



# Navigating by the Stars

---

Planetarium Reserved lab – Teacher's Guide

## PROGRAM OUTLINE

---

**Description:** In this lab, we travel far away from city lights to have our own star party – a get-together to appreciate the wonders of the sky! We'll learn that these constellations are not only patterns in the sky, but methods of communication, navigation, and timekeeping. We'll begin by finding the Big Dipper and learning some of the patterns different cultures created with the same stars. We'll learn how to find the North Star and use it for navigation, then find out how to use a star map, an indispensable tool for touring the night sky, and put our skills to the test by working in groups to find constellations visible in the current night sky.

**Activities:** Learning to use a star map to navigate around the night sky.

## LEARNING OBJECTIVES

---

- Understand that constellations are patterns in the stars created by people.
- Learn that there are different stories about the stars, but that everyone in a given culture generally agrees on a single figure for each star pattern that is thought to be important.
- Learn how to find the cardinal directions using the stars, and learn why the North Star points north.
- Understand how and why the appearance of the sky changes throughout the night, throughout a year and over thousands of years.
- Learn to use a star map to find constellations and become familiar with the night sky.

**Process Skills Focus:** Inquiry, observation and communication.

**Topics:** Constellations, star patterns, star map, celestial navigation, Greek myth, dark sky.

## ABOUT THE PLANETARIUM LABS

---

OMSI's Kendall Planetarium launched a new programming initiative in autumn 2011 of five Planetarium Reserved Labs, researched, written and programmed by OMSI Planetarium staff. These 50 minute interactive experiences are available by reservation for school and community groups of all ages. The unique immersive environment of the planetarium is fully utilized during a Lab to engage students in participatory astronomy and space science education, encouraging discovery through hands-on learning.

OMSI's Kendall Planetarium is the most technologically advanced planetarium in the Pacific Northwest and hosts over 100,000 OMSI visitors annually. We strive to create an inspiring and unique visitor experience through the novel and immersive environment of the planetarium theater. Fully integrated within OMSI's mission, the Planetarium offers a cutting-edge variety of educational and entertaining multimedia presentations on astronomy and space science, as well as a diverse catalog of laser light programs.

For more information about the *Navigating by the Stars* Lab, the *Navigating by the Stars* Teacher's Guide and/or other Planetarium Reserved Labs, please contact **Marguerite Moore, Senior Space Science Educator**, at [mmoore@omsi.edu](mailto:mmoore@omsi.edu) or by phone at 503.797.4503.

To book a Planetarium Reserved Lab for your class or group, please contact **OMSI Program Sales** at [register@omsi.edu](mailto:register@omsi.edu) or by phone at 503.797.4661.

## SOURCES

---

The information and activities presented in the *Constellations Tonight* Teacher's Guide have been adapted for use and distribution by OMSI from the following:

- *Constellations Tonight*, from the Planetarium Activities for Student Success (PASS) series, developed by the Lawrence Hall of Science at the University of California, Berkeley. ©2008 by the Regents of the University of California.
- NASA's The Space Place. <http://spaceplace.nasa.gov/>

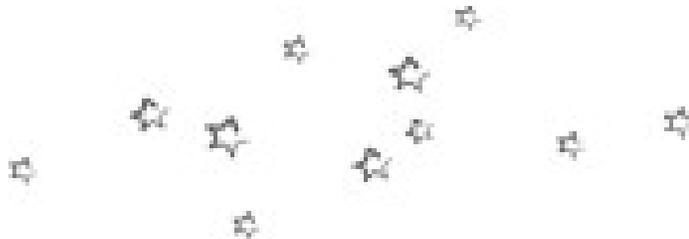
**GLOSSARY**

- Constellation:** An arbitrary formation of stars perceived as a figure or design. The International Astronomical Union defines a constellation by boundary lines, indicated by sky coordinates, around the shape of the star pattern; there are 88 such designated constellations.
- Asterism:** A pattern or shape of stars that is not a whole constellation, but is rather part of a constellation. An example of an asterism is the seven bright stars in the constellation Ursa Major known as the Big Dipper.
- Light pollution:** Urban sky glow caused by manmade lighting.
- Cardinal directions:** The four principle compass points North, East, South and West, often denoted by their initials, N, E, S, W. These can be easily remembered using a mnemonic such as “Never Eat Soggy Waffles”.
- Celestial navigation:** The art and science of navigating by noting positions of the stars, Sun, Moon, and planets.
- Star map / star chart:** A map of the night sky used to identify and locate astronomical objects such as stars, constellations and galaxies.
- Horizon:** The apparent boundary between the Earth and the sky as seen by an observer.
- Zenith:** The point on the celestial sphere that is directly above the observer.
- Star hopping:** A technique that is often used by amateur astronomers of using bright stars and familiar constellations/star patterns as a guide to finding fainter objects and more obscure constellations/star patterns.
- Orbit:** The path of an object around another body.

