



# BURN BRIGHTER

## Week 13: Trail Signs

**Explore:** Explore different parks and take note of different trail markings.

**Analyze:** Learn the difference between trail signs, markers, and blazers and find or narrate different scenarios they would each be used in.

**Apply:** Use trail signs, markers, and blazers to illustrate a story. Can you make your story a scavenger hunt? Use the signs to get the reader to the end!

## Week 14: Signaling

**Explore:** Explore different ways to signal using everyday objects like light, sound, and mirrors.

**Analyze:** Learn the different styles of signaling and their origins. When and where did "SOS" originate and when is it supposed to be used?

**Apply:** Using what you have learned invent your own set of signals and share them with your friends. Make a game using your signals and see if the other team can guess how or where to rescue you.

## Week 15: Compasses

**Explore:** Label the parts of a compass and their definitions. Observe them carefully noting what they each do.

**Analyze:** How does a compass work? Research the origins of compass-making and who invented the compass.

**Apply:** How do animals use internal compasses to migrate? Which animals contain internal compasses? Research this phenomenon and select one to two animals from different ecosystems. Write or illustrate a short story in which no migrating animals knew which direction to go during winter.

What are some of the implications?

Do the migrating animals make it to their destination?

## Week 16: Maps

**Explore:** What are the different types of maps? How do they look different and what information is conveyed? Discover at least three different types, taking note of differences in time periods.

**Analyze:** Analyze the life and process of a cartographer. Pick a famous map maker to study. Make a presentation of their life.

**Apply:** Create a weather, political, or topographical map of your state. Make it as accurate as possible. Present it to your family and communicate what information is shown on your map and how it's represented.

Send it to BU: [learningoutside@barefootuniversity.org](mailto:learningoutside@barefootuniversity.org)

## Week 17: Celestial Navigation

**Explore:** What is celestial navigation and when did humans begin using the stars to navigate?

**Analyze:** Analyze tools used to "shoot" the sun and stars. Compare sextants, octants, astrocompasses, and graphs. How did they develop over time?

**Apply:** While Polaris is our current pole star for navigation, has it always been? Using your research skills discover past stars that were used for celestial navigation. Which ancient civilizations used these stars and how do we know? Look out into the night sky and pick your own star to study. Can you use this star for celestial navigation? Why or why not?

## Week 18: Compasses

**Explore:** Explore other tools used to help with navigation and direction. Have they developed over time? What has stayed the same?

**Analyze:** What's your personal navigation story? Have you gotten lost? Has GPS let you down? Have you sailed the seas? Take time to write out your story (or create one) and think about why the ending is what it is. How could it have ended differently? Can you write the same story with a different ending using what you know about directions and compasses?

**Apply:** Print out maps of your city, state, and country. Using your compass, plot pathways from one location to another. Let someone else use the cardinal directions you plotted to see if they can make it to the correct place.

EXTENSION ACTIVITIES

"Using these complex skills of traditional navigation can bring a deep sense of satisfaction. More importantly, finding your way in the backcountry with a map, altimeter and compass requires a situational awareness that only comes from keen observation and visceral feel for the landscape." – Steve McClure

# TIME & NAVIGATION

## BURN BRIGHTER

### Week 19: GPS

**Explore:** What are different professions that use GPS to get the job done? Can you make a list of 10? How do they use GPS at work?

**Analyze:** The atomic clocks in the GPS system are so accurate that they take into account Albert Einstein's understanding of time, space, and relativity. Why is this important and how do GPS satellites operate differently than clocks on earth?

**Apply:** Automatic Dependent Surveillance-Broadcast uses satellite-based navigation and positioning information broadcast between aircraft and ground stations. Take a field trip to a local airport to learn more about this and why its coverage and accuracy are better than previously used systems.

### Week 20: Orienteering

**Explore:** What is orienteering? Name 3 things you can use for navigation in nature.

**Analyze:** Are there any local orienteering groups in your area? If there are, reach out to a group and schedule a visit. If not, contact your local state park to see if they offer a beginner's orienteering class or program.

