# Day 1
## Stars and Constellations

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## Introduction

This day focuses on one of the most awesome things we can see in the night sky: **stars** and star patterns that we call **constellations**. Stars are big exploding balls of gas — mostly **hydrogen** and **helium** — held together by their own **gravity**. **Astronomers** think that there are 200 billion stars in the **Milky Way**, the **galaxy** where our own solar system lives.

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## Questions to guide explorations and experiments

- What is a star? Why do they shine and seem to twinkle?
- Where do stars come from?
- What is a constellation?
- Why did people name patterns of stars and create stories about them?

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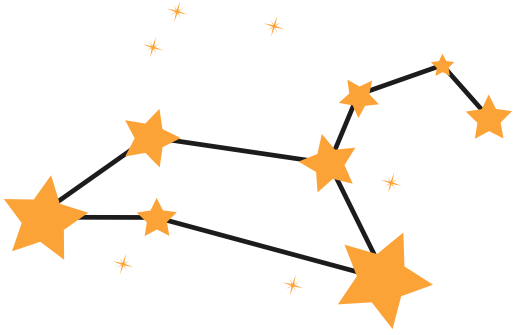
## Books and activities

- **Books:** fiction, nonfiction and poetry all about stars, constellations, and comets
- **Activities:** explore why stars twinkle, look at constellations, and create a "star nursery" nebula



# Children's Books

## Fiction

- *A Big Mooncake for Little Star* by Grace Lin (Ages 4-7)
- *Blackout* by John Rocco (Ages 6-9)
- *Bright Sky, Starry City* by Uma Krishnaswami (Ages 6-9)
- *Coyote Places the Stars* by Harriet Peck-Taylor (Ages 4-8)
- *Her Seven Brothers* by Paul Goble (Ages 6-9)
- *How the Stars Fell into the Sky* by Jerrie Oughton 6-9)
- *The Story of the Milky Way* by Joseph Bruchac (Ages 6-9)

## Poetry

- *Comets, Stars, the Moon, and Mars: Space Poems and Paintings* by Douglas Florian (Ages 6-9)
- *Once Upon a Star: A Poetic Journey Through Space* by James Carter (Ages 6-9)
- *Out of This World: Poems and Facts About Space* by Amy Sklansky (Ages 6-9)
- *Stuff of Stars* by Marion Bauer (Ages 6-9)

## Nonfiction

- *The Big Dipper* by Franklyn Branley (Ages 6-9)
- *A Child's Introduction to the Night Sky* by Steve Parker (Ages 9-12)
- *Find the Constellations* by HA Rey (Ages 9-12)
- *Glow-in-the-Dark Constellations* by CE Thompson (Ages 6-9)
- *The Great Race: The Story of the Chinese Zodiac* by Dawn Casey (Ages 4-7)
- *A Hundred Billion Trillion Stars* by Seth Fishman (Ages 6-9)
- *The Kids' Book of the Night Sky* by Ann Love and Jane Drake (Ages 9-12)
- *Look Up! Henrietta Leavitt, Pioneering Woman Astronomer* by Robert Burleigh (Ages 6-9)
- *Once Upon a Starry Night: A Book of Constellations* by Jacqueline Mitton (Ages 6-9)
- *The Sky Is Full of Stars* by Franklyn Branley (Ages 6-9)
- *The Stars: A New Way to See Them* by HA Rey (Ages 9-12)
- *Wishing on a Star: Constellation Stories and Stargazing Activities for Kids* by Fran Lee (Ages 6-9)
- *Zoo in the Sky: A Book of Animal Constellations* by Jacqueline Mitton (Ages 6-9)

# Space Words

**Astronomer / Astronomy**
A scientist who studies space and the Universe beyond Earth. Astronomy is the branch of science that studies space.

**Atmosphere**
The layer of gases surrounding Earth and other planets, held in place by gravity.

**Big Dipper**
Part of the constellation Ursa Major (Big Bear), made up of this constellation's seven brightest stars. These stars form a shape that looks like a ladle, or dipper.

**Constellation**
A group of stars in the night sky forming patterns that look like animals, objects, or characters. There are 88 official constellations. At different times of the year and in different hemispheres, different constellations can be seen in the sky.

**Galaxy**
A collection of billions of stars and other matter held together by gravity. Our planet Earth and the sun belong to the Milky Way galaxy. A telescope helps us see other galaxies from Earth.

**Gravity**
A force that pulls matter together; a force that pulls people and objects toward the ground.

**Helium**
A gas that is lighter than air. Balloons filled with helium will float high in the sky.

**Hubble Telescope**
A space telescope launched into low Earth orbit in 1990 and is still out there. The Hubble has taken thousands of images that have helped scientists and the public to understand our Universe better.

**Hydrogen**
A very light gas and one of the most abundant gases in the Universe.

**Interstellar**
The space located between stars.

**Light year**
The distance that light travels in one year, about 6 billion miles.

**Little Dipper**
The constellation Ursa Minor (Little Bear). The stars that make up this constellation also form a pattern that looks like a dipper.

**Milky Way**
The galaxy that contains the Earth, the Sun, and the solar system. It can be seen in the night sky as a long, cloudy group of stars.

**Nebula**
A cloud of dust and gas found in interstellar space. They are sometimes called "star nurseries" because stars are created there.

**Orion**
A large winter constellation in the northern sky. In Greek mythology, a hunter.

**Polaris (North Star)**
A bright star in the constellation Ursa Minor (Little Dipper). It seems to remain in a constant position in the sky; for this reason, Polaris is used for navigation.

**Refract**
To bend as you move from one medium to another. Example: The movement of air and dust in the atmosphere bends, or *refracts,* a star's light in different directions.

**Scintillation**
A spark, flash, or twinkle of light.

**Star**
A giant ball of hot gas that emits light and energy created through nuclear fusion at its core.

**Telescope**
An instrument that uses lenses and mirrors to make far away objects look larger and closer to us.

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# Activity 1: Twinkle, Twinkle

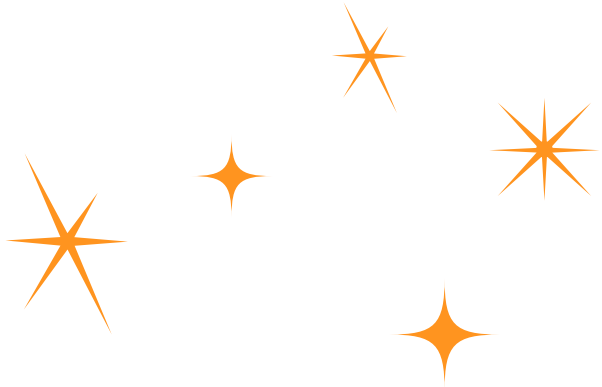
## Introduction

**Stars** are so far away from Earth that, even through large telescopes, they appear only as tiny points of bright light. Stars seem to twinkle because we see them through the layers of the **atmosphere** — the gases that surround our planet.

The movement of air and dust in the atmosphere bends, or **refracts**, a star's light in different directions. Because the light is scattered by the time it reaches our eyes on Earth, stars appear to twinkle. You might think of it as the light traveling a zig-zag path to our eyes, instead of the straight path the light would travel if Earth didn't have an atmosphere.

## Supplies

- 12-inch x 12-inch square of aluminum foil
- 2-quart glass bowl
- Water
- Flashlight
- Pencil (optional)



**This activity works best in a darkened room**

## Get kids thinking

In this activity, kids will be exploring why stars appear to twinkle.

**Ask kids:** Have you ever looked at stars in the night sky? What have you observed?

Have you ever looked up high in the night sky at the stars and then moved your head down closer to the horizon. Do the stars seem to change?

Stars closer to the horizon will appear to twinkle more than stars higher up in the sky because there is a lot more atmosphere between you and a star near the horizon.

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# Activity 1: Twinkle, Twinkle

## Let's get started!

Demonstrate this activity in front of the kids, and then let them try it themselves in small groups. Crumple your square of foil, then open it up, and place it on a table or on the floor. Fill your clear bowl with tap water and place it on top of the crumpled foil.

Darken the room by turning off the lights. Hold the flashlight about 12 inches above the bowl. Look at the foil through the undisturbed water. **Ask the kids:** What does the reflected light look like?

Now using your finger or a pencil, tap the surface of the water gently. Look at the foil through the moving water. **Ask the kids:** How does the reflected light look like now?

*What happened?* The light rays reflecting from the foil when there was a movement in water appears to blur or twinkle.

*Why?* The movement of the water causes the depth of the water to vary. The light rays twinkle because they bend or **refract** in different direction when it passed through the different depths of water.

This is similar to the light rays from the stars. They appear to be twinkling when you are observing from Earth because they refract differently as the light rays move through the different thickness of air in the **atmosphere.** The scientific word for this twinkling phenomenon is **scintillation**.

## More activities

Do Stars Really Twinkle (video)
https://www.youtube.com/watch?v=_-GfIT6jK44

# Activity 2: Explore Constellations Three Ways

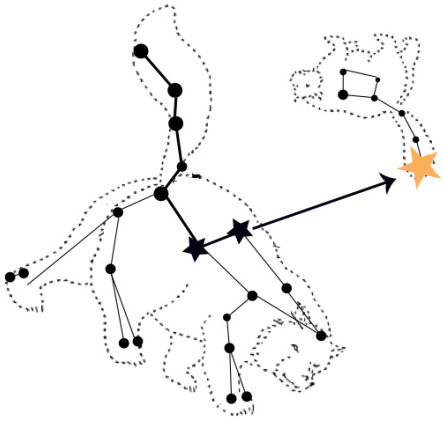
## Introduction

A constellation is group of stars that make up an imaginary shape in the night sky.

In ancient times, people saw patterns of stars in the night sky that seemed to make recognizable shapes. Some of them are named after mythical heroes like Hercules and Orion the Hunter. Other star patterns are named after animals, like **Ursa Major** — the big bear.

The star patterns became a way to preserve stories, like the legend of Perseus rescuing the princess Andromeda from a sea monster named Cetus.

As astronomers began mapping the night sky, these star patterns were included in the maps and called "constellations." There are 88 official constellations, according to the International Astronomical Union. At different times of the year, different constellations can be seen in the sky.



Sailors have used constellations to help with navigation for thousands of years. It's pretty easy to spot **Polaris (North Star)** once you've found **Ursa Minor (Little Dipper).**

## Get kids thinking

- Have you ever looked for the **Little Dipper** and the **North Star** in the night sky?
- Can you guess why we see different constellations in the summer night sky than we see in the fall, winter, or spring? In the summer, we can see Hercules the Hero but we can't see **Orion the Hunter** (we see Orion in the winter sky).
- Do you know any stories about constellations, like the stories of Hercules, Orion the Hunter, or Pegasus the winged horse?

This would be a great time to read a story about constellations, such as this Native American tale about the creation of the **Big Dipper** such as *Her Seven Brothers* by Paul Goble. Or you could read one of the stories from these books by Jaqueline Mitton: *Zoo in the Sky* or *Once Upon a Starry Night*.

# Activity 2: Explore Constellations Three Ways

## Option 1: Sidewalk Chalk Constellations

### Supplies

- Summer sky constellation template and constellation card templates (provided)
- Buckets of sidewalk chalk
- Plastic buckets with rocks, pebbles, bottle caps (these are the "stars" in your constellation)

### Let's get started!

In this activity, kids will build a favorite constellation outside using rocks, pebbles, bottle caps, and chalk.

Print out a copy of the summer sky constellation chart for each child. Also print out enough of the individual constellation pages so that the kids will have some options when they choose their constellation for this activity. The templates can be found after page 23.

Get everyone together in a circle, pass around the summer sky constellation charts, and talk about the different constellations on the chart. **Ask the kids:** Can you identify any of the animals or characters?

Tell the kids that you've set out copies of different constellations on the table, and invite the kids to select one that they would like to "build" outside.

Time to head outside! Bring the buckets of rocks, pebbles and bottle caps outside where there's lots of sidewalk space. Show the kids how to draw their constellation on the sidewalk, starting with the pebbles, rocks, and bottle caps (these are the "stars") and then use the chalk to connect the stars and complete their constellation. Thing big! And don't forget to have the kids write the names of their constellations in chalk next to their creation.

# Activity 2: Explore Constellations Three Ways

## Option 1: Sidewalk Chalk Constellations

As a group, take a walking tour of your "night sky" and encourage each child to identify their constellation, and share a story about their animal or character if they know one.

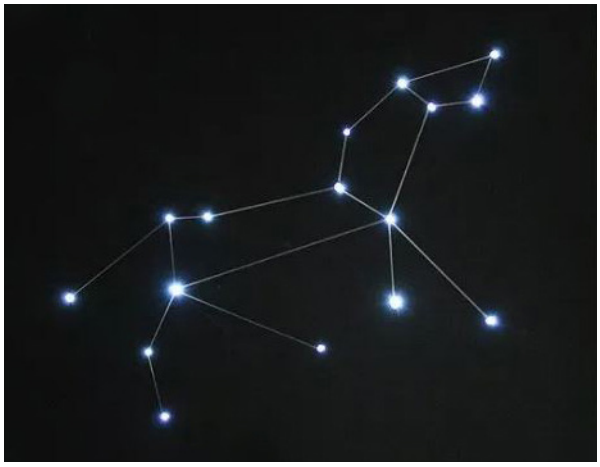
To extend this activity, you can encourage the kids to create their own constellations — the "sky's the limit" when it comes to using their imaginations!


Photo © Creekside Learning

# Activity 2: Explore Constellations Three Ways

## Option 2: Constellation Light Show

### Supplies



- Constellation card templates (provided)
- Black construction paper (8-1/2 x 11), one sheet for each child
- Sharpened pencils or toothpicks
- Tape
- Flashlight
- Pieces of cardboard

**This activity needs a darkened room**

### Let's get started!

In this activity, kids will prepare a constellation for a group light show in the dark.

Print out enough copies of the individual constellation pages so that the kids will have some options when they choose their constellation. The templates can be found after page 23.

Ask the kids to choose a favorite constellation. Show them how to tape their constellation template to a sheet of black paper, and then put the taped constellation on top of a piece of cardboard to protect the surface you are working on when you poke holes in the paper.

Tell the kids that each of the dots on the constellation sheet represents a star. Using a small pointed object (a pen or toothpick works well), show them how to poke holes in the dots for each star.

Then gather all the kids together in the room for the starry night show! Turn off all the lights in the room, hold your paper up to the wall and shine the flashlight behind it. Everyone will see the stars of your constellation light up on the wall. Give each child a turn to show their constellation to the group.

# Activity 2: Explore Constellations Three Ways

## Option 3: If I Was a Constellation (Life-Sized Constellations)

### Introduction

Show kids the constellation Orion and discuss with them how the stars mark his shoulders and his belt, sword, and shield. Tell them the story of Orion and as a group, write an acrostic poem.

### Supplies

- Orion constellation illustration (provided)
- Roll of black paper (at least 36" wide) — you can use white if black is not available.
- 8-1/2 x 11 white paper
- Stars cut out of yellow construction paper (about 8-10 2-inch stars per child)
- Pencils, pens, markers
- White chalk — or colored chalk if using white paper on the wall
- Tape

### Let's get started!

In this activity, kids will invent their own life-sized constellations. After telling the Orion story, ask the kids to think about how they might create their own character or animal constellation by posing with their bodies.