**POST-VISIT QUIZ**

*Check your comprehension of the planetarium show!*

- 1) Why is it better to observe the night sky in a place that is far away from city lights?
  
- 2) The Big Dipper is a grouping of stars called an \_\_\_\_\_. It is not a whole constellation, but is located within the constellation of Ursa Major.
  
- 3) What direction does Polaris indicate?
  
- 4) The place where the sky appears to meet the Earth is called the \_\_\_\_\_.
  
- 5) Circle the names of constellations from the list below:  
 Polaris      Ursa Major      Moon      Orion      Zenith
  
- 6) All of the stars in the night sky are located within our own galaxy. The name of our galaxy is the \_\_\_\_\_ galaxy.
  
- 7) The stars in the sky appear to move during the night. Is this motion caused by the stars moving or rather the Earth turning?
  
- 8) Draw your own constellation that uses some of the stars below. Also, write a few sentences to explain the story of your constellation.



This constellation, called \_\_\_\_\_, has the following story:

**OREGON  
STANDARDS**

---

**Scientific Inquiry Standards:**

- K.3S.1 Explore questions about living and non-living things and events in the natural world.
- K.3S.2 Make observations about the natural world.
- 1.3S.2 Record observations with pictures, numbers, or written statements.
- 1.3S.3 Describe why recording accurate observations is important in science.
- 2.3S.2 Make predictions about living and non-living things and events in the environment based on observed patterns.

**Engineering Design Standards:**

- 1.4D.3 Show how tools are used to complete tasks every day.
- 2.4D.3 Describe an engineering design that is used to solve a problem or address a need.

**Earth and Space Science Content Standards:**

- K.2E.1 Identify changes in things seen in the sky.
- H.2E.3 Describe how the universe, galaxies, stars, and planets evolve over time.

**Physical Science Content Standards:**

- K.2P.1 Examine the different ways things move.

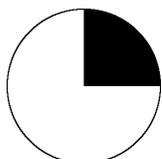
## SUGGESTED CLASSROOM ACTIVITIES

# Make a Star Finder

*Description:* In this activity, students become familiar with the night sky by learning the constellations visible each month.

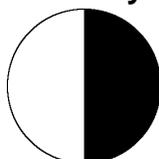
## TIME REQUIRED

### Advance Preparation



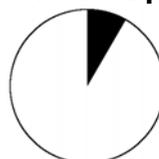
15 minutes

### Activity



30 minutes

### Clean Up



5 minutes

## SUPPLIES

- Planisphere materials for each student (2 pages, copied below)
- Scissors
- Markers, colored pencils, etc. (optional, for decoration)

## ADVANCE PREPARATION

- Print out the Planisphere materials for each student (one Sky Wheel Holder and one sheet of Basic Constellations). Cut out the Sky Wheel, since some of the cuts may be difficult for students to do:
  - Start by folding the paper along the horizontal dashed line so that the "Instructions for Using Uncle Al's Star Wheel" are visible.
  - Cut out the Sky Wheel along the dashed line near the top of the page.
  - Cut out the ellipse on the Sky Wheel along the dashed line.
  - Tape or staple the folded part of the page the rest of the page to form a pocket.

## ACTIVITY

- Instruct the students to color the Basic Constellations page. It's useful to point out several key asterisms and constellations: the Big Dipper, Orion, and Pegasus the horse. Have the students highlight these groupings of stars. The students should also focus on the position of Polaris the North Star and might perhaps put a red "X" on the page at the position of Polaris.
- Have the students cut out their Basic Constellations page along the dotted black line.
- Instruct the students to place the Basic Constellations page inside of the pocket on the Sky Wheel page.
- By lining up the date and the time that you're looking at the night sky, you'll be able to see what's visible!
- Challenge the students to figure out if the constellation Orion is visible in the winter or in the summer (it's visible in the winter).