**Apply:** Working with friends, design an orienteering course in a local park. After designing your course, make a detailed map to give to a parent or friend. Can they navigate your course using just the map given? What do you need to change? Send your map with your name and community name to: [earningoutside@barefootuniversity.org](mailto:earningoutside@barefootuniversity.org)



### Week 24: Bearings

**Explore:** How do you find your bearings in the wilderness? Can you do this with or without a compass?

**Analyze:** Where and when did the phrase "get/find your bearings" originate? Before compasses and maps, how did people explain where they were in relation to where they were going? Research the origins of the compass and bearing compass. What makes a bearing compass different? Compare and contrast.

**Apply:** Take a bearing from one landmark to another or grab a partner and play a game. Go to a local park and blindfold your partner. Take them on a blindfolded walk, making sure to spin them in circles a few times. After you reach a suitable destination, take the blindfold off. Give your partner 30 seconds to answer each question: What direction is north? What direction are we facing? Where is the parking lot? Take turns using what you know about bearings and repeat the game as many times as you want! This is a great way to learn cardinal directions by heart.

### Week 21: Time

**Explore:** Look at the night sky. Identify a star pattern or constellation you recognize. Look again in an hour, has it moved? What direction? Check in another hour to see what happens.

**Analyze:** What was the hour watch made by the Longines-Wittnauer watch company? How did it aid navigators? Is it still used?

**Apply:** Research different instruments used in timekeeping and navigation throughout the ages. Create a timeline of innovative artifacts used.

### Week 22: Time

**Explore:** When we think of time, we use a watch. What if you didn't have a watch? What are other ways of telling time? Do these differ depending on the season or your location on the globe?

**Analyze:** Select your favorite uniquely-shaped, natural treasure like a fossil, feather, or seed. Place this item on a piece of paper. Starting at 9 am, trace the shadow of your item every hour until 5 pm. Use a different color for every hour. Did the shadow movement surprise you?

**Apply:** Research different civilizations and their relationship with time. How did Vikings tell time while sailing? How did Egyptians keep track of time? Was time important to ancient civilizations? Recreate an example of tools they used for telling time using only items found in nature. Send a picture with your name and community name to: [learningoutside@barefootuniversity.org](mailto:learningoutside@barefootuniversity.org)

### Week 23: Land Survey

**Explore:** Why is land surveying important? What skills and tools do land surveyors use to do their job? Is a college degree required?

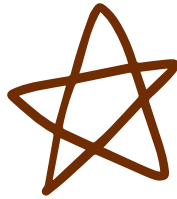
**Analyze:** How can land surveying in the past be compared to what land surveyors do now? How have the tools and equipment changed in the past 100 years? How will the tools change in the future?

**Apply:** Become a reporter. Come up with a set of 3-5 questions to ask a surveyor. Research land surveyors in your area and reach out to them for an interview! Record your findings and report them in a short video.

## Rhythm Fire

# STAR SCIENCE

## Make An Astrolabe



You can learn how to measure the position of stars by making an astrolabe - a tool that astronomers and seafarers used for centuries.

Scientists measure a star's position relative to the horizon. An astrolabe measures how high above the horizon the star is in degrees.

Supplies:

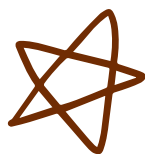
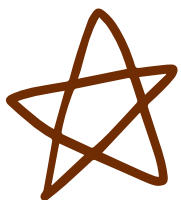
- String
- Plastic protractor
- Weight (washer, rock, or fishing weight)
- Pen and paper



Directions:

Cut a 12-inch piece of string and tie it to the hole in the middle of the crossbar on the protractor. Then, tie the weight to the other end. Hold the protractor with the zero-degree mark closest to you, making sure the curved part is down. Sitting on the ground, look at the flat edge of the protractor with your eye at the zero. Pick the star you want to measure and point the flat edge at the star. Once you have the star in your sight, hold the string against the side of the protractor. Look at the degree marking where the string crosses and write the number down. This number tells how many degrees above the horizon your star is. Use the protractor to take readings for several stars. Return in 30 minutes to take new readings. Take note of the patterns in which the stars seem to move across the sky.