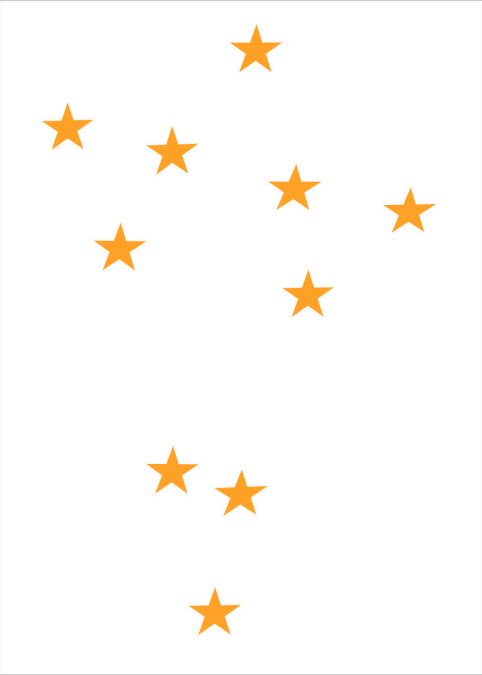
Tape kid-sized sheets of paper to the wall and have each child stand in the constellation pose of their own invention in front of their paper. Mark the main points of the body with pencil or marker — just make a small "X".

# Activity 2: Explore Constellations Three Ways

## Option 3: If I Was a Constellation

Next, have the kids tape the paper stars to the main points on the body, on top of the "X". They can connect the stars with the marker if they'd like to. **Tell kids:** That's you as a life-sized constellation!

Ask the kids to give their constellation a name, write it on a sheet of paper in acrostic style (vertically, and then write a descriptive acrostic poem for their invented constellation.



### More constellation activities

Constellation Centerpiece (PBS Parents)
http://www.pbs.org/parents/adventures-in-learning/2014/06/create-constellation-centerpiece/

Constellation Viewers (Literary Hoots)
http://www.literaryhoots.com/2015/05/constellations-astronomy-for-kids.html

# Activity 3: Nebulas — Where Stars Are Born

## Introduction

A **nebula** is an **interstellar** cloud of dust and gas. Some nebulas are called "star nurseries" because that's where stars are formed, or "born." Our own Sun was born 4.6 billion years ago!

## Supplies (for each child)

- Clear glass jar with a lid
- Plastic spoon
- Water
- Tempera paint (at least 2 colors, blues, purples, and pinks work well)
- Glitter
- Cotton balls (about 18 per child, depending on the size of the jar)

## Get kids thinking

In this activity, kids will create a model of a nebula. A nebula looks like a big cloud of dust and gas located in **interstellar** space. They are very far away — the closest one to Earth is called the **Helix Nebula** and it is 700 **light years** away. That means even if you could travel at the speed of light, it would take you 700 years to get there!

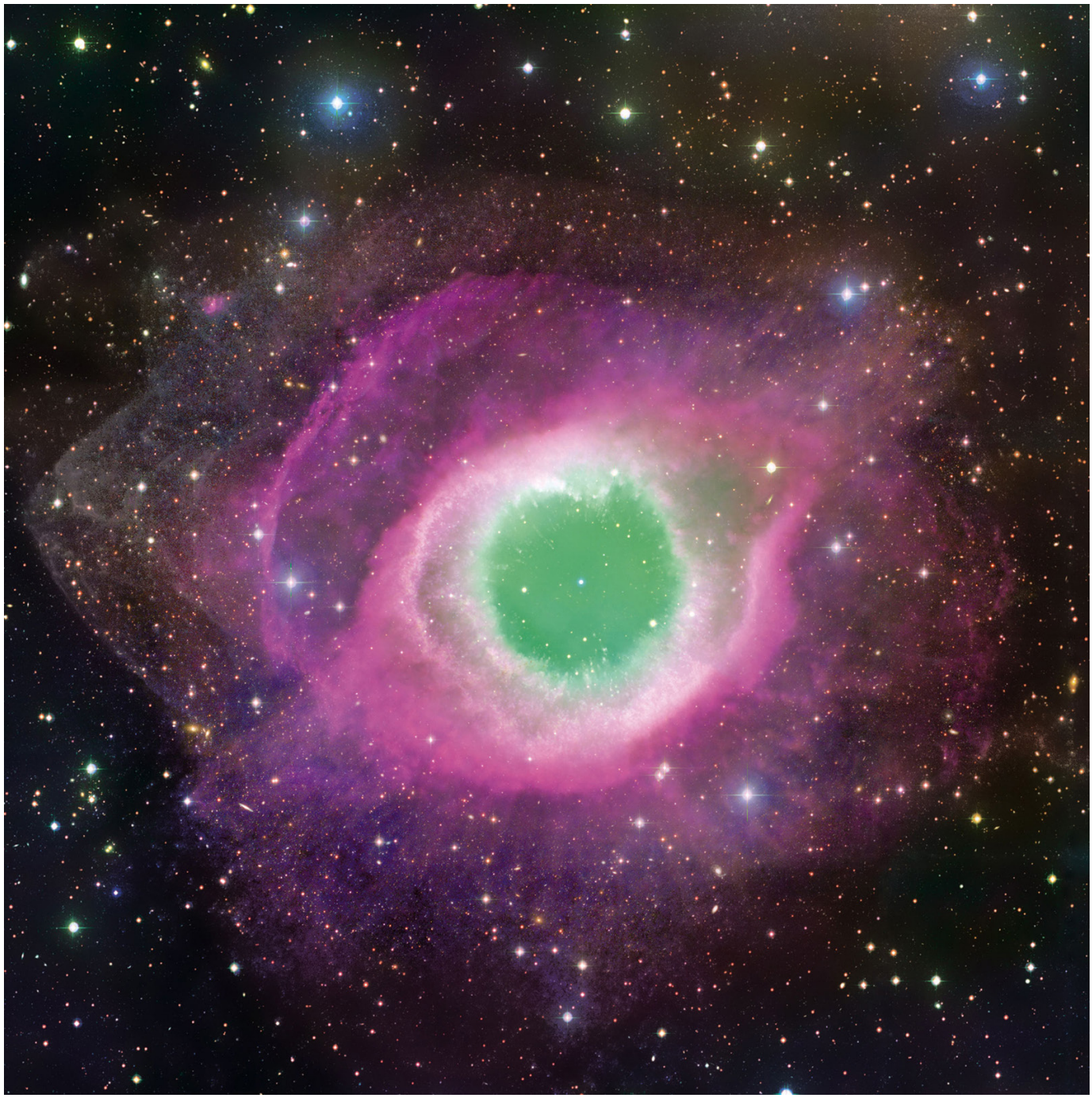
**Ask kids:** If nebulas are so far away, how do we know what they look like? **Astronomers** use very powerful space telescopes, such as the **Hubble telescope**, to take pictures of nebulas.

Share photographs of the Helix Nebula and the Orion Nebula (see pages 17-18). If you have access to the Internet, watch this video from NASA, Flight Through the Orion Nebula.

https://www.smithsonianmag.com/smart-news/take-trip-through-orion-nebula-nasas-awesome-video-1-180967825/

# Activity 3: Nebulas — Where Stars Are Born

## Helix Nebula



# Activity 3: Nebulas — Where Stars Are Born

## Orion Nebula

On a clear night, if you look at the constellation **Orion**, you might get a glimpse of a star nursery. Below Orion's belt (near the tip of his sword) about 1,350 light years from Earth, the nebula looks like a mudge in the sky. But that hazy smudge is Orion Nebula, which creates some of the **Milky Way**'s newest stars.

# Activity 3: Nebulas — Where Stars Are Born

## Let's get started!

Have kids fill one-third of their glass jars with water. Tell kids to add a few drops of tempera paint to the jar and stir.

Then have kids add 3-6 cotton balls (depending on the size of the  jar) to the water mixture in the jar, pressing down with the spoon. Next, ask kids to sprinkle in about a teaspoon of glitter.

Tell the kids to repeat steps 1-4 two more times, or until their jar is full. Screw on the lid and your nebula jar is ready to display.

The nebula jar is a colorful (and even calming) object for a child's room, plus they can proudly say to visitors, "look, I made a nebula" and then explain what that word means!

Photo © PBS Parents

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# Writing About Stars

Writing helps kids process and solidify new knowledge and gives them an opportunity to use new vocabulary and concepts. Offer one or more of these prompts or questions to get your Space Rangers writing.

## Write a constellation myth

Talk about what a myth is — a made-up story that explains the existence of something in nature, such as where thunder comes from or how the Milky Way formed. Myths often feature supernatural and heroic characters who have the power to make amazing things things happen.

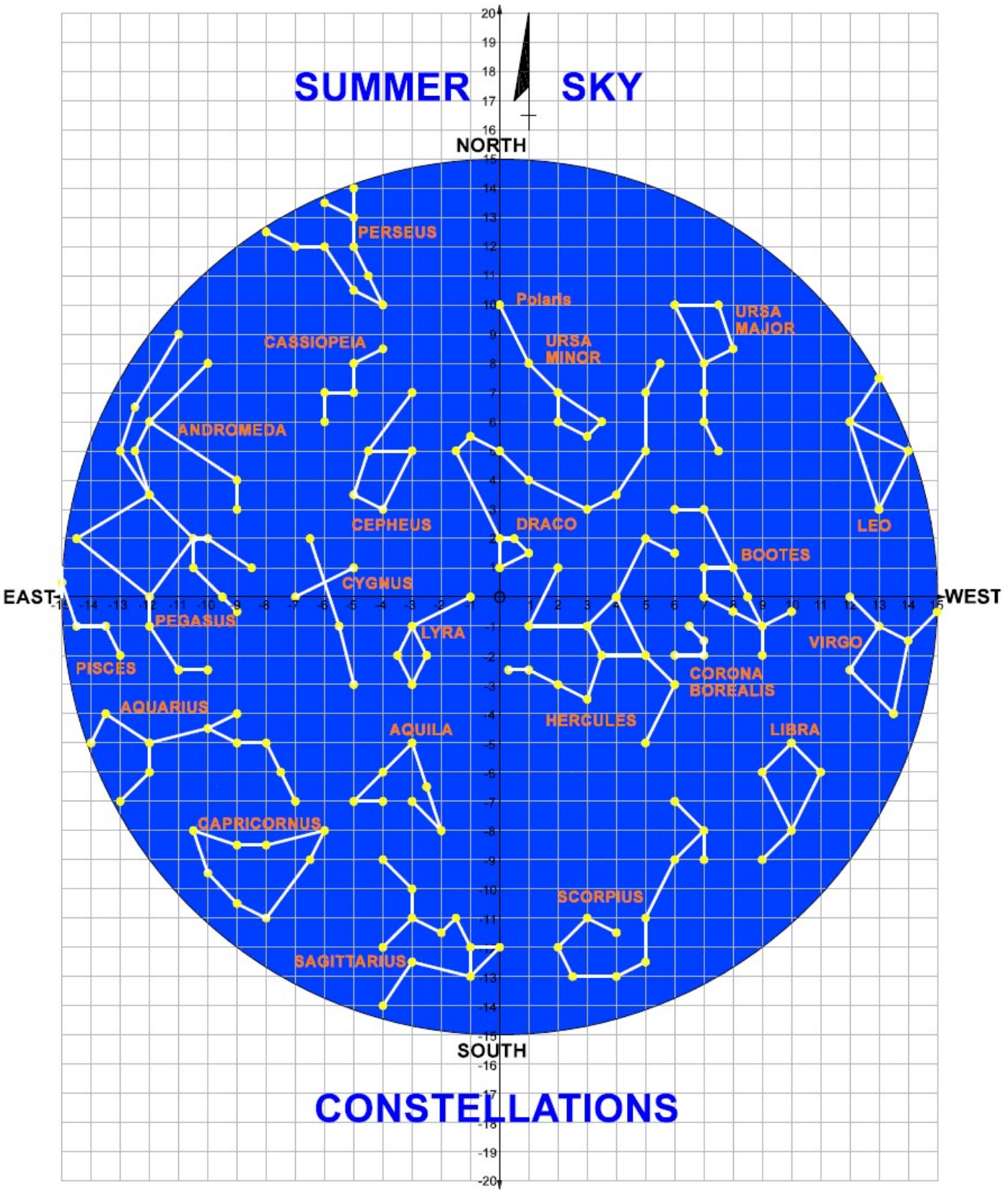
Next, read a constellation myth to the group, and tell the kids that they'll be writing their own constellation myths.

Give the kids a copy of the Summer Star Chart (see the next page) and paper, pens, pencils, and/or markers for writing and drawing.

Look together at the stars on your star chart. What kinds of patterns do the kids see? Ask each child to find a cluster of stars and design a new constellation with its own modern-day myth. The constellation myth should explain how and why this particular constellation is in the sky.

Share your stories in a group circle.

**Variation:** Look at the Summer Star chart. Find two constellations that are neighbors and write a new story about the two characters together.


SUMMER SKY
NORTH
SOUTH
EAST
WEST
PERSEUS
Polaris
URSA MAJOR
CASSIOPEIA
URSA MINOR
ANDROMEDA
CEPHEUS
DRACO
LEO
BOOTES
CYGNUS
PEGASUS
LYRA
VIRGO
PISCES
CORONA BOREALIS
AQUARIUS
HERCULES
AQUILA
LIBRA
CAPRICORNUS
SCORPIUS
SAGITTARIUS
CONSTELLATIONS

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# Writing About Stars

## Blackout poetry

Blackout poetry is like a treasure hunt since you find hidden meanings and secret messages in unlikely places. It also creates a beautiful "night sky" — with words as the twinkling stars of your poem.

Create an example for the kids as you explain the activity.

### Supplies (for each child)

- Old newspapers or magazines
- Thin and thick black markers
- Highlighters (optional)


### How to

1. Select a newspaper or magazine page.
2. Look at all of the words on the page.
3. Go back over the page, and with a thin black marker draw a box around the words that you want in your poem.
4. Color in (black out) the rest of the words on the page with the thick black marker, leaving just the words you selected.
5. Highlight all or some of the words, if you like, to create a more colorful effect.

