145 K5III
Epsilon Lyrae		EP-see-lon LYE-ree	Epsilon Lyrae	2,8	Binoc double but really quadruple A3V/A5V
Fomalhaut the mouth of the southern fish	(A)	FOE-mal-ought	Alpha Piscis Austrini	none	18th Br, Dia-2 Dis-23, Lum-14 A3V
Hamal the horn of the butting one	(A)	HAM-el	Alpha Arietis	3,4	Dis-75, Lum-70 K2III
Kochab the north star	(A)	KOE-kab	Beta Ursae Minoris	1	N Star 1500 BC-300 AD Dis-110, Lum-130 K4III
Markab anything on which one is carried, saddle	(A)	MAR-kab	Alpha Pegasi	3	Dis-110, Lum-95 A0III

Star Name/ Meaning		Pronunciation	Bayer/Flamsteed Designation	Map(s)	Remarks
Merak	(A)	ME-rack	Beta Ursae Majoris	1	Dis-80, Lum-65
loins of the greater bear					A1V
Mintaka	(A)	MIN-tak-uh	Delta Orionis	6	Sp Bin, Double Dis-1500, Lum-20,000
belt or girdle					09II
Mirfak	(A)	MIRR-fak	Alpha Persei	4	Dis-600, Lum-4000
the elbow of the Pleiades					F5Ib
Mizar	(A)	MY-zar	Zeta Ursae Majoris	1	Beautiful double, Sp Bin Dis-90, Lum-70
veil, trousers or waist cloth					A2V
Polaris	(L)	pole-AIR-iss	Alpha Ursae Minoris	1	49th Br, Double, Sp Bin Dis-550, Lum-1600, Var
the polestar					F8Ib
Pollux	(G)	POLL-lux	Beta Geminorum	5,7	17th Br, Dia-4 Dis-35, Lum-35
immortal twin					K0III
Procyon	(G)	PRO-see-on	Alpha Canis Minoris	5	8th Br, Double Dis-11.3, Lum-6
before the dog, i.e., Sirius					F5IV
Rasalhague	(A)	RAS-el-hay-gwee	Alpha Ophiuchi	8	Dis-60, Lum-40
serpent charmer					A5III
Regulus	(L)	REG-you-luss	Alpha Leonis	7	21st Br, Triple, Dia-5 Dis-85, Lum-160
the prince					B7V
Rigel	(A)	RYE-jell	Beta Orionis	6	7th Br, Triple, Dia-50 Dis-900, Lum-60,000
Orion's left foot					B8Ia

Star Name/ Meaning		Pronunciation	Bayer/Flamsteed Designation	Map(s)	Remarks
Saiph sword of the powerful one	(A)	SAFE	Kappa Orionis	6	Dis-1250, Lum-25,000 B1Ia
Scheat the leg	(A)	SHEE-at	Beta Pegasi	3	Var, Dia-145, T-3100 Dis-210, Lum-370 MII-III
Sirius the scorching one	(G)	SEER-ee-us	Alpha Canis Major	6	1st Br, Double, 5th Nr Dis-8.8, Lum-23 A1V
Spica the ear of corn	(L)	SPY-ka	Alpha Virginis	8	16th Br, Sp Bin, Var Dis-220, Lum-1500 B1V
Thuban dragon	(A)	THEW-ban	Alpha Draconis	1	Polestar 3700-1500 BC Dis-215, Lum-135 A0III
Vega falling eagle or vulture	(A)	VEE-guh	Alpha Lyrae	2	5th Br, Dia-3.5 Dis-26, Lum-58 A0V



Asterisms of the Summer Sky

ABBREVIATIONS

A: From the Arabic

Br: The brightness rank of the star as compared to Sirius, the brightest star of the nighttime sky

Compan: Companion

Dia: The diameter of the star compared to the sun which is equal to one. The true diameter of the sun is equal 864,000 miles (1.4 million km).

Dis: The distance measured to the star in light years. A light year is the distance that light travels in one year-- 5.8 trillion miles (9.3 trillion km).

Double: The star is double, meaning that it has a gravitationally bound companion. There are also triple, quadruple, quintuple, sextuple, and even greater numbered multiple star systems.

Ecl Bin: A binary star system which is variable in its light output because the two stars undergo mutual eclipses with one another.

G: From the Greek

L: From the Latin

Lum: The luminosity or total energy radiated from a star per second as compared to the sun which is equal to one. The true luminosity of the sun is equal to 3.86×10^{33} $^{erg}/_{sec}$.

Nr: Designates the nearness of the star to the sun. The Alpha Centauri star system is the closest one to our sun, 4.3 light years distant.

P: From the Persian

Sp Bin: The star is a spectroscopic binary, i.e., a double star, but its binary nature cannot be inferred through direct visual observations. Instead, the orbital motions of the components about their common center of mass, causes the spectral lines of each star to be rhythmically Doppler-shifted back and forth. The system is thus revealed.