## Create Your Own Constellation

---

*Description:* In this activity, students use their imaginations to create their own constellation by drawing a pattern from the stars on a blank star map. Students then give their constellation a name and write a story about it. Encourage students to share their designs and stories with each other, perhaps even presenting to the class.

*If time allows, part of this activity is completed during the Constellations Tonight lab. In this case, students will take home the constellation they created during the lab, and can name and write a story about it in class.*

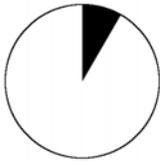
### CROSS-CURRICULAR CONNECTIONS

---

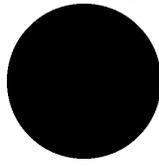
This activity can be used with science lessons and language arts lessons. It involves the stage of scientific thinking in which many different ideas, or hypotheses, are generated. Students should be reminded that each individual's design and story is a valid creation and interpretation. There is no "one correct answer" to this situation – emphasize that sometimes several different ideas can be equally good solutions to the same problem.

### TIME REQUIRED

---

**Advance Preparation**

5 minutes

**Activity**

60 minutes

**SUPPLIES**

- Blank star map
- Pencils
- Notebooks (for story writing)

**ADVANCED PREPARATION**

- Print out one star map for each student.

**ACTIVITY**

- Study the star map. Look for patterns and shapes that could be formed by the dots. Be creative! Think of things or people that are important or interesting to you. Remember, cultures created constellations based on stories, histories and events that were important to them in their time
- Using your pencil, connect the dots and outline the pattern or patterns that you see. Use curvy lines and straight lines. You can make big patterns, or small patterns. Use lots of stars, or just a few stars.
- Once you have drawn your constellation, give it a name.
- Write a short story about your constellation.

**CLASS DISCUSSION**

- Invite a few students to share their constellations and stories with the class, ***or***
- Break students into small groups to discuss their constellations.

Sample questions for discussion:

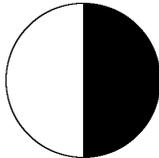
- Are there similarities between anyone's constellation patterns? Did anyone draw the same shape(s)?
- Which stars did you choose to use, and why?
- How did you come up with your story?
- Are there similarities between anyone's stories? Why do you think that might happen?

## Directions Game and Mapping the Classroom

*Description:* This activity helps students improve their ability to use maps. The setting of the classroom provides an opportunity for students to understand familiar surroundings in new ways, by measures of “direction” and “distance”. Students will describe and find locations in the classroom and create a map of the classroom.

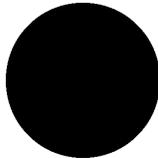
### TIME REQUIRED

#### Advance Preparation



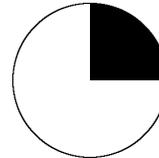
15-30 minutes

#### Activity



60-75 minutes

#### Clean Up



15 minutes

### SUPPLIES

- Pencils
- Classroom Map worksheet – one per student (included below)

### ADVANCED PREPARATION

Label the four walls of your classroom with paper signs marked with the four primary compass directions. These need not correspond to the actual compass directions. However, a person facing “North” should be able to see “East” to the right, “West” to the left, and “South” to the rear.

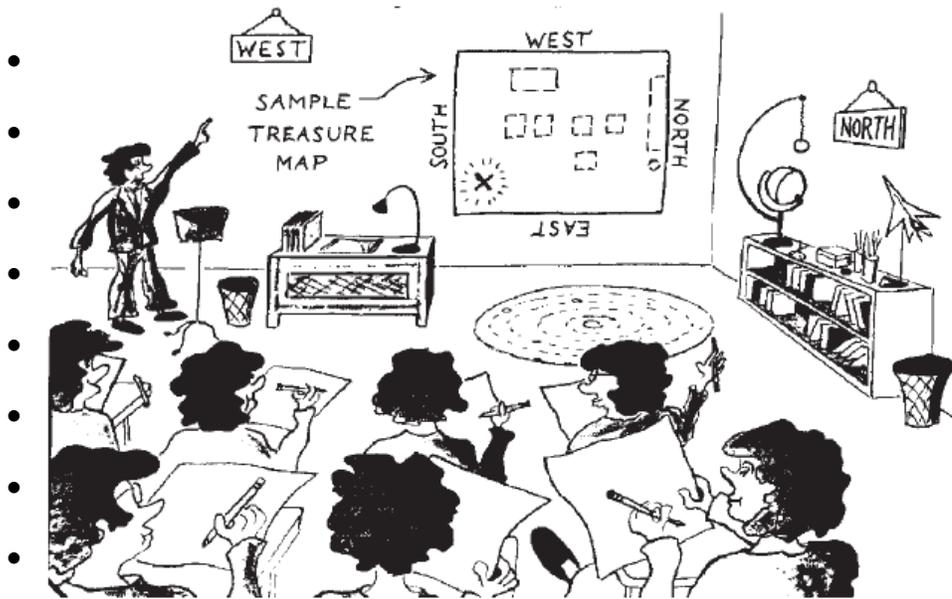
You may need to recreate the Classroom Map worksheet, depending on the shape of your classroom.