# Kid-friendly Websites and Apps

## Websites

Constellations (NASA Space Place)
https://spaceplace.nasa.gov/search/constellations/

What Is a Nebula? (NASA Space Place)
https://spaceplace.nasa.gov/nebula/en/

This Week's Sky at a Glance (Sky and Telescope)
https://www.skyandtelescope.com/observing/sky-at-a-glance/

How to Find the Summer Constellations (NPR)
https://www.npr.org/2018/06/26/621935519/how-to-find-the-summer-constellations-360-video

Stargazing (Ranger Rick, National Wildlife Federation)
https://rangerrick.org/crafts_activities/try-stargazing/

Flight Through the Orion Nebula (Smithsonian)
https://www.smithsonianmag.com/smart-news/take-trip-through-orion-nebula-nasas-awesome-video-1-180967825/

How Many Stars Are There? (It's Okay to Be Smart, PBS Digital Studio)
https://www.pbs.org/video/its-okay-be-smart-how-many-stars-are-there/

Super Stars: Constellations (Crash Course Kids)
https://thekidshouldseethis.com/post/what-is-a-constellation-crash-course-kids

DK Find Out: Constellations (DK Publishing)
https://www.dkfindout.com/us/space/constellations/

# Kid-friendly Websites and Apps

## Stargazing apps

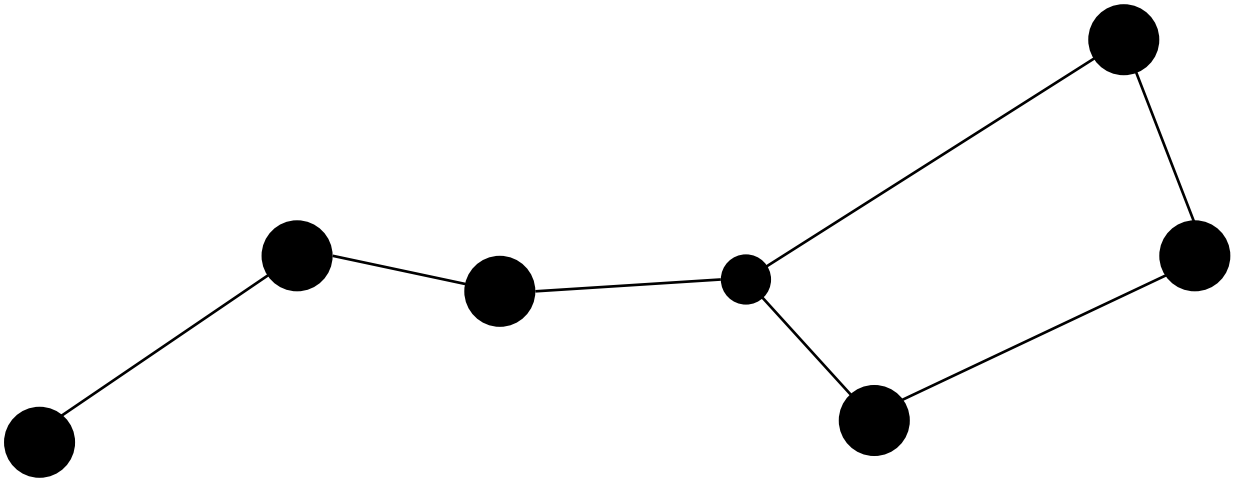
Each of these uses GPS to instantly map the sky from where you are standing.

Star Chart (Android) $
https://www.commonsensemedia.org/app-reviews/star-chart

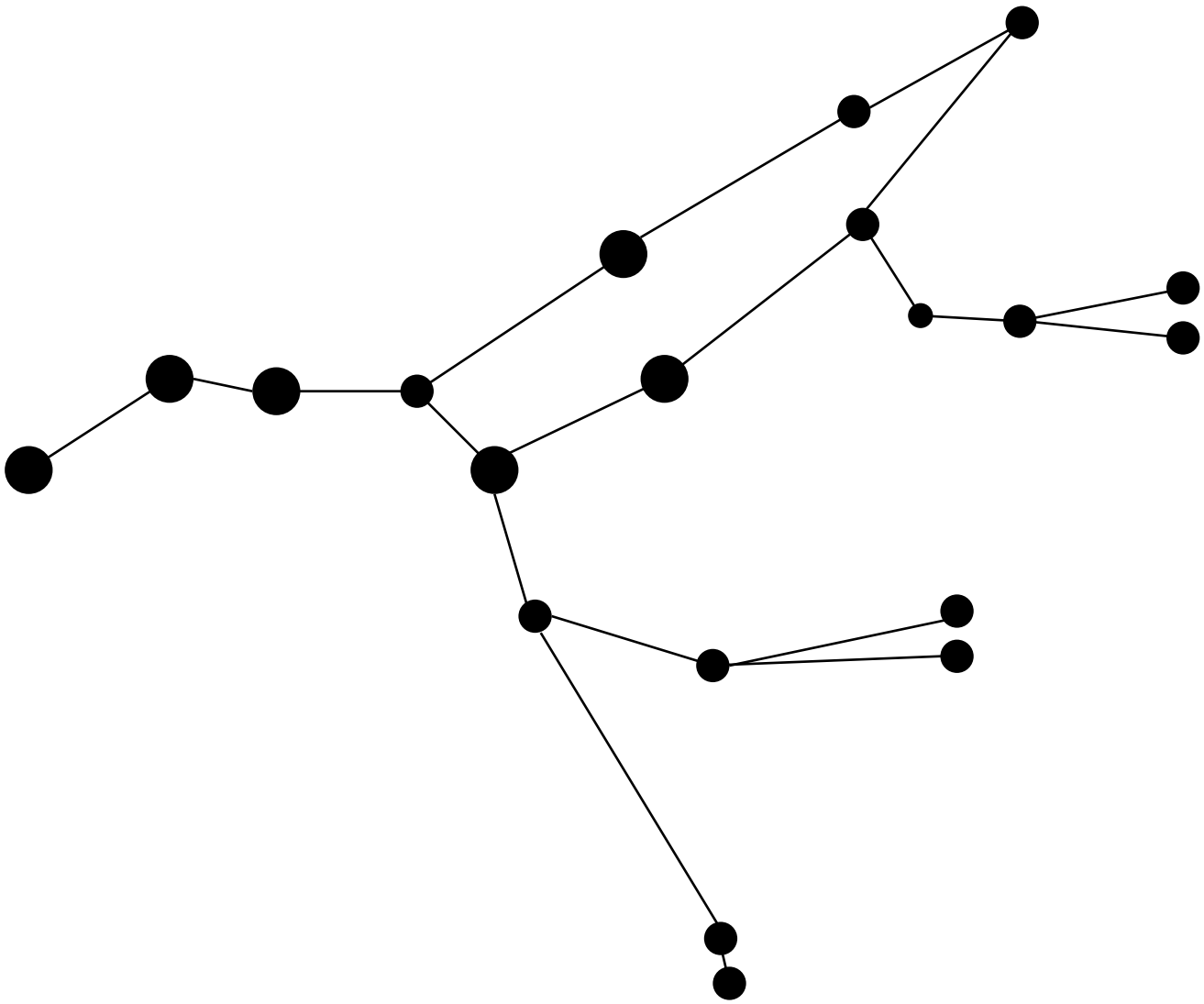
Sky Map (Android)
https://www.commonsensemedia.org/app-reviews/sky-map

Star Walk Astronomy Guide (Apple) $
https://www.commonsensemedia.org/app-reviews/meet-the-insects-water-grass-edition

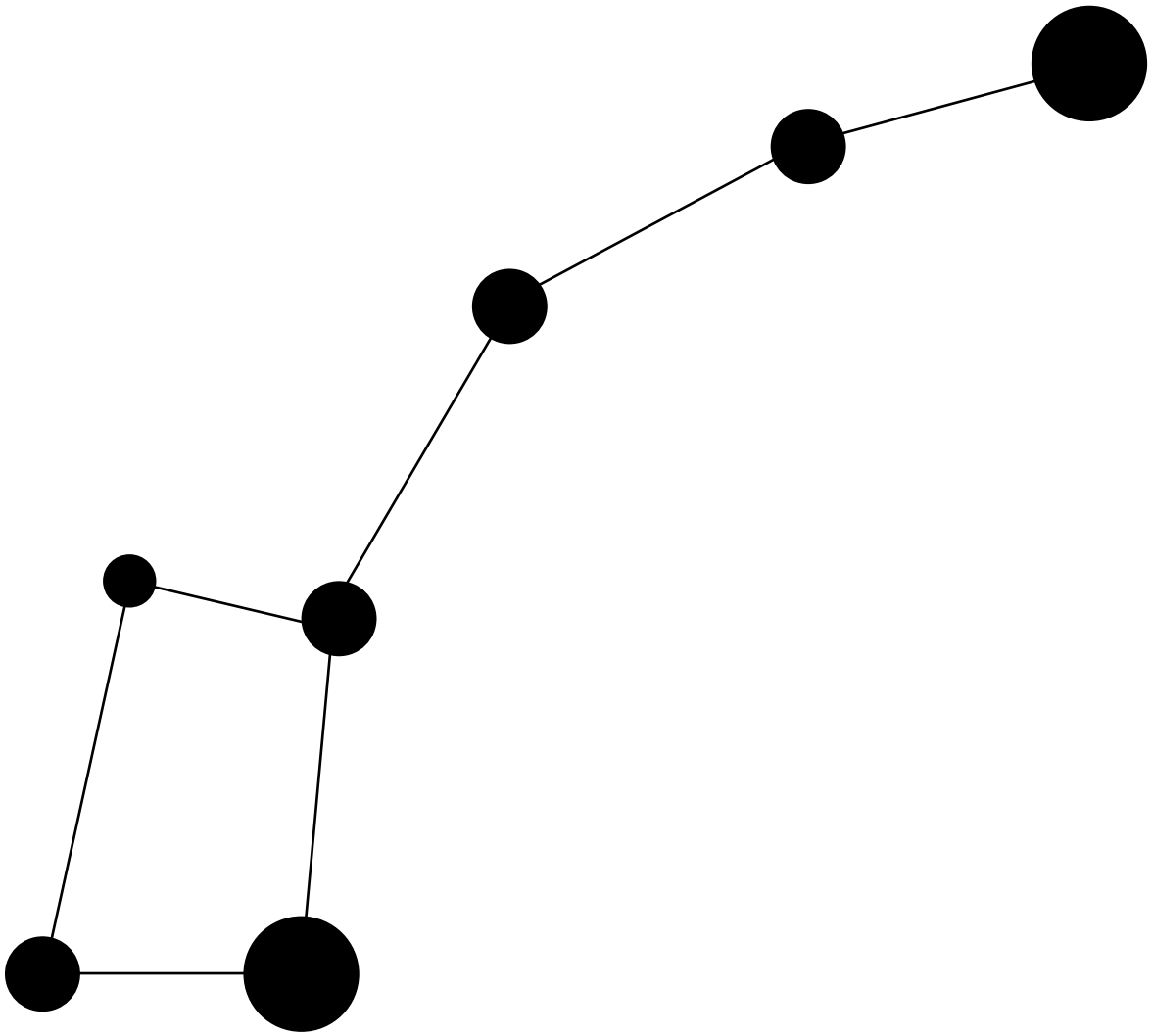
Redshift Astronomy (Apple) $
https://www.commonsensemedia.org/app-reviews/redshift-astronomy