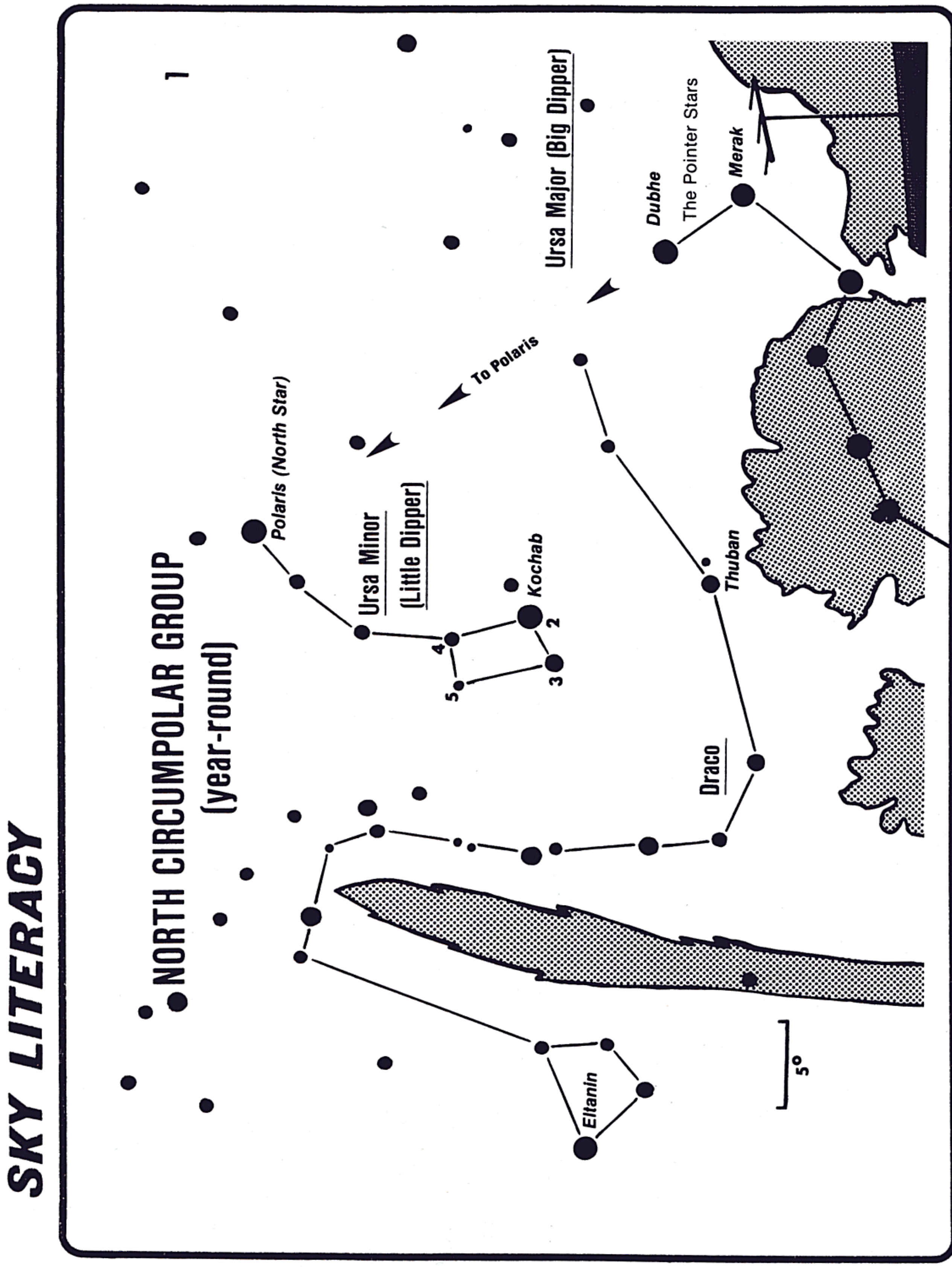
Spectrum Bin: The star is a spectrum binary. The spectrum of what visually appears to be a single star displays the spectral characteristics of two stars with different temperatures, thus revealing its duplicity.