## ACTIVITY

### ***Part A: The Directions Game***

- Point out the four signs on the walls of the classroom that indicate the primary compass directions: North, East, South and West. Ask questions such as “what direction would I need to look to see Northeast? Southeast?” to test student’s understanding of the system of compass directions. Once the students are accustomed to the layout of directions in the classroom, the main activity begins.
- Choose a volunteer. Have this volunteer stand in the center of the classroom and face AWAY from the blackboard (or white board, or projector, etc).
- On the blackboard, write the name of some object in the classroom (e.g. “George’s desk”, “whale poster”) so that everyone but the volunteer can see it. This object should be within the line of sight of the volunteer. Let everyone read it, then erase it.
- Instruct the class that they are now going to help the volunteer find the object by looking around, by giving the volunteer information about the DIRECTION they should turn, and HOW FAR they must look to locate the chosen object. For example, they might tell the volunteer to “look Northeast, about halfway to the wall. \*\*Choose one person at a time to provide information to the volunteer\*\*
- If the volunteer is unable to find the object on the first try, encourage the students to give descriptive clues about the object, but not to name the object. Let the students use whatever strategies they can think of (like giving the size, shape or color of the object).
- Repeat this activity with new participants, until students become very familiar with describing location by DIRECTION and DISTANCE.

### Part B: Mapping the Classroom



- Start to draw a map of the classroom on the blackboard – label the four primary directions and draw in the location of your desk.
- Ask the students, “If a stranger who has never been to our classroom before saw this map, how would they use it to find my desk?” This first problem references their learning from the Directions Game. If they have trouble transferring their understanding, help them by drawing an arrow from the center of the map to the location of the desk, and ask what the stranger would do if they stood at the center of the classroom.
- Hand out the Classroom Map worksheet, and tell students that now that they understand how to use directions and distance to locate things on a map, they are now to complete the map of the classroom.
- Have them copy down the location of your desk for reference. Instruct them to draw all of the things that rest on the floor- tables, chairs, desks, and anything else they deem important. Remind them to make sure the directions on the maps correspond to the directions in the classroom, and that the distances are about right.
- Be on hand to help students as needed. Encourage them to share their maps with each other, to get ideas and compare and criticize.
- Once they are done, have them exchange maps with a partner. Ask each pair to compare and contrast their maps.

- Ask students to return their maps to their owner. Allow them an opportunity to improve their maps, if necessary, to make them more useful to someone who has never seen the classroom before.
- Next, have students plant a “treasure” somewhere in the room, by marking the spot with an “X” on the map.
- Again, have students trade maps with a partner and try to find each other’s “treasure”.

\*\*\*NOTE: To adapt this activity for older students, use a larger portion of the school ground, rather than just the classroom.\*\*\*

## RESOURCES

### **NASA Education**

<http://www.nasa.gov/offices/education/about/index.html>

### **YouTube: Space Lab**

<http://www.youtube.com/spacelab>

### **Zooniverse – Real Science Online**

<https://www.zooniverse.org/>

### **Astronomy for Kids – Constellation Hunt**

[http://www.kidsastronomy.com/astroskymap/constellation\\_hunt.htm](http://www.kidsastronomy.com/astroskymap/constellation_hunt.htm)