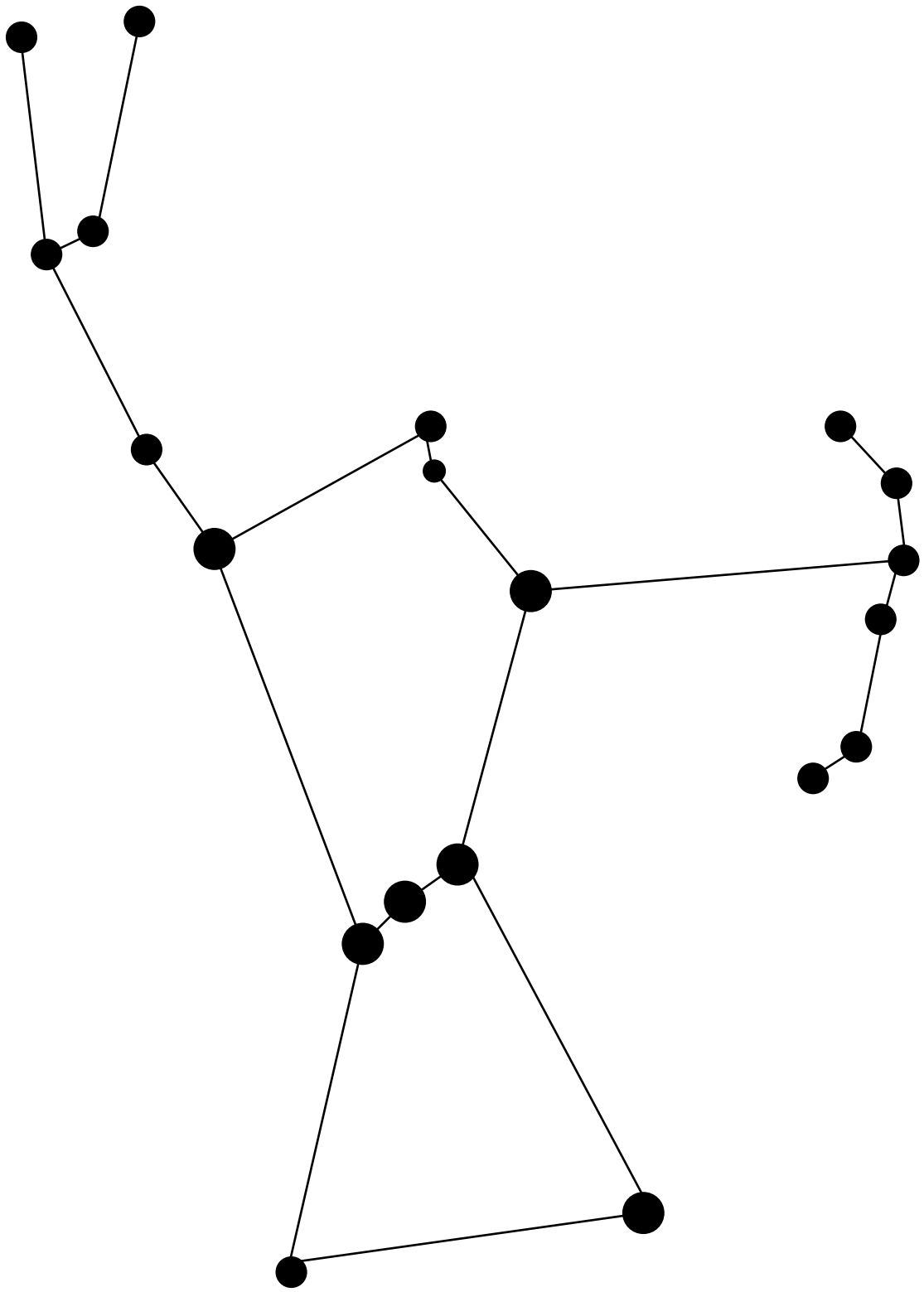
Big Dipper



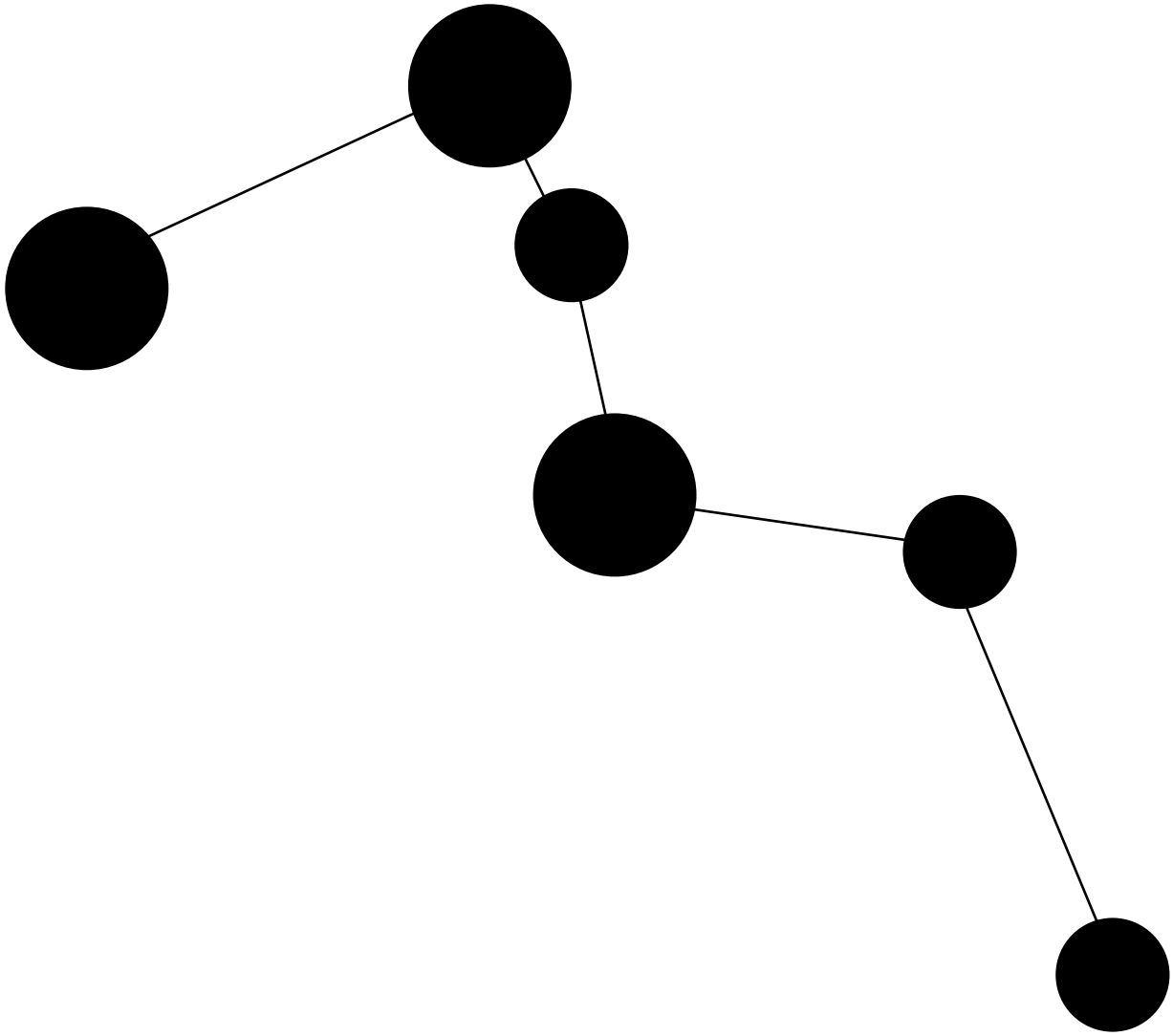
Ursa Major, The Big Bear



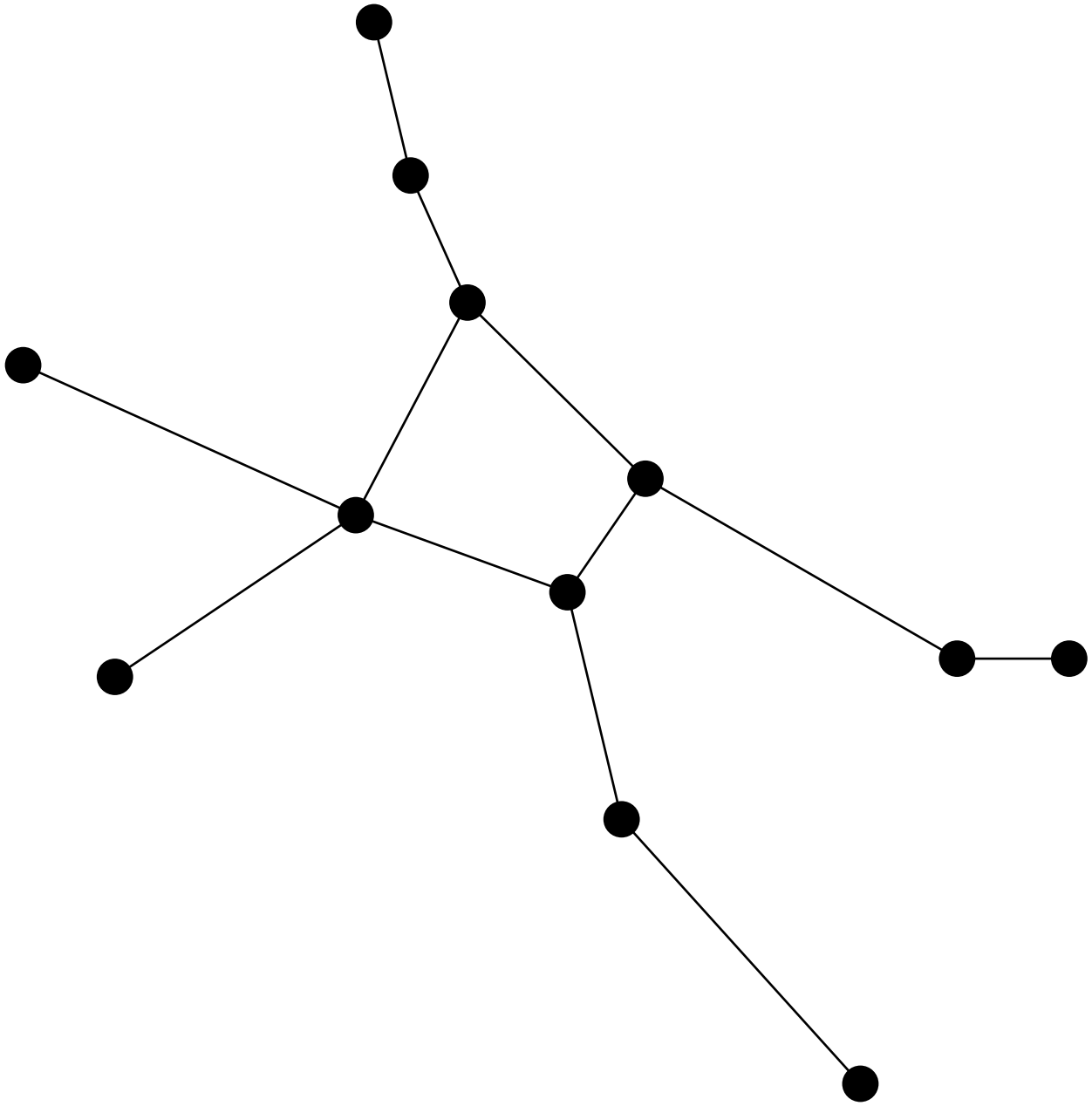
Little Dipper (Ursa Minor, The Little Bear)