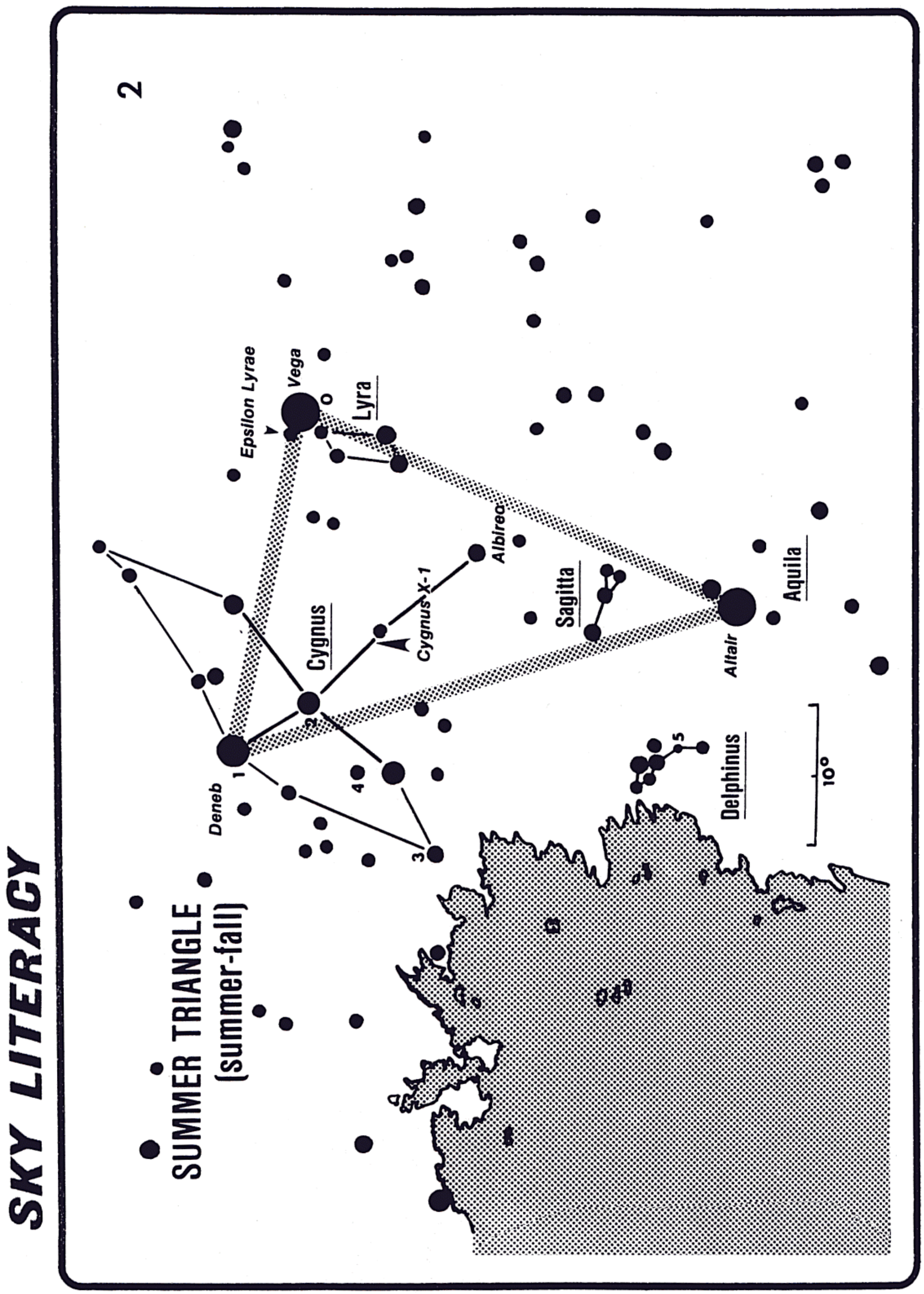
T: The temperature of the star measured in the absolute (Kelvin) scale. An approximate conversion to Fahrenheit is to multiply the Kelvin temperature by two. Exactly, Fahrenheit = (temp in K - 273) x 1.8 + 32).

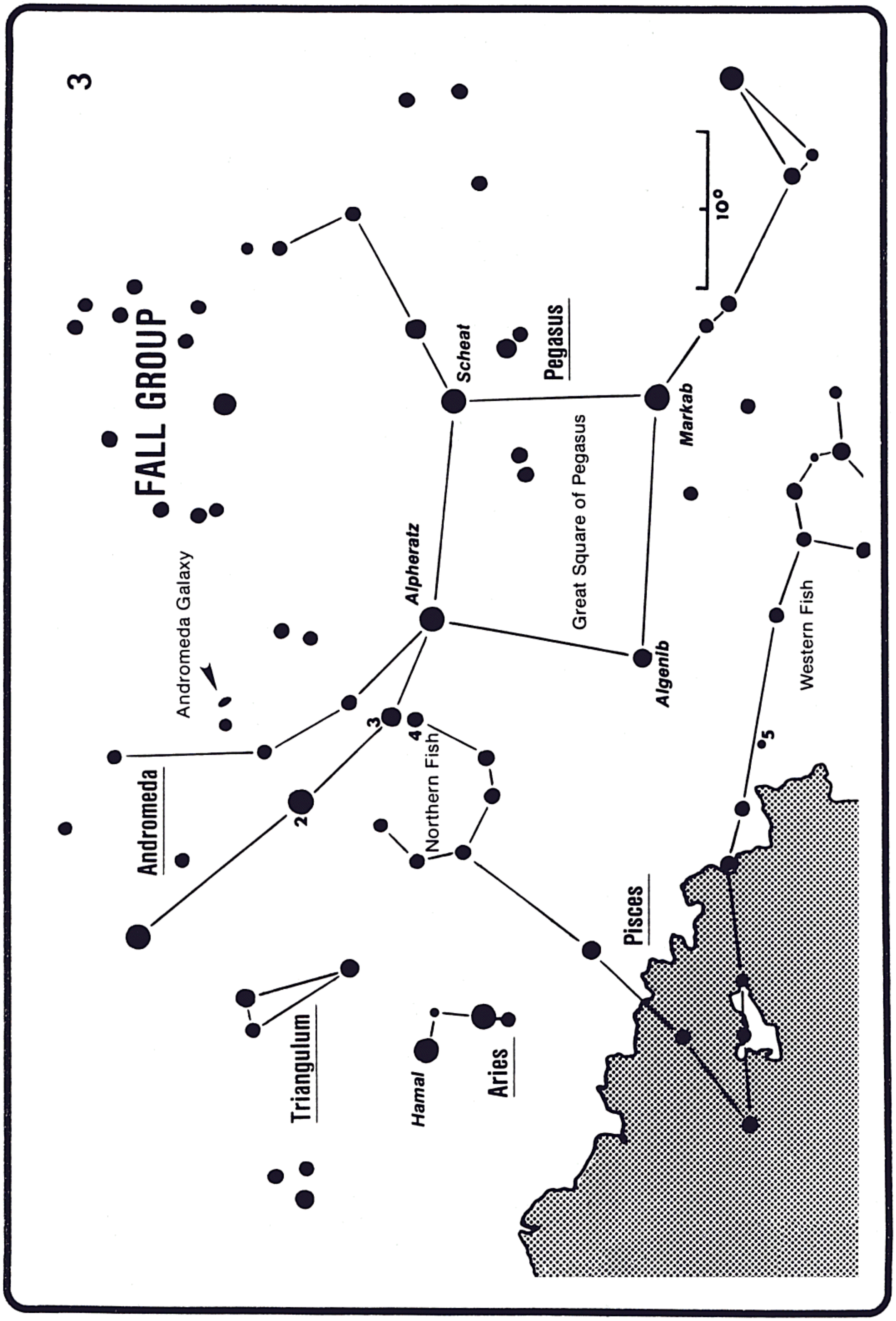
Var: The light intensity of the star is intrinsically variable; its fluctuations are caused by inconsistencies in the star's energy producing mechanisms.