**In the Middle Ages, astrolabes were the most sophisticated astronomical instruments in widespread use.**



**It seems I can't find the border between Russia and Alaska using my compass. I couldn't get my Bering Strait.**

## Cycle Two Vocabulary

**Directional Signs:** help the hiker navigate from Point A to Point B

**Cautionary Signs:** warn of potential trail hazards

**Regulatory Signs:** are the do-this and don't-do-that placards

**Interpretive Signs:** explain a natural or historical site

**Objective Signs:** give information about trail conditions

**Signal Fire:** three fires burning in a triangular fashion is an international signal for rescue

**Smoke Signal:** a column of smoke used as a way of conveying a message to a distant person

**Ground-to-Air Signal:** A way of informing overhead rescue teams about your situation - It contains signals and symbols for only the bare minimum of important information

**Cardinal Points:** the four main points of the compass, North, East, South, and West

**Cartography:** the study and the construction of maps

**Compass Course:** the course to steer which has been corrected for current, variation, and deviation

**Celestial navigation:** a method of navigating by referring to the stars or other objects in the sky

**Compass:** a device that always points towards magnetic north, used for navigation

**Compass Rose:** a design on a chart that shows direction, showing which way is north, south, east, west

**Constellations:** star groups that form a recognizable pattern

**Bearing:** using LOPs from several navigational aids or marks to obtain a position fix

**Declination:** the angular distance to a point on the celestial sphere measured north and south from the celestial equator along the hour circle

**Deviation:** the compass errors caused by metallic or magnetic objects on board the vessel

**Fix:** a position verified by reference to bearings taken off a known point such as a conspicuous landmark

**Geographical Position:** in celestial navigation, it is the point on the earth's surface directly beneath the Zenith, and the bit of the surface you are standing on is your body's Geographical Position or GP

**Magnetic Compass:** a device used for navigation that aligns with the earth's magnetic field thus indicating the direction of magnetic north

**Magnetic bearing:** a bearing taken from a magnetic compass.

**Magnetic north:** the northerly position of the earth's magnetic field, this varies from True North

**True north:** geographic north as opposed to magnetic north

**Variation:** the angle between True North and Magnetic North

**Way Points:** navigation positions as entered in a GPS

**Star:** an exploding ball of burning gas held together by gravity  
**sextant,** a tool used to find latitude and longitude using the positions of celestial objects

**Neat Line:** this is an engraved line that is drawn around the perimeter of the map's image

**Relative:** location describes the position of something in relation to something else using cardinal directions

**Absolute:** location describes the exact location of something often using longitude and latitude

**Coordinate:** a set of values that shows the exact location of something  
**Sextant:** a doubly reflecting navigation instrument that measures angular distance between two objects.

**Octant:** an obsolete instrument used in the form of a graduated eighth of a circle, used in astronomy and navigation.

**Astrograph:** a telescope designed and used in astronomical surveys of the sky

**Chronometer:** an instrument used in measuring time, commonly used for marine navigation



# FOOD FOR THOUGHT

*Fun takes on this classic campfire snack*

## S'mores - 10 ways!!

**Salty & Lit:** Ghiardelli Carmel, Marshmallow, Ritz

**Samoa:** Mounds, Carmel Marshmallow, Shortbread cookies

**Neapolitan:** White & Milk Chocolate, Strawberry Marshmallow, Graham Crackers

**Grasshopper:** Peppermint Patty, Marshmallow, Chocolate Graham Crackers

**Nutty Buddy:** Reese's PB cups, Marshmallow, Chocolate Chip Cookies

**Hazlenut:** Nutella, Marshmallow, Graham Crackers

**The Black Forest:** Chocolate-Covered Cherries, Marshmallows, Oreos

**The Sugar Pig:** Chocolate, Pre-Cooked Bacon, Marshmallows, Graham Crackers

**Cobbler:** Peach or Blackberry Jam, Marshmallow, Waffle Cookies

**Mexican Hot Chocolate:** Spicy Chocolate Bar, Marshmallows, Cinnamon Graham Crackers



## MAPS & NAVIGATION

### Play the Compass Game

Before the game starts, hide an item. Pick a start line for your child(ren). Give them a compass to use. Then, start giving them clues to find your hidden object. I.e: "Go six steps NE" or "Take six hops south." Keep it going until they've found your hidden object.