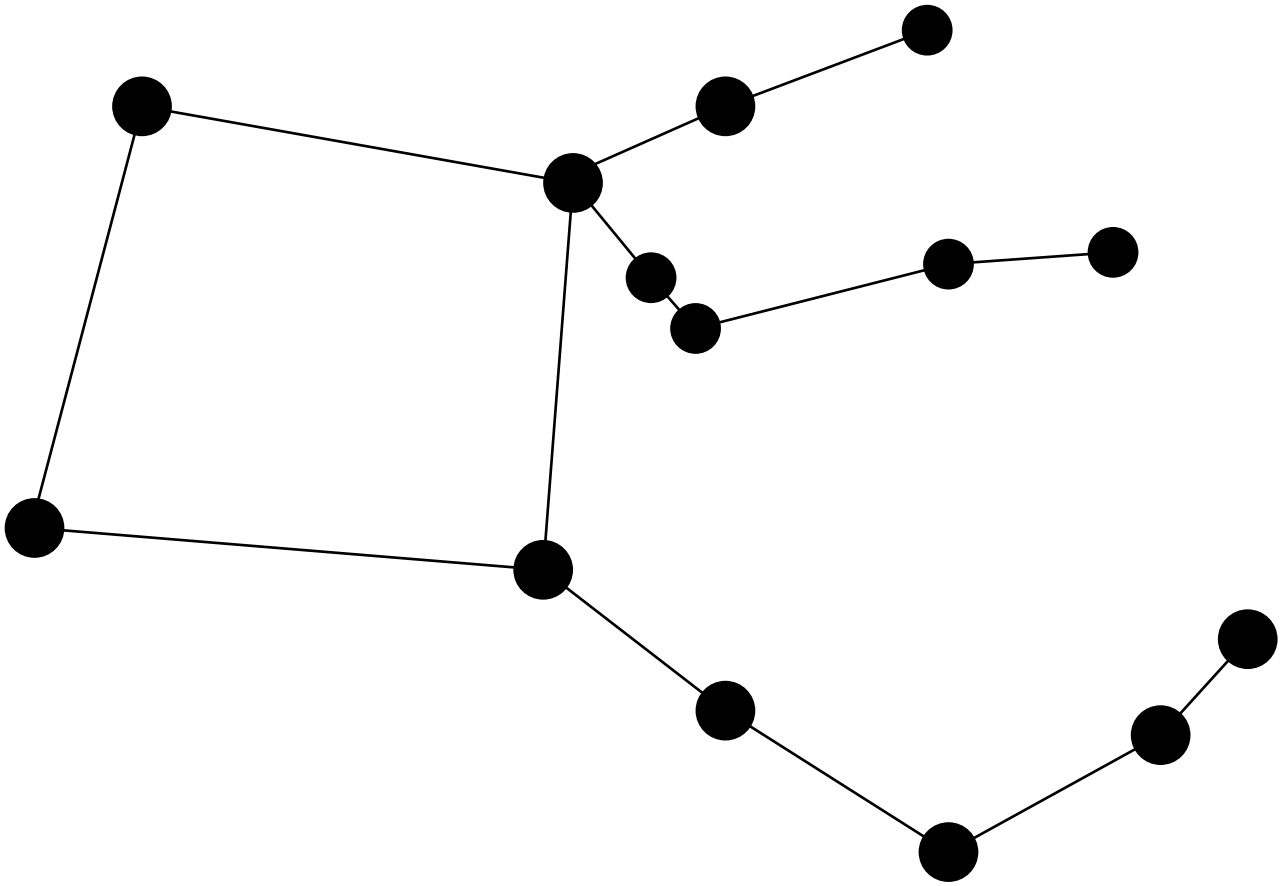
Orion, The Hunter



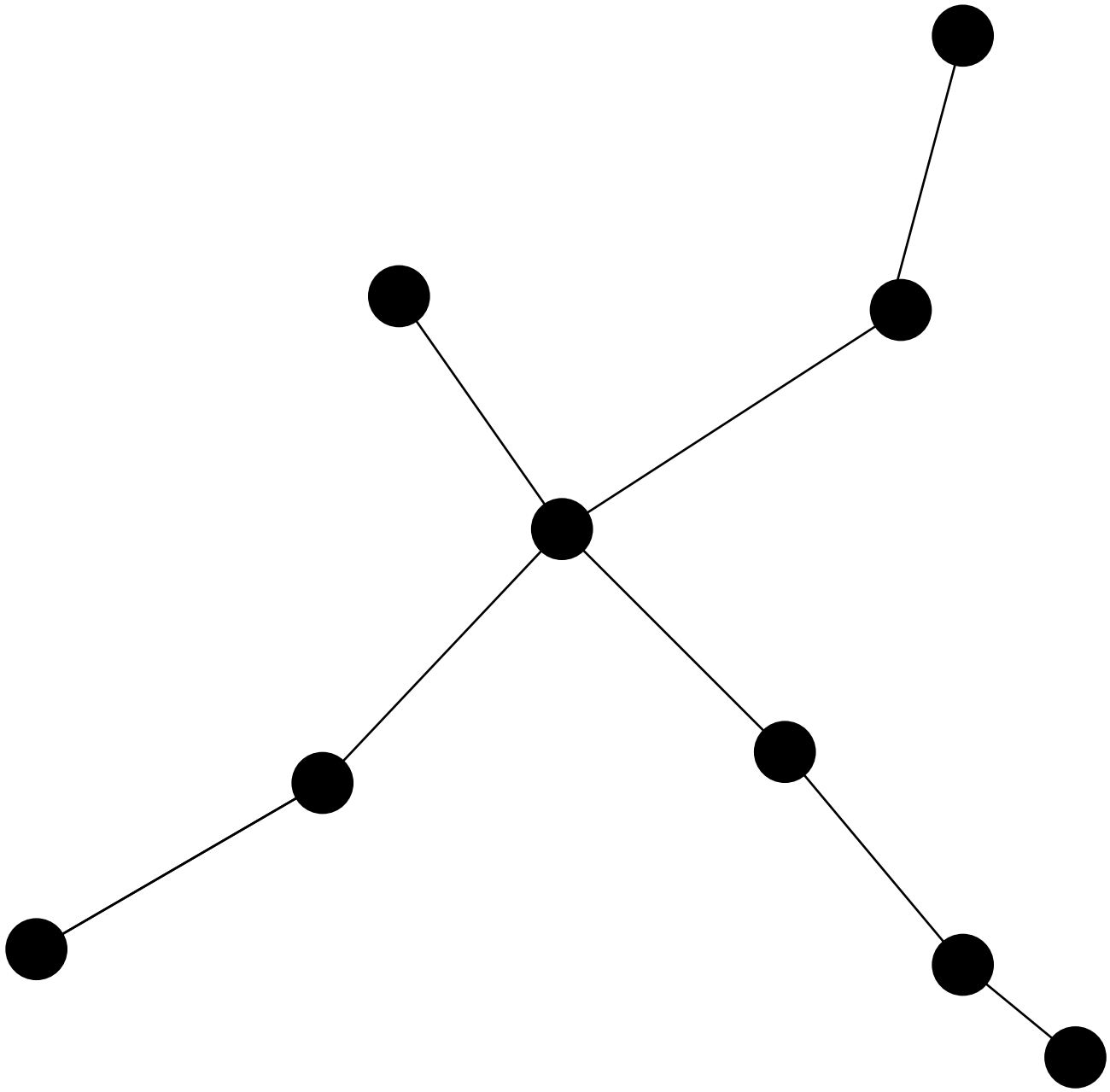
Cassiopeia, The Queen



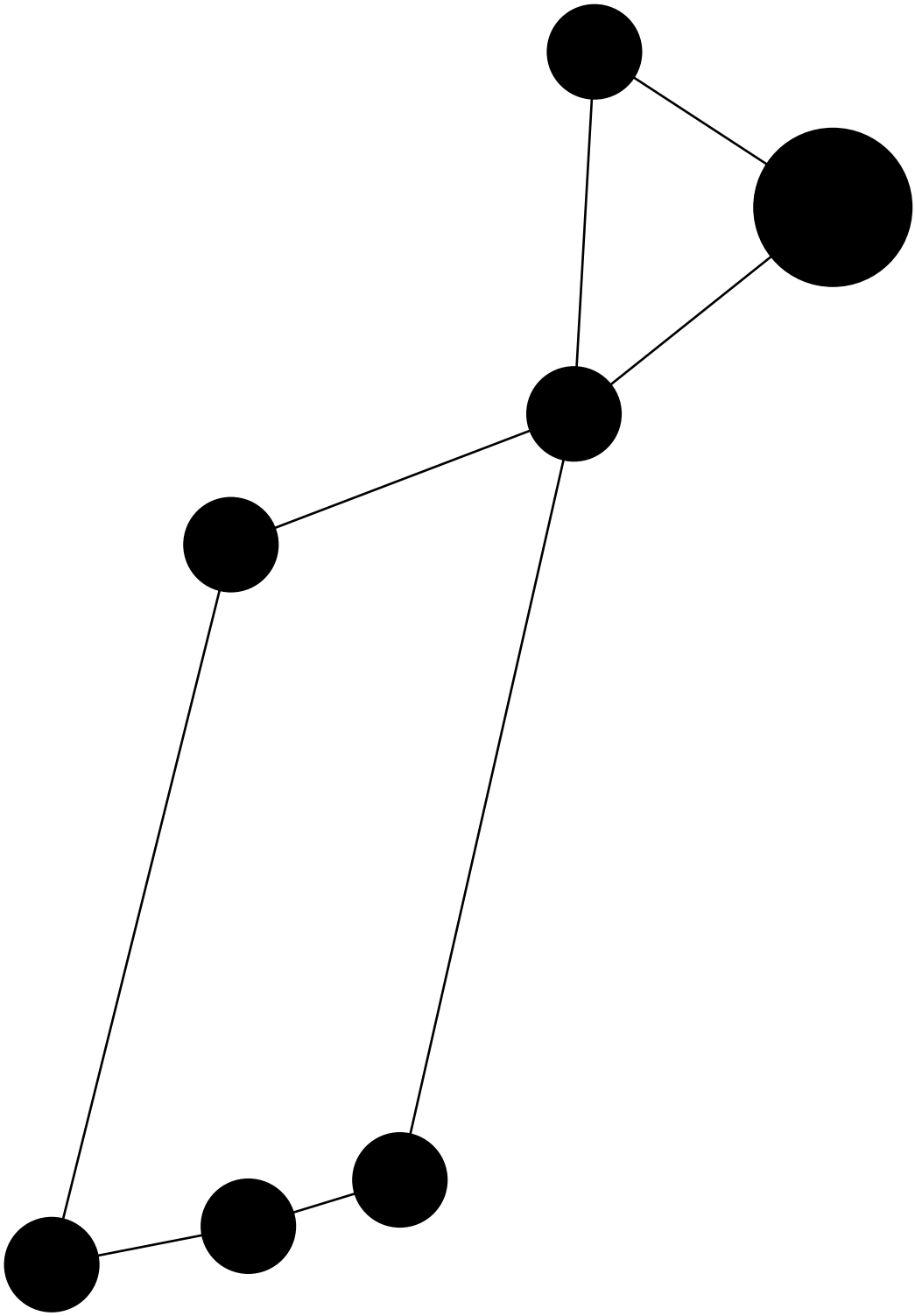
Hercules, The Hero



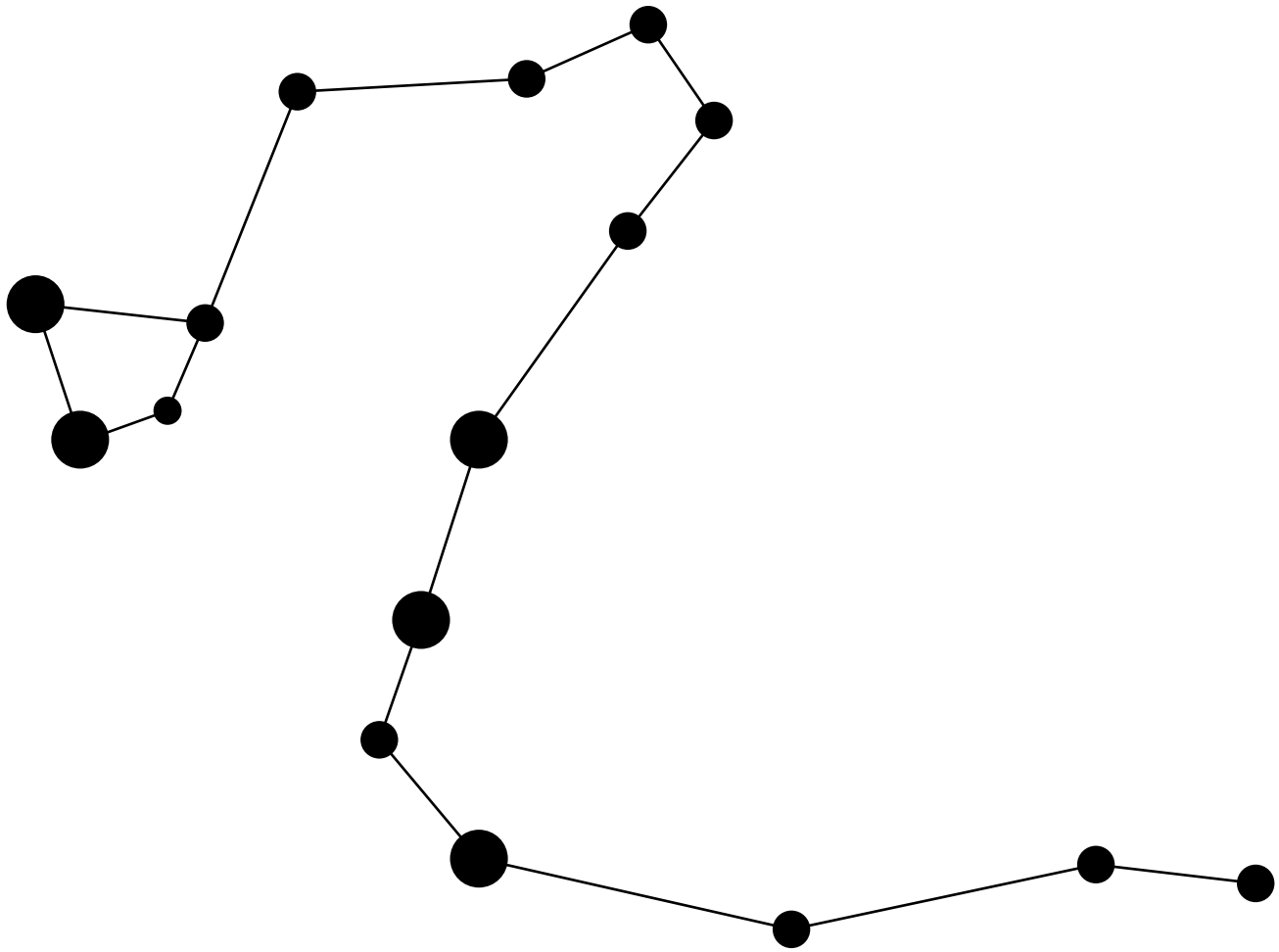
Pegasus, The Winged Horse



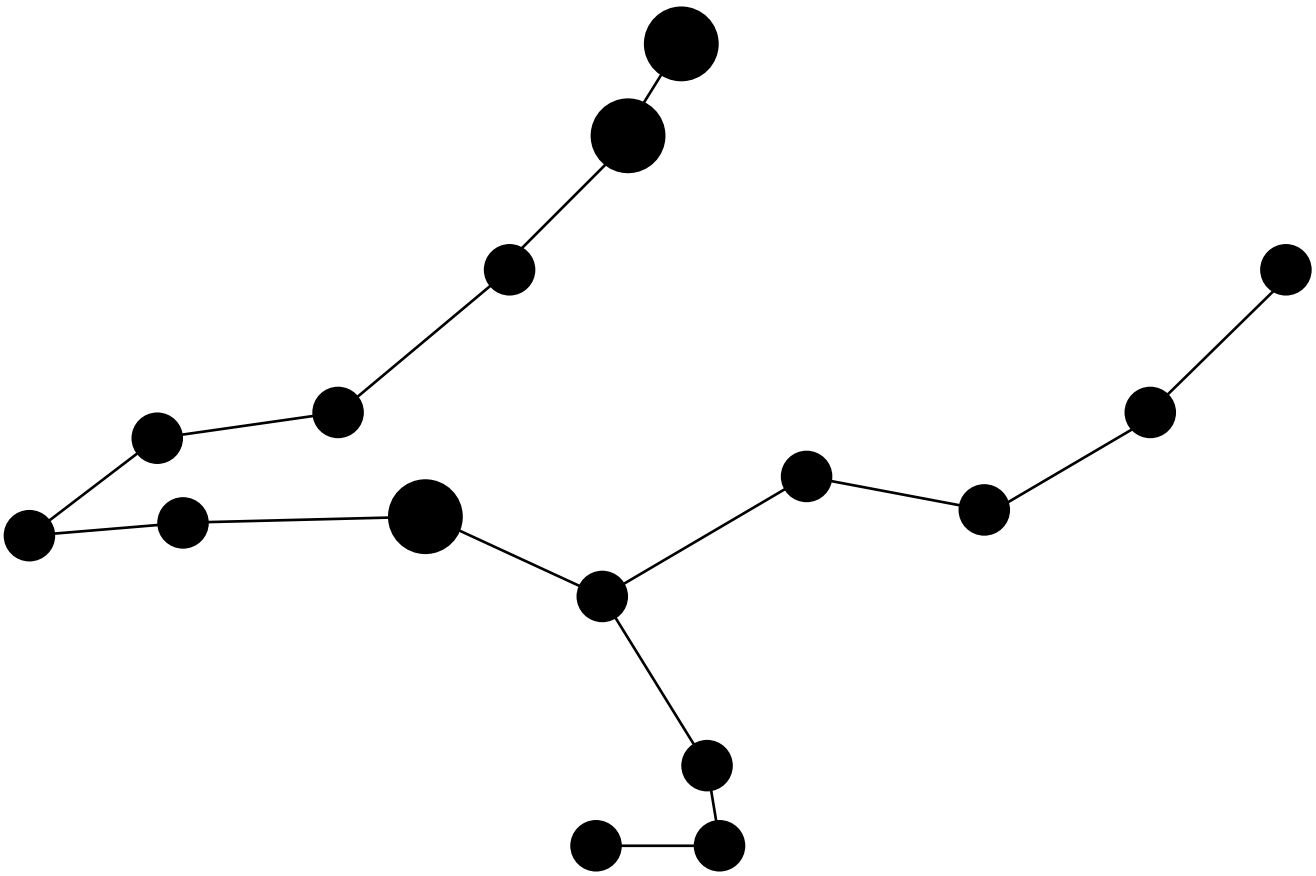