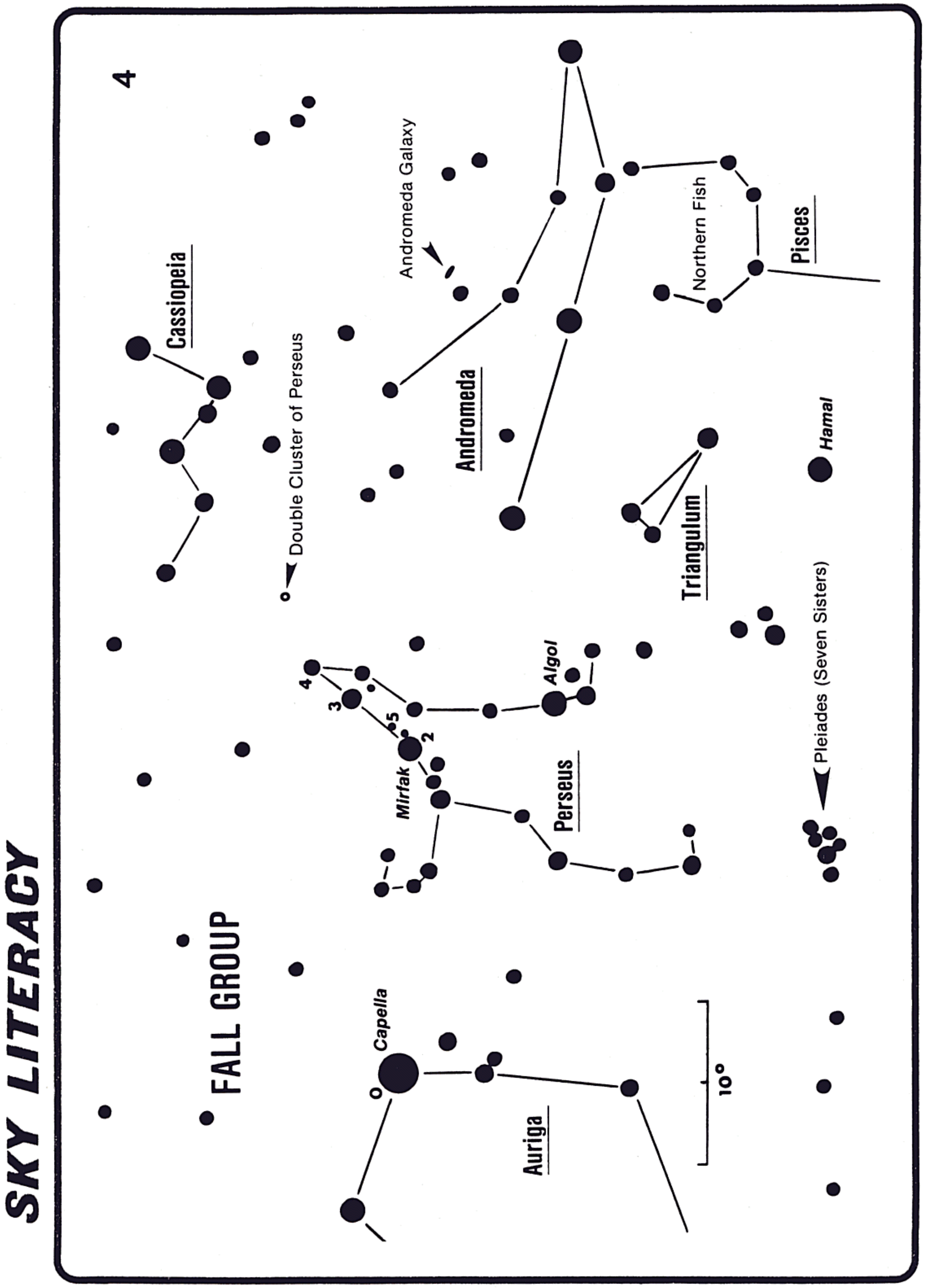
The letters and numbers at the very end of each star's data entry in the "Remarks" column, represent the spectral and luminosity classifications of that star.