### CYCLE TWO • READING SUGGESTIONS

- Maps & Navigation by Bear Grylls**
- My Heart is a Compass by Deborah Marcero**
- The Lost Art of Reading Natures Signs by Tristan Gooley**
- The Star People: A Lakota Story by S.D. Nelson**
- Zoo in the Sky by Jacqueline Mitton**
- Carry On, Mr. Bowditch by Jean Lee Latham**
- The Barefoot Navigator by Jack Nagan**
- Essential Wilderness Navigation by Craig Caudill**
- The Boy Who Loved Maps by Kari Allen**
- How to Go Anywhere and Not Get Lost by Hans Aschim**
- Around the World in 80 Days - Jules Verne**
- A Long Walk to the Water by Linda Sue Park**
- The Story of Clocks and Calendars - Betsy & Giulio Maestro**



# RHYTHM FIRE • CYCLE TWO

You are the **X**. Spend 5-10 mins recording sounds on your map as you hear them.



**SOUND MAP**

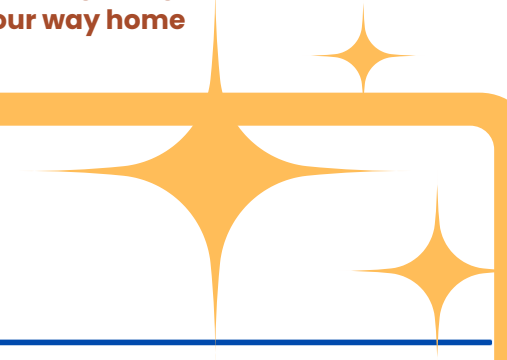
A sound map shows sound data for an area.

# GET CREATIVE:

## BURN BRIGHTER

Pick a topic:

1. Write a myth based on a constellation that you've created
2. Tell a story about getting lost in the woods and finding your way home



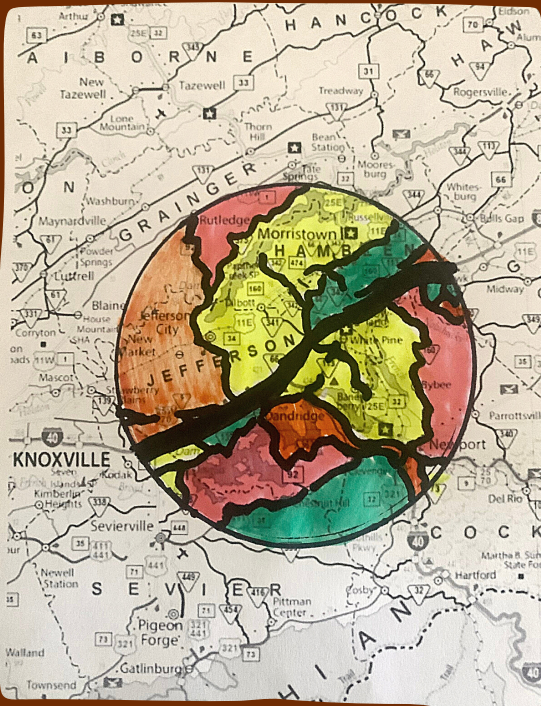
A large writing area enclosed in a thick orange border. It features a vertical red margin line on the left side and ten horizontal blue lines for writing.

## BURN BRIGHTER

# FINE ART FUN



Art Credit: Barefooter Kenlee, Knoxville, TX



Once you're done: Email us a picture of your art along with your name, age, & BU community. We might feature you on our social media page!

## Compass Rose Art

1. Using a piece of watercolor paper, paint your palette with a fun picture, map, or abstract design. Get creative and think outside the box.
2. Once your art is dry, use a black sharpie to draw your compass rose and label the directions as shown.