Cygnus, The Swan



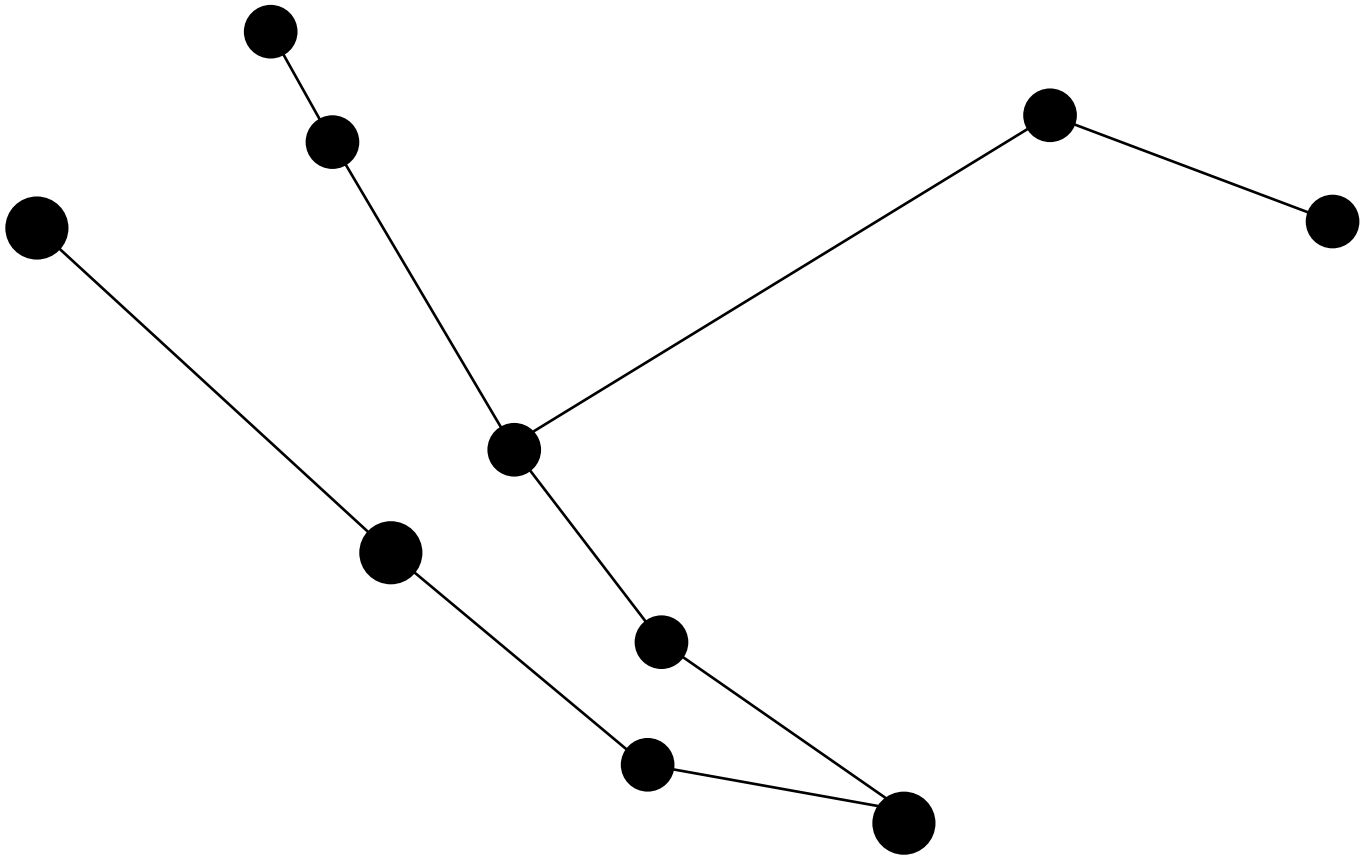
Lyra, The Lyre



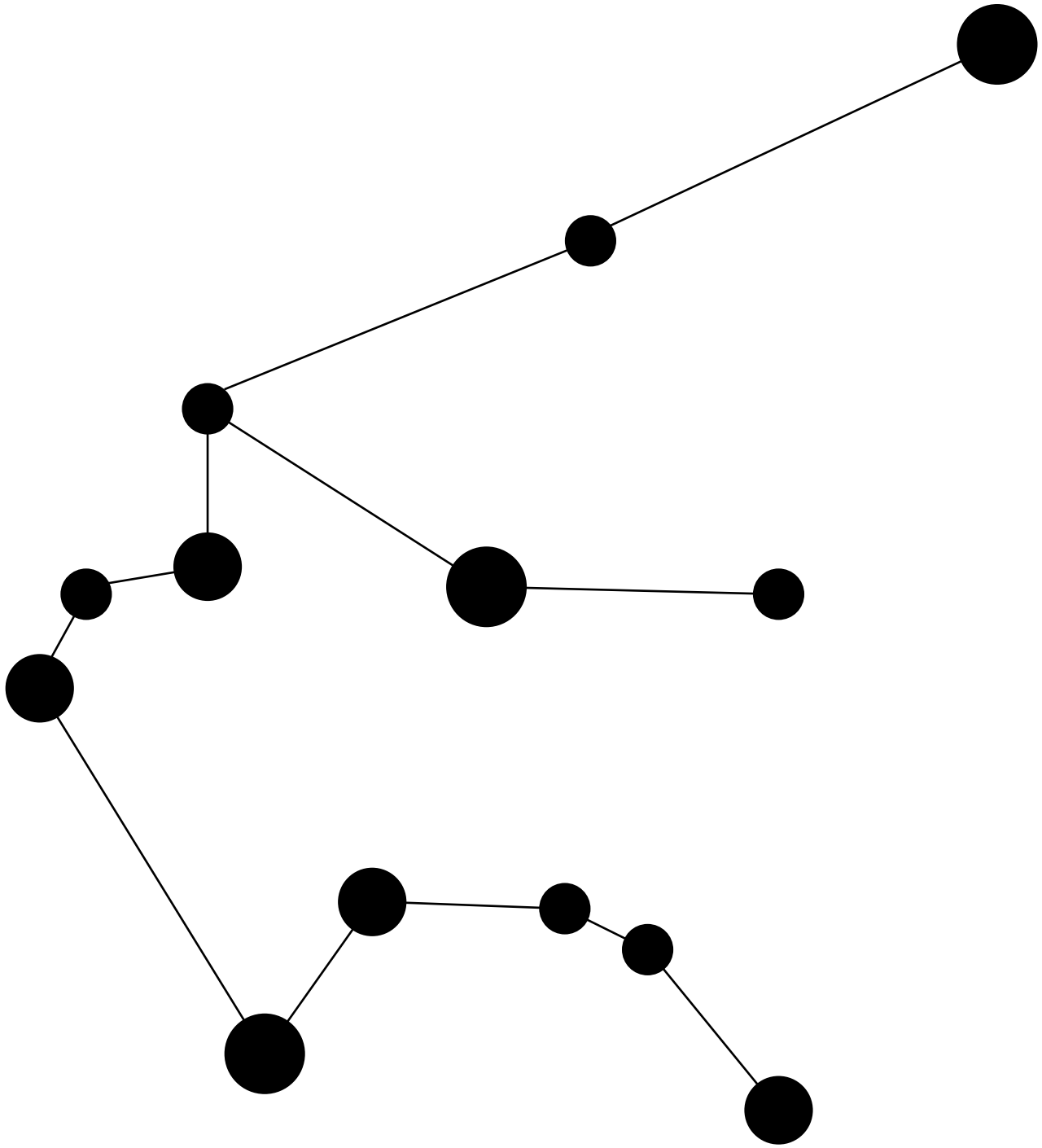
Draco, The Dragon



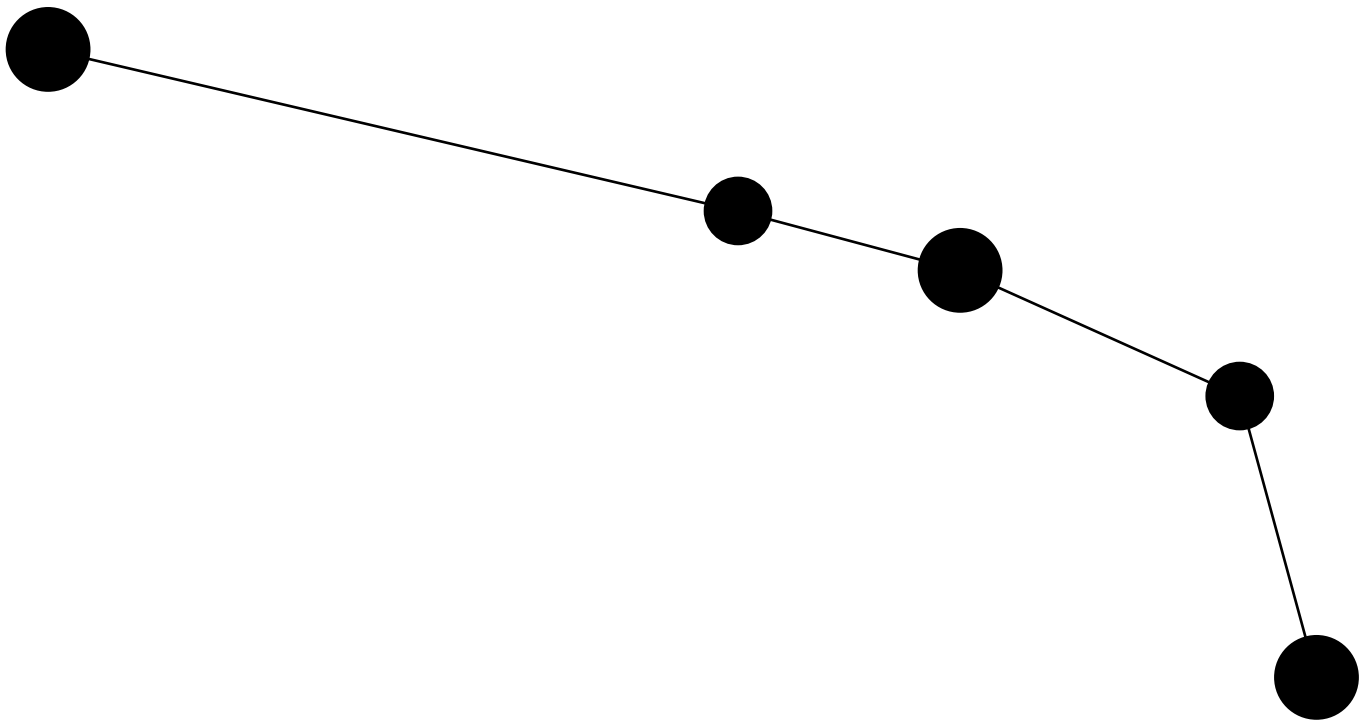
Perseus, The Hero



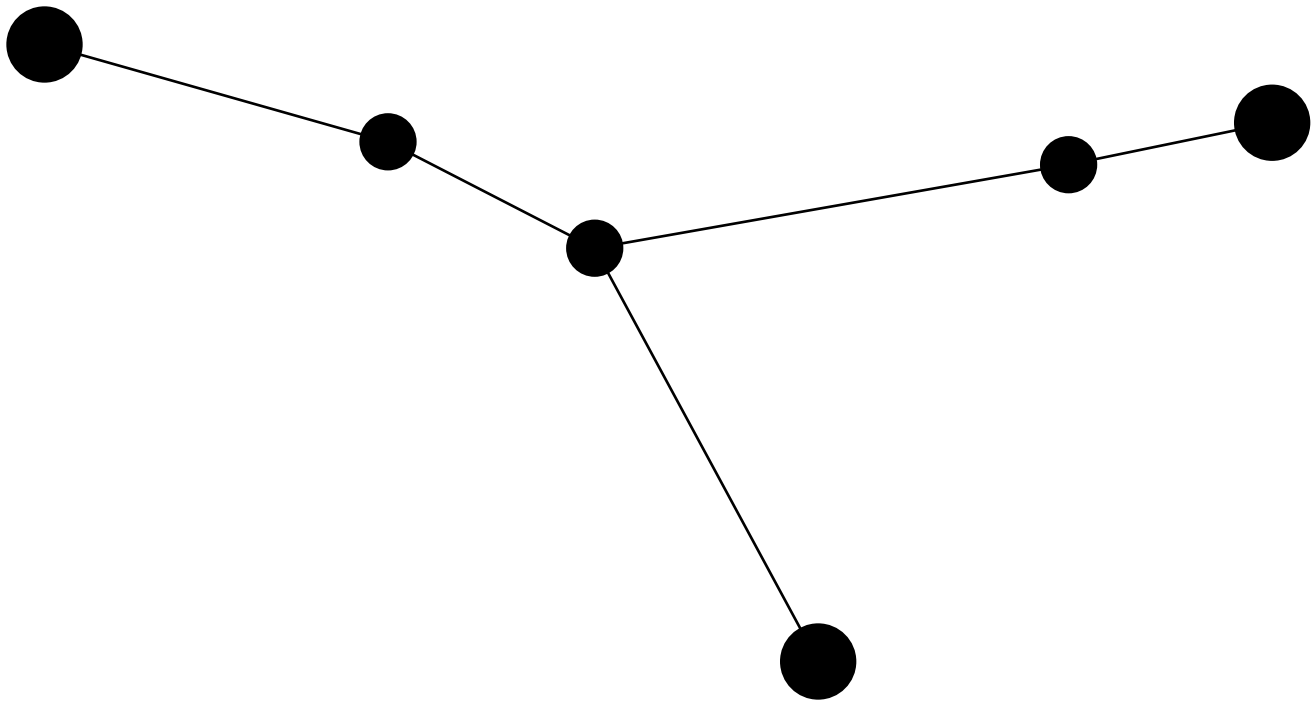
Andromeda, The Princess