August 4, 2020

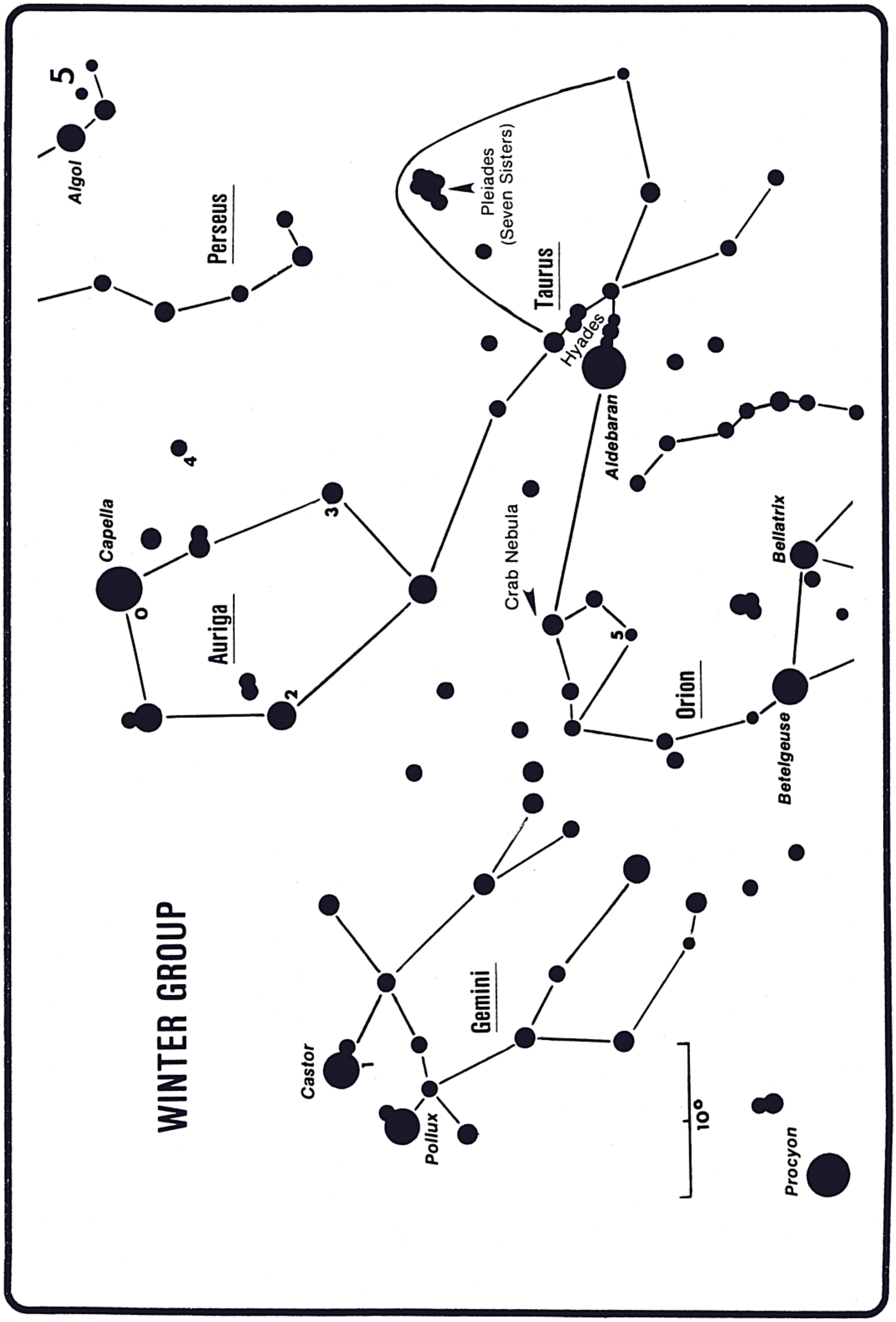

SKY LITERACY
NORTH CIRCUMPOLAR GROUP
(year-round)
1
Polaris (North Star)
Ursa Minor
(Little Dipper)
Kochab
2
3
4
5
To Polaris
Ursa Major (Big Dipper)
Dubhe
The Pointer Stars
Merak
Thuban
Draco
Eltanin
5°