### **International Astronomical Union – The Constellations**

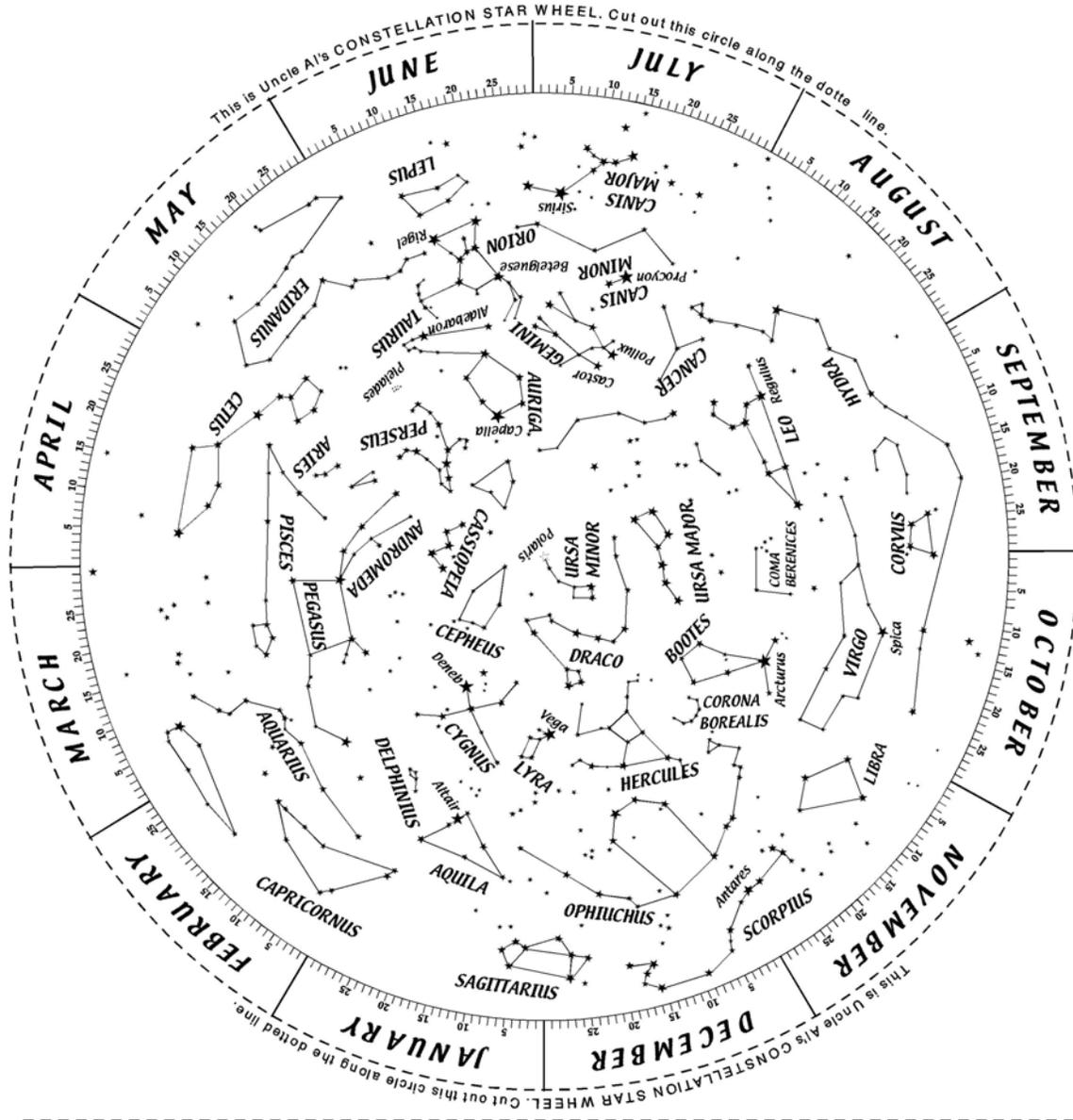
<http://www.iau.org/public/constellations/>