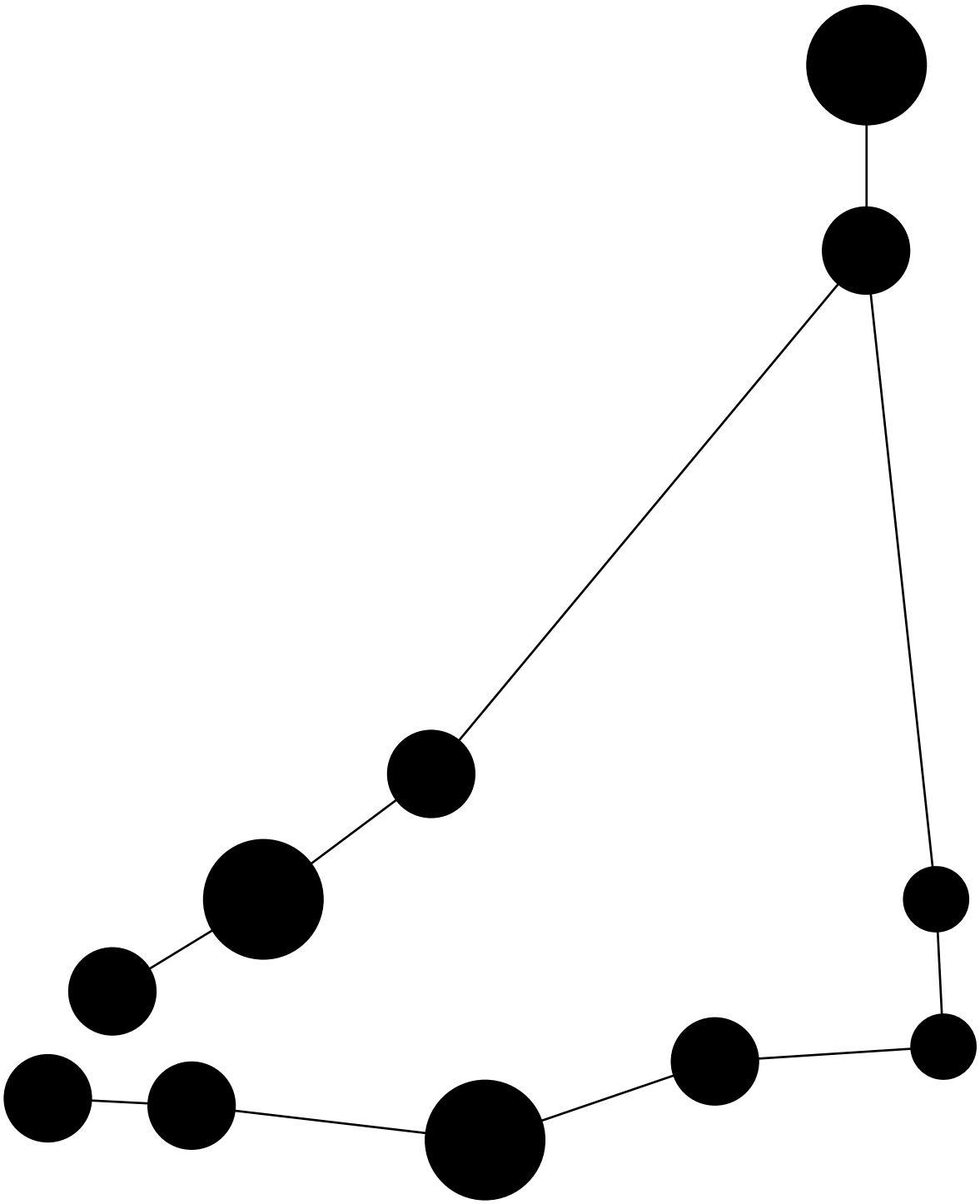
Aquarius, The Water Carrier



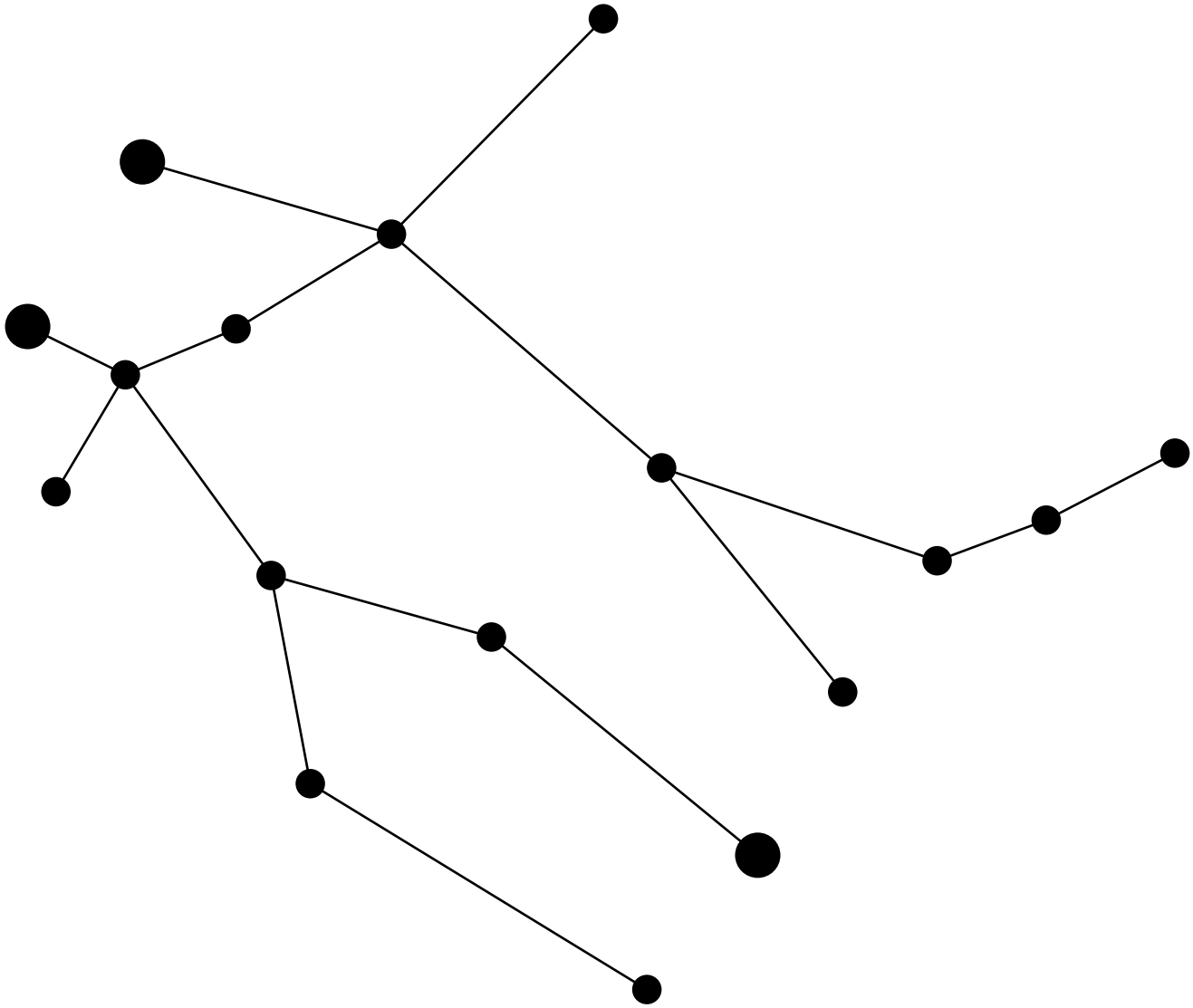
Aries, The Ram



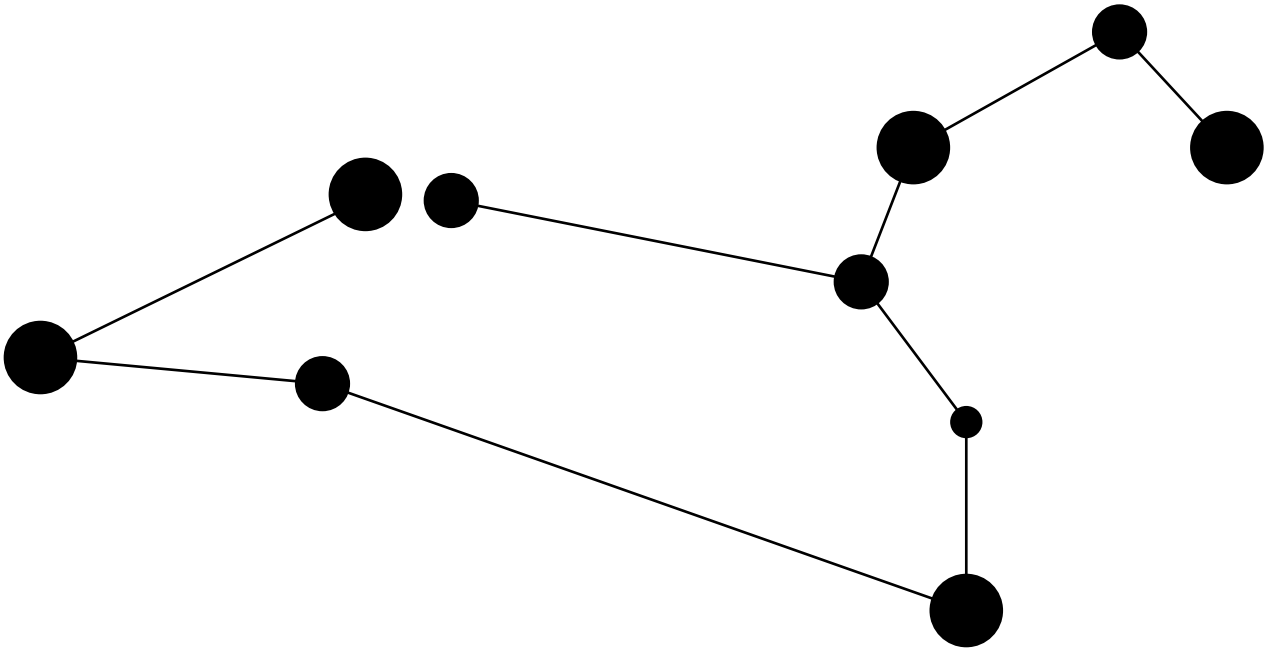
Cancer, The Crab



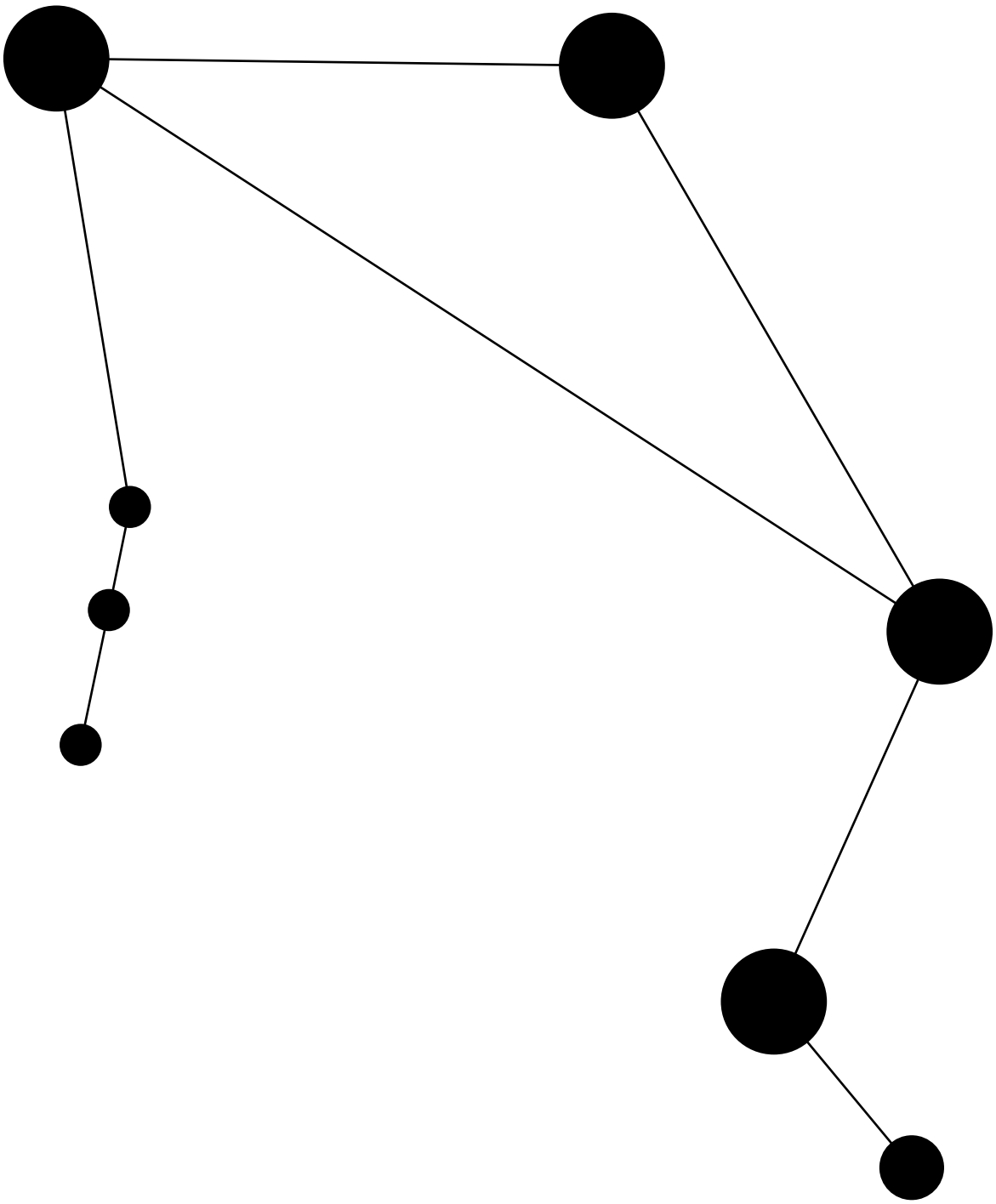
Capricorn, The Goat with the Tail of a Fish