## ABSTRACT MAP ART

- Print a black-and-white map of your city, state, park, or another favorite area.
- Using a black marker, trace or draw a circle onto an area of your map.
- Use the marker to trace major roads, rivers, or areas on your map.
- Color or paint each area a different color, creating your print.

# RHYTHM FIRE • CYCLE TWO



## CYCLE TWO SKILLS

- Compass Reading
- Fire Signaling
- Cardinal Directions
- Trail Signs
- Log Cabin Fire
- GPS
- Water Boiling
- Mapping
- Constellations
- Complete a Whittling Project
- Bow & Drill
- Bearings
- Flint & Steel
- Telling Time by Day
- Magnifying Glass Fire
- Telling Time by Night



## TIME & NAVIGATION CROSSWORD



### Across

- 2. A pastime to find a treasure using GPS
- 4. An important survival skill used to let others know where you are
- 7. The direction along Earth's surface towards the geographic North Pole
- 9. The position towards which someone or something moves or faces

### Down

- 1. A tool consisting of several parts including a dial, scale, and needle
- 3. A group of stars depicted by characters of Greek or Roman mythology
- 5. The antonym you use if you're lost hiking
- 6. A timepiece for the day
- 8. A graphic depiction of land, usually for legal purposes
- 9. Used to calculate distance on a map

ANSWERS: Across: 2. geocaching 4. signaling 7. true north 9. direction  
Down: 1. compass 3. constellations 5. STOP 6. sundial 8. survey 9. scale



# CONSTELLATIONS

BURN BRIGHTER

Draw it



Research it



## Pegasus

Location: \_\_\_\_\_

Brightest Star: \_\_\_\_\_

What it is: \_\_\_\_\_

## Cassiopeia

Location: \_\_\_\_\_

Brightest Star: \_\_\_\_\_

What it is: \_\_\_\_\_

## Orion

Location: \_\_\_\_\_

Brightest Star: \_\_\_\_\_

What it is: \_\_\_\_\_

## Scorpius

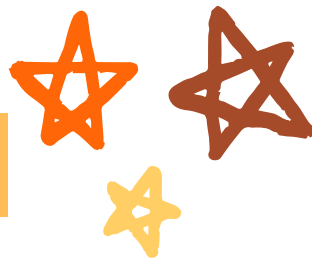
Location: \_\_\_\_\_

Brightest Star: \_\_\_\_\_

What it is: \_\_\_\_\_

## Make a star jar

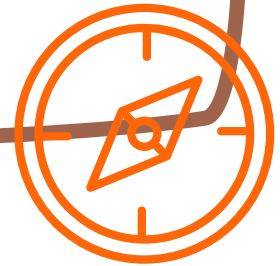
1. Use a plastic or glass bottle. (We used a plastic Voss bottle with the labels removed.) You could also use a mason jar.
2. Combine 1.5 cups of warm distilled water with an 8 oz bottle of black glitter glue in a large measuring cup. Stir well.
3. Fill the bottle almost full with the glue mixture.
4. Add super fine glitter. For extra sparkle and texture, you can also add different weights of glitter and/or glow-in-the-dark stars.
5. Close the bottle tightly, super glue shut & shake and observe.



## Rhythm Fire • Cycle Two

### FIND DIRECTIONS AND DRAW A MAP WHILE OBSERVING NATURE.

1. Find an outdoor nature area for this activity. Use a compass to find magnetic north.
2. Mark off a square area ten paces long. Mark the starting spot, go ten paces north, then ten east, ten south, and ten west. Use rocks to mark the corners.
3. Use a field guide or iNaturalist app to ID plants. Try to identify all of the plants in the square.
4. Make a map to record all of your findings. Make sure to mark the directions and represent the measurements of your square.



### SIGNALING:

Signal mirrors were extensively used by military personnel during World War II. The longest surface-to-air distance record was set by a sea survivor in the Pacific, whose signal was seen by a pilot 105 miles away.

Smoke signals and signal fires are probably some of the oldest forms of long-range communication, used by the ancient Chinese, ancient Greeks, and Native Americans.

# DID YOU KNOW?



Did you know Osage Orange wood puts off 32.9 million BTUs of heat per cord?