### **The Evening Sky Map**

<http://skymaps.com/>

### **Portland Clear Sky Chart**

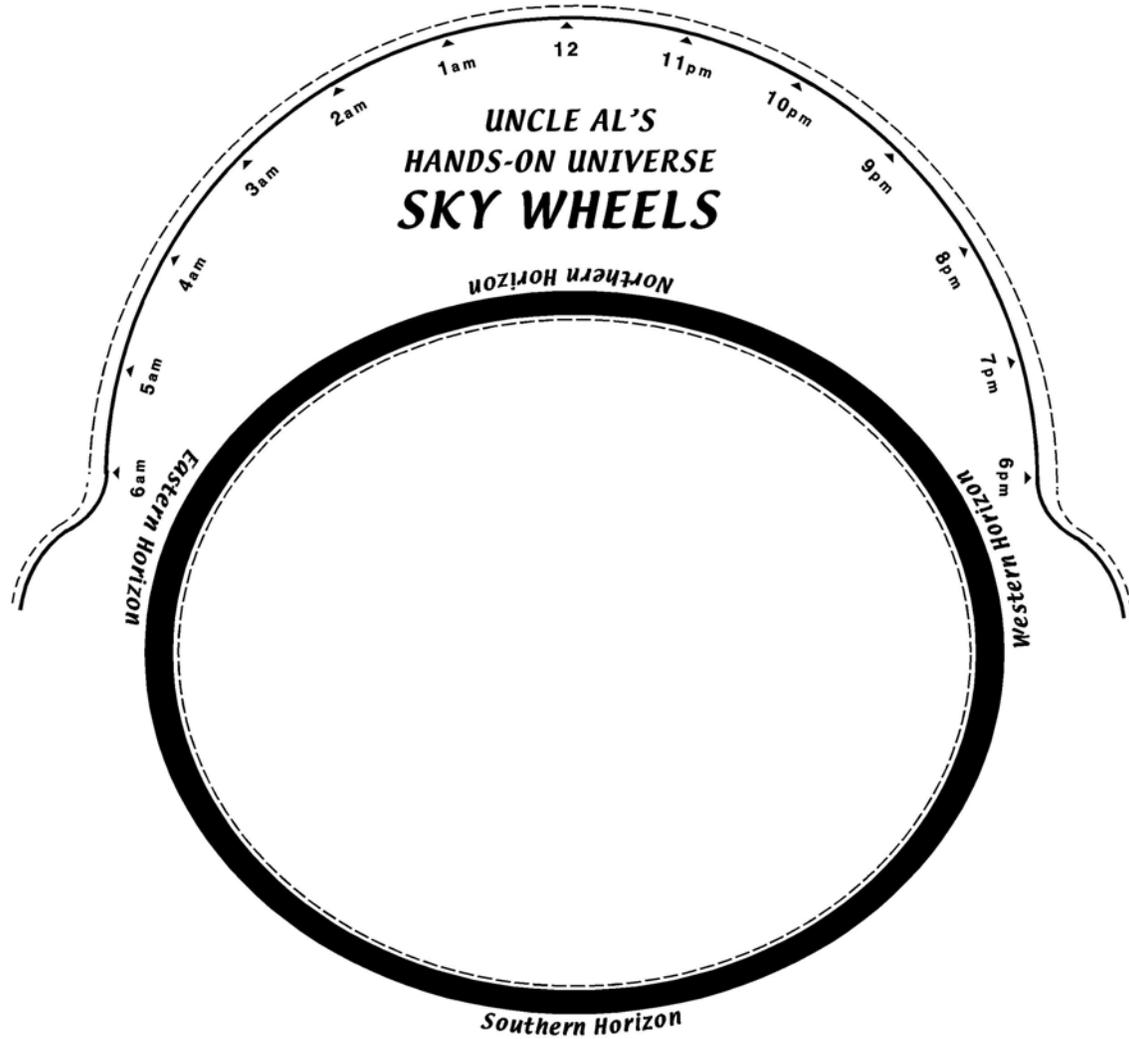
<http://cleardarksky.com/c/PortORkey.html>



**INSTRUCTIONS FOR ASSEMBLING UNCLE AL'S STAR WHEELS**

- Step 1:** Print out all pages. Paste them onto a file folder or any other sturdy piece of paper or cardboard.
- Step 2:** Cut along all the black dashed lines on the Star Wheel and Star Holder printouts. On the "Star Holder" remove the interior of the oval shape and the cardboard above the hour labels
- Step 3:** On the "Star Holder", fold the cardboard along the dotted line.
- Step 4:** Tape or staple the edges together forming a pocket.
- Step 5:** Take your printed and trimmed star-wheel, and place it inside your newly made STAR HOLDER.