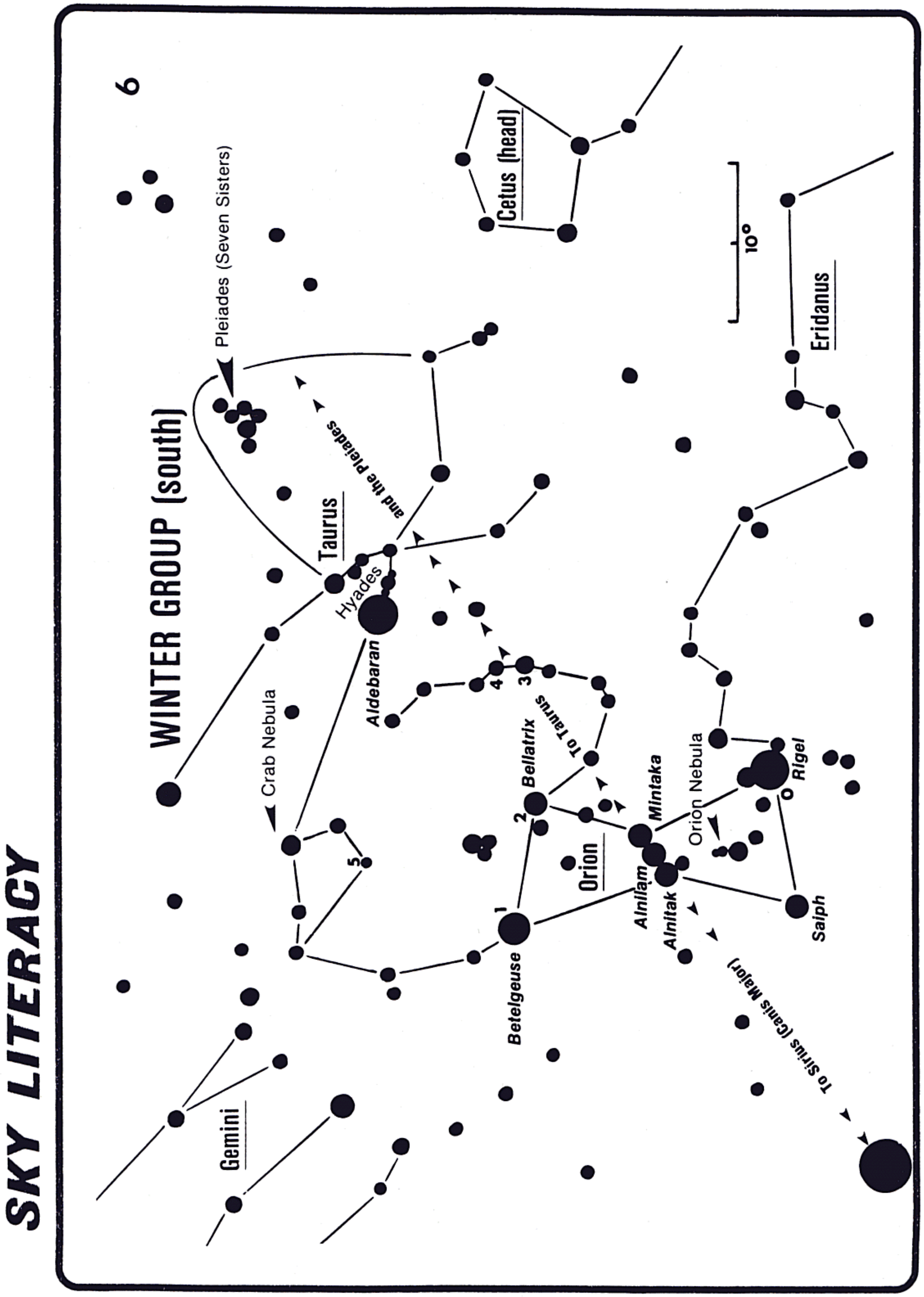

SKY LITERACY
2
SUMMER TRIANGLE
(summer-fall)
Deneb
Epsilon Lyrae
Vega
Lyra
Cygnus
Cygnus X-1
Albireo
Sagitta
Aquila
Altair
Delphinus
10°