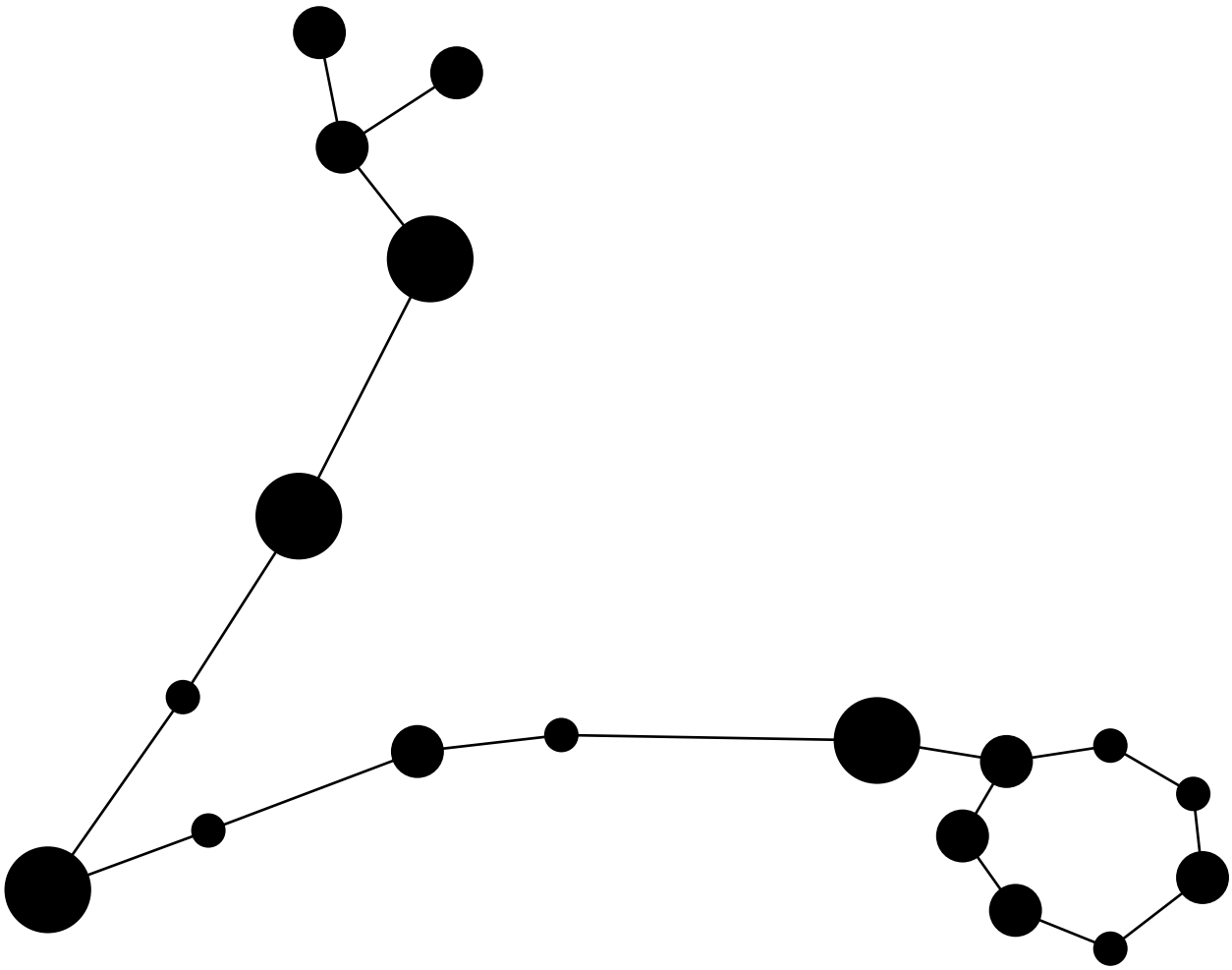
Gemini, The Twins



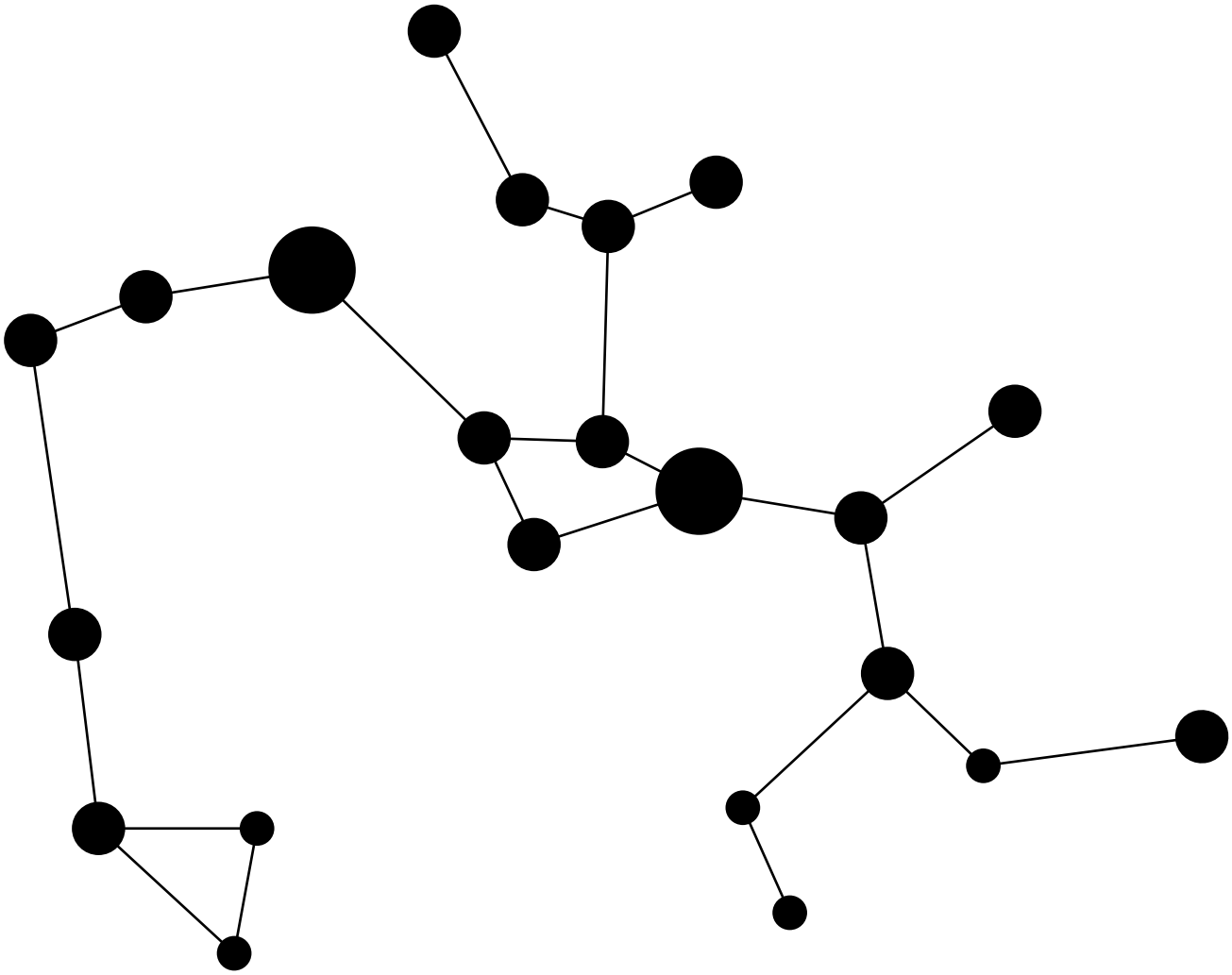
Leo, The Lion



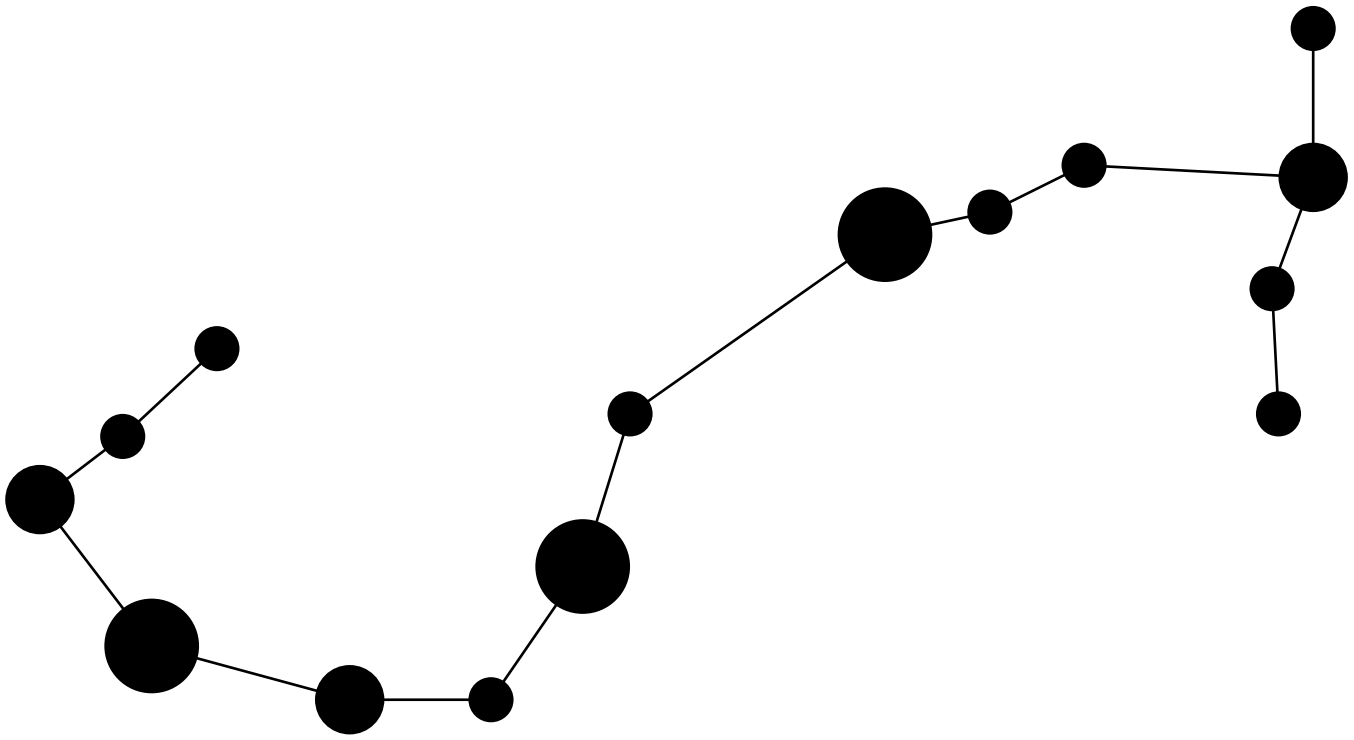
Libra, The Scales



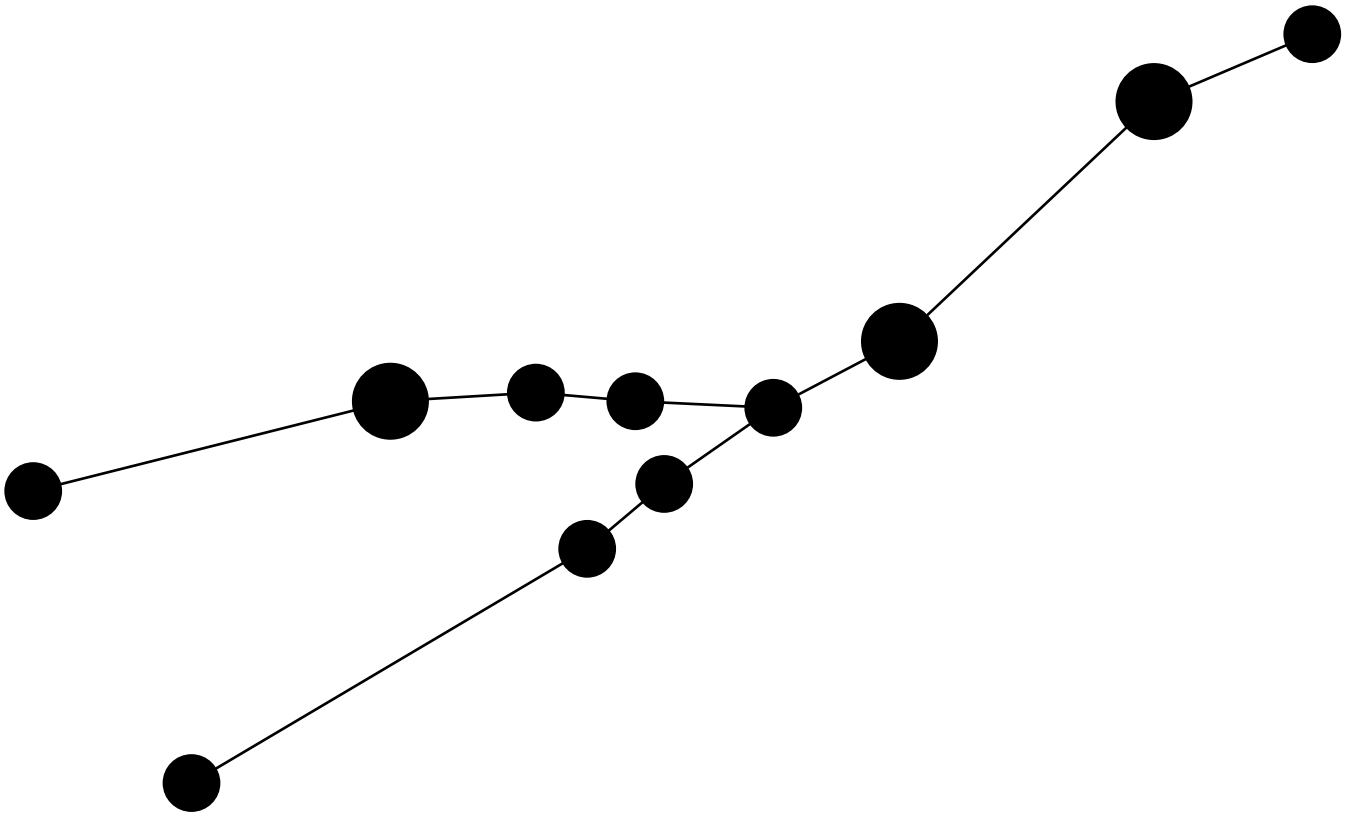
Pisces, The Fish



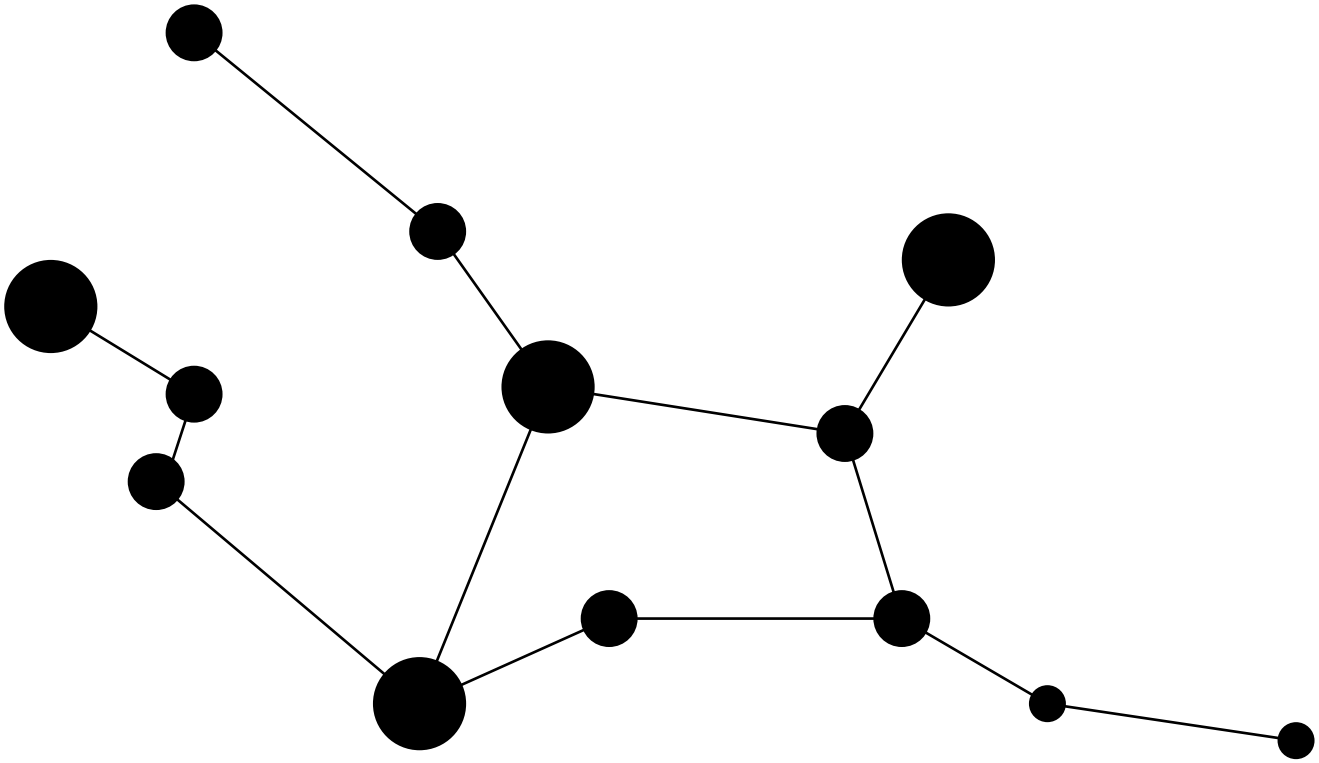
Sagitarius, The Archer



Scorpio, The Scorpion

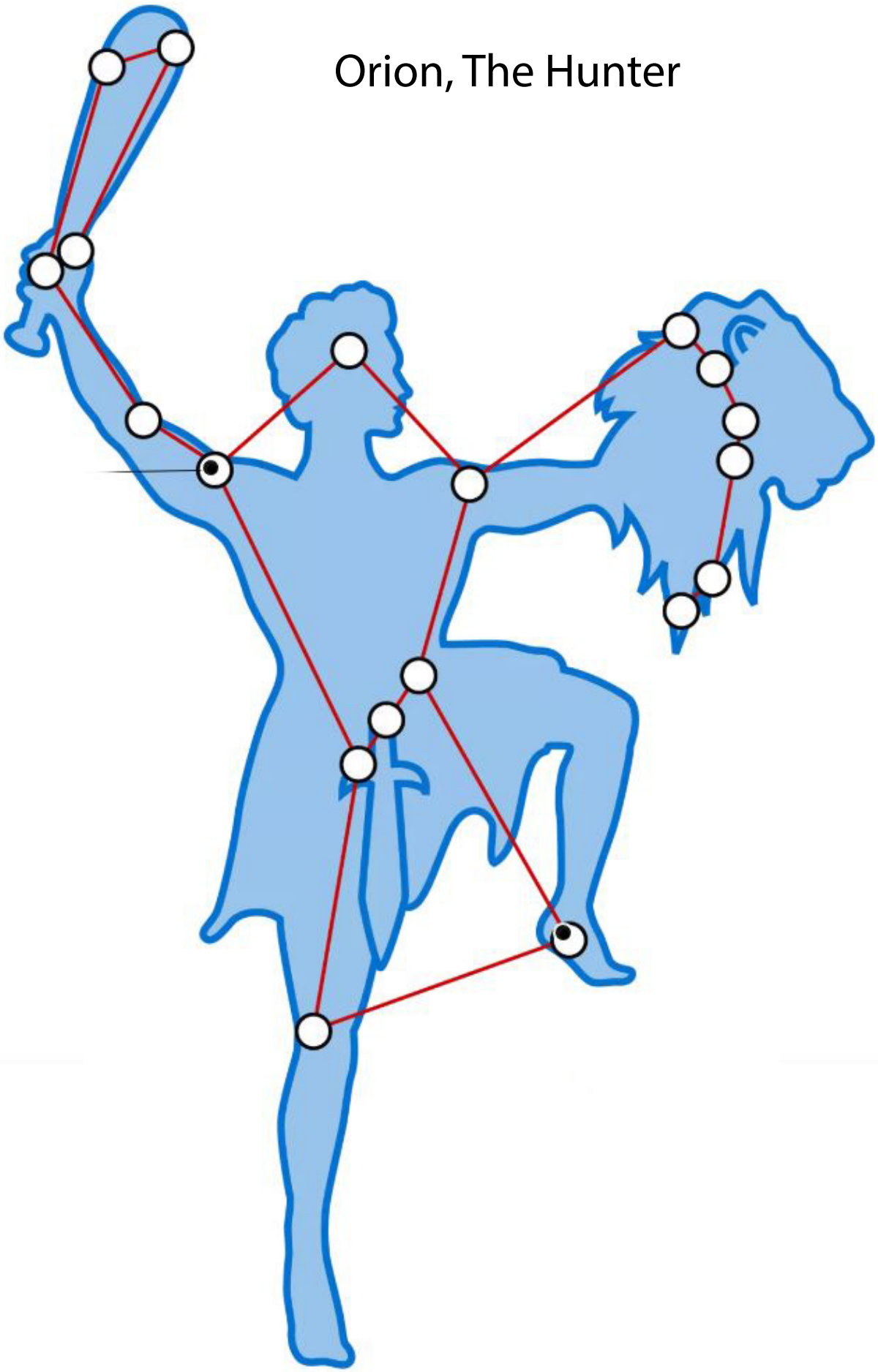


Taurus, The Bull