Uncle Al's HOU Sky Wheels are based on LHS Sky Challengers created by Budd Wentz and available through LHS Museum Store. (510) 642-1016 <http://www.lhs.berkeley.edu/pass/ast110&111&121.html>

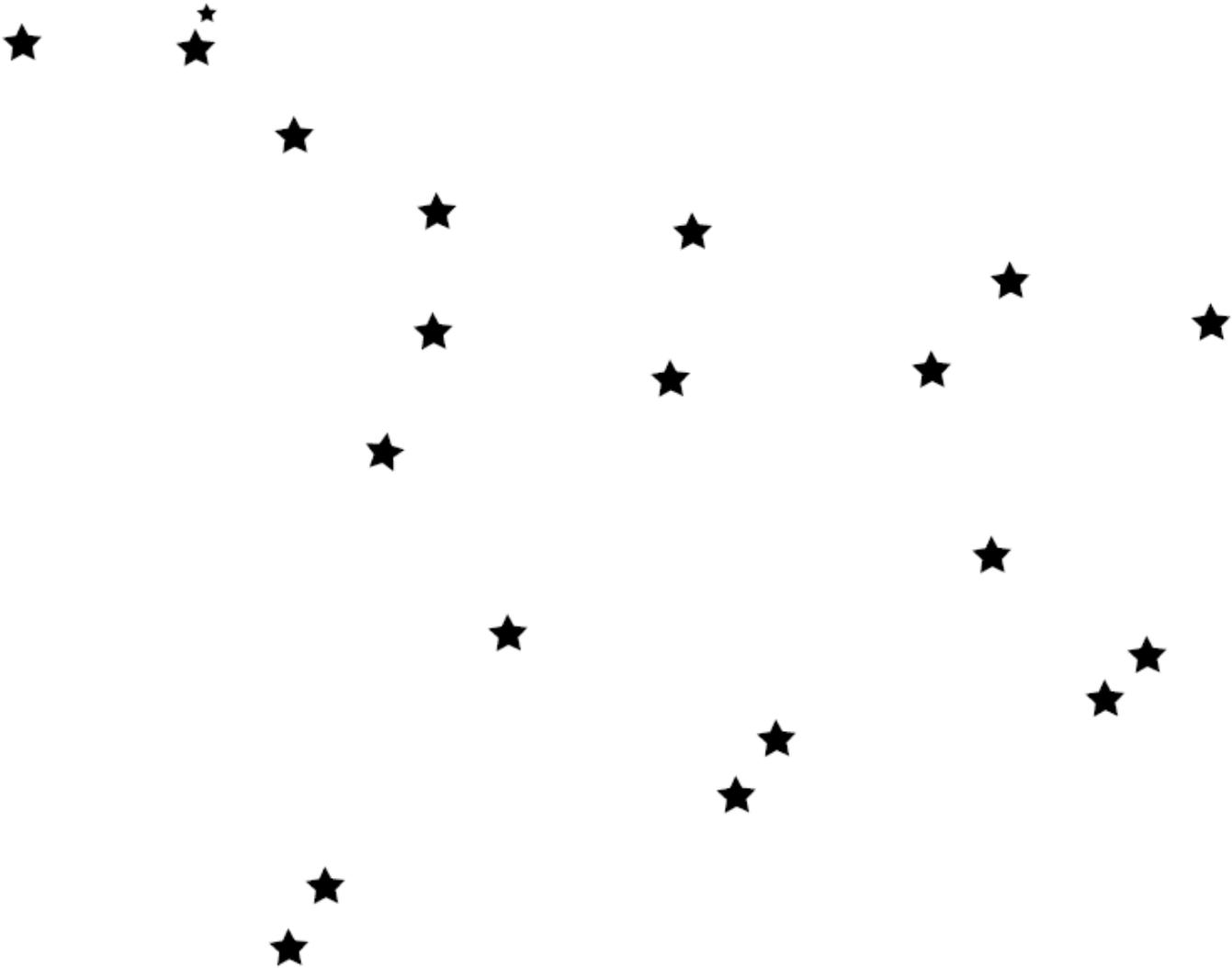


Wheels are based on LHS Sky Challengers created by Budd Wentz and available through LHS Museum Store  
 (510) 642-1016 <http://www.lhs.berkeley.edu/passesast110&11&121.html>  
 © 2000 by the Regents of the University of California

- Instructions for Using Uncle Al's Star Wheels**
1. Align your date and time, and then look up at the sky.
  2. Locate the constellation you want to find on the map.
  3. Turn your map so the horizon it is closest to is at the bottom.
  4. The star positions in the sky should match those on the wheel!