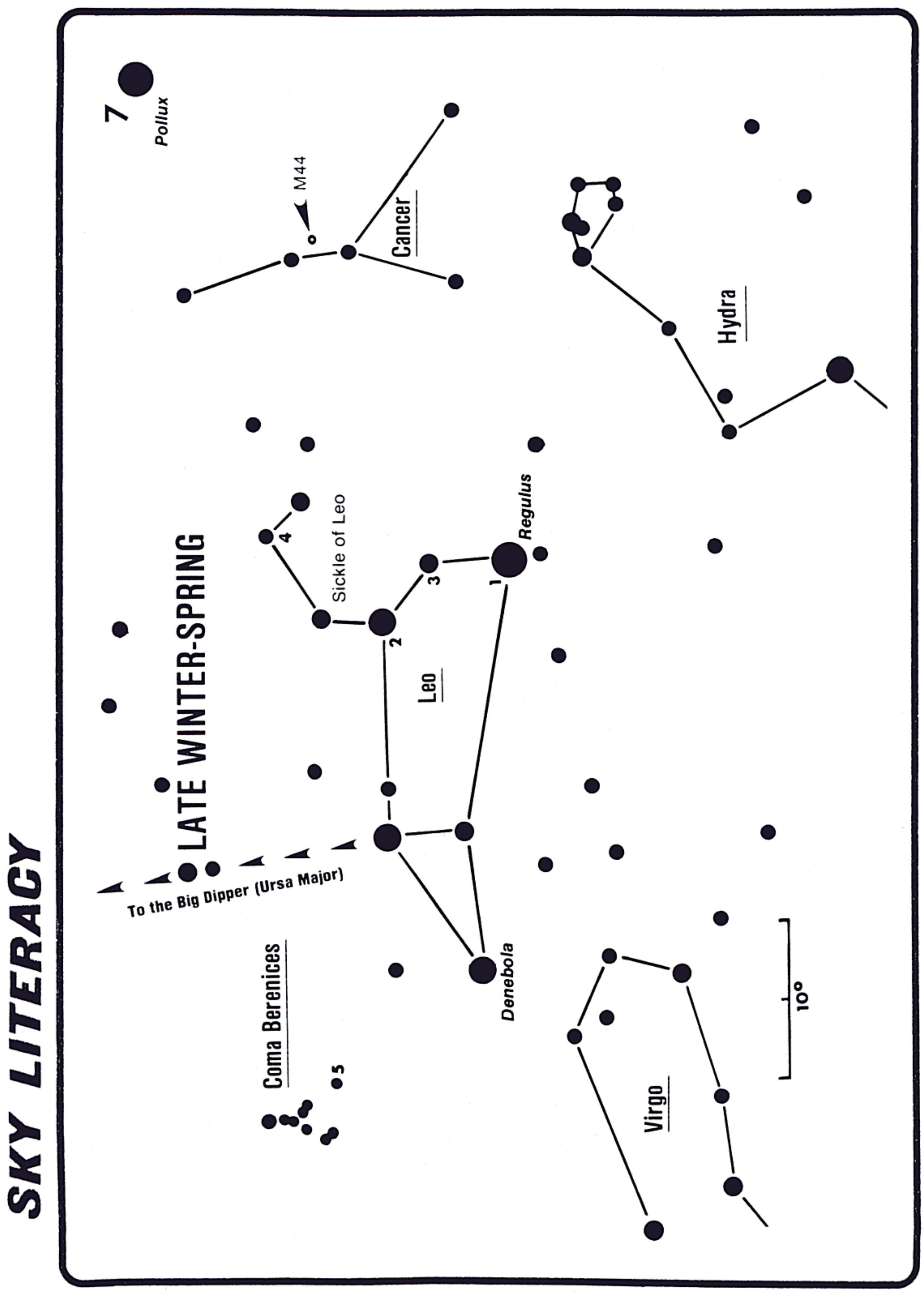

SKY LITERACY
3
FALL GROUP
Andromeda
Andromeda Galaxy
Alpheratz
Scheat
Pegasus
Great Square of Pegasus
Markab
Algenib
10°
Western Fish
Northern Fish
Pisces
Triangulum
Hamal
Aries

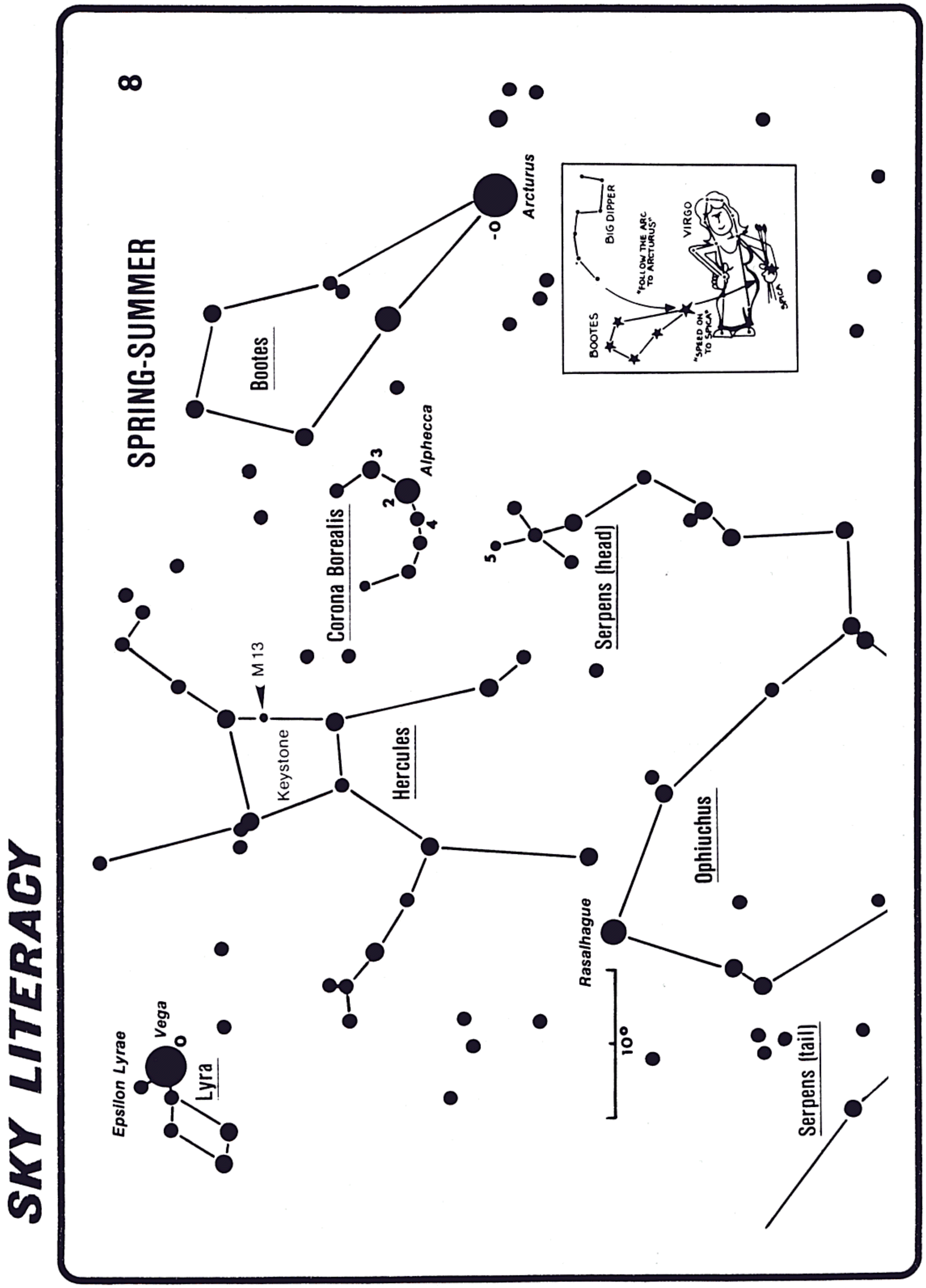

SKY LITERACY
4
FALL GROUP
Cassiopeia
Andromeda Galaxy
Double Cluster of Perseus
Andromeda
Northern Fish
Pisces
Hamal
Triangulum
Pleiades (Seven Sisters)
Algol
Perseus
Mirfak
Capella
Auriga
10°