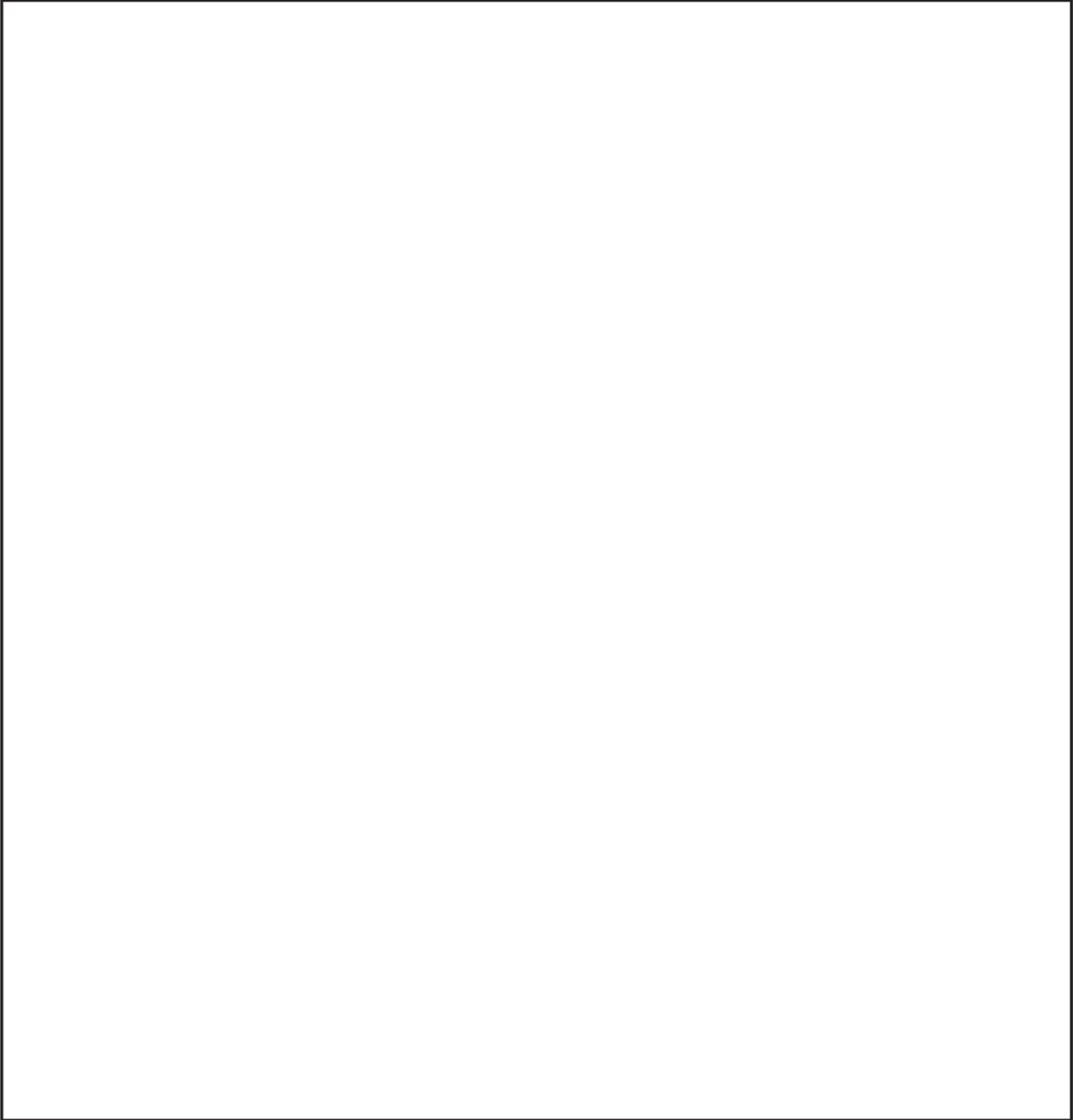
**SIMPLE STAR MAP**

---



**CLASSROOM MAP  
WORKSHEET**

South



East

West

North