SKY LITERACY

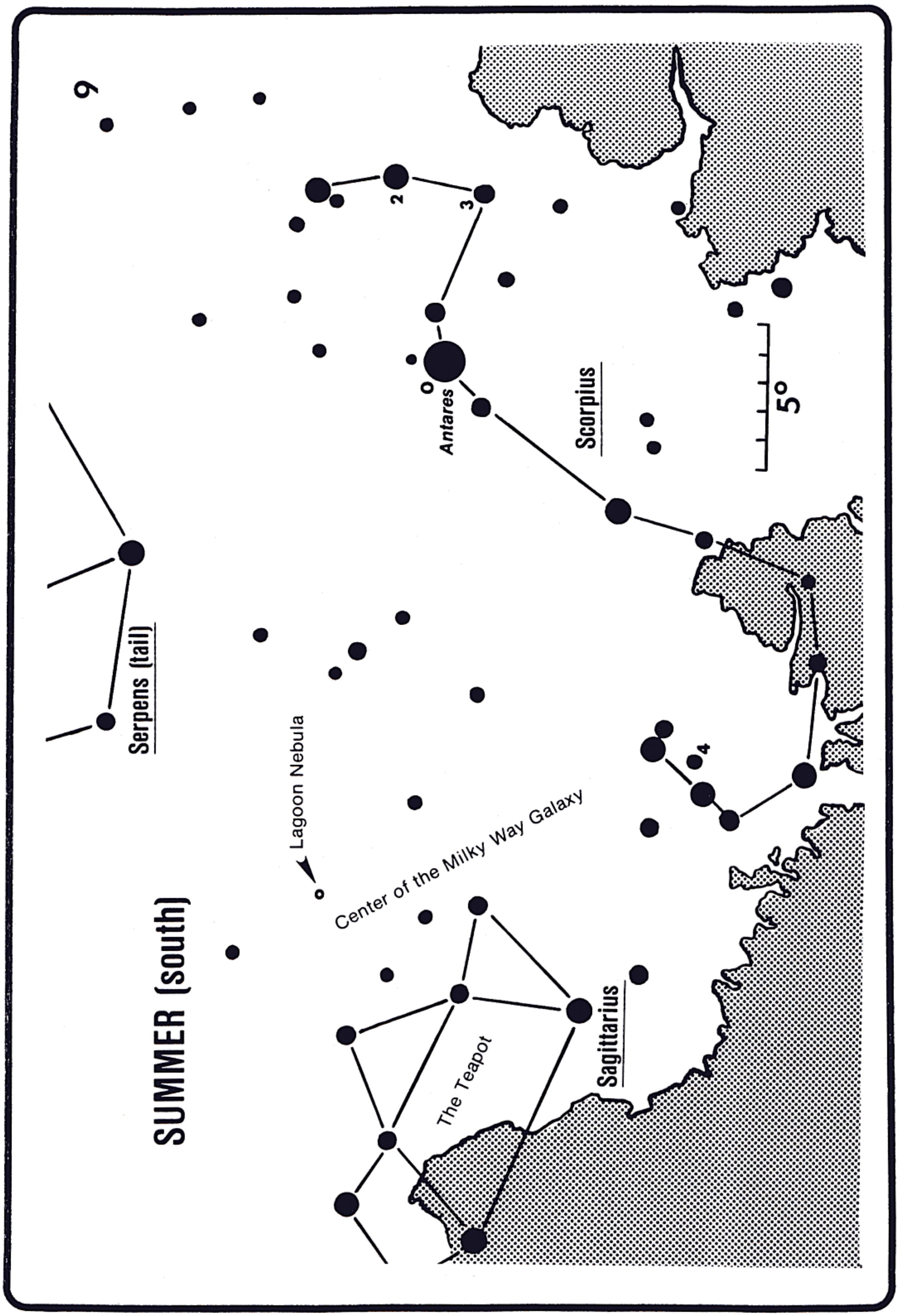



SKY LITERACY
6
WINTER GROUP (south)
Pleiades (Seven Sisters)
and the Pleiades
Taurus
Hyades
Aldebaran
Crab Nebula
Cetus (head)
10°
Eridanus
To Taurus
Bellatrix
Mintaka
Orion Nebula
Rigel
Orion
Alnilam
Alnitak
Saiph
Betelgeuse
To Sirius (Canis Major)
Gemini
1
2
3
4
5


SKY LITERACY
LATE WINTER-SPRING
7
Pollux
M44
Cancer
Hydra
Sickle of Leo
Regulus
1
2
3
4
Leo
To the Big Dipper (Ursa Major)
Coma Berenices
5
Denebola
Virgo
10°


SKY LITERACY
SPRING-SUMMER
8
Bootes
Arcturus
-0
Corona Borealis
Alphecca
2
3
4
5
Serpens (head)
M13
Keystone
Hercules
Ophiuchus
Rasalhague
10°
Serpens (tail)
Epsilon Lyrae
Vega
0
Lyra
BIG DIPPER
"FOLLOW THE ARC TO ARCTURUS"
VIRGO
BOOTES
"SPEED ON TO SPICA"
SPICA

SKY LITERACY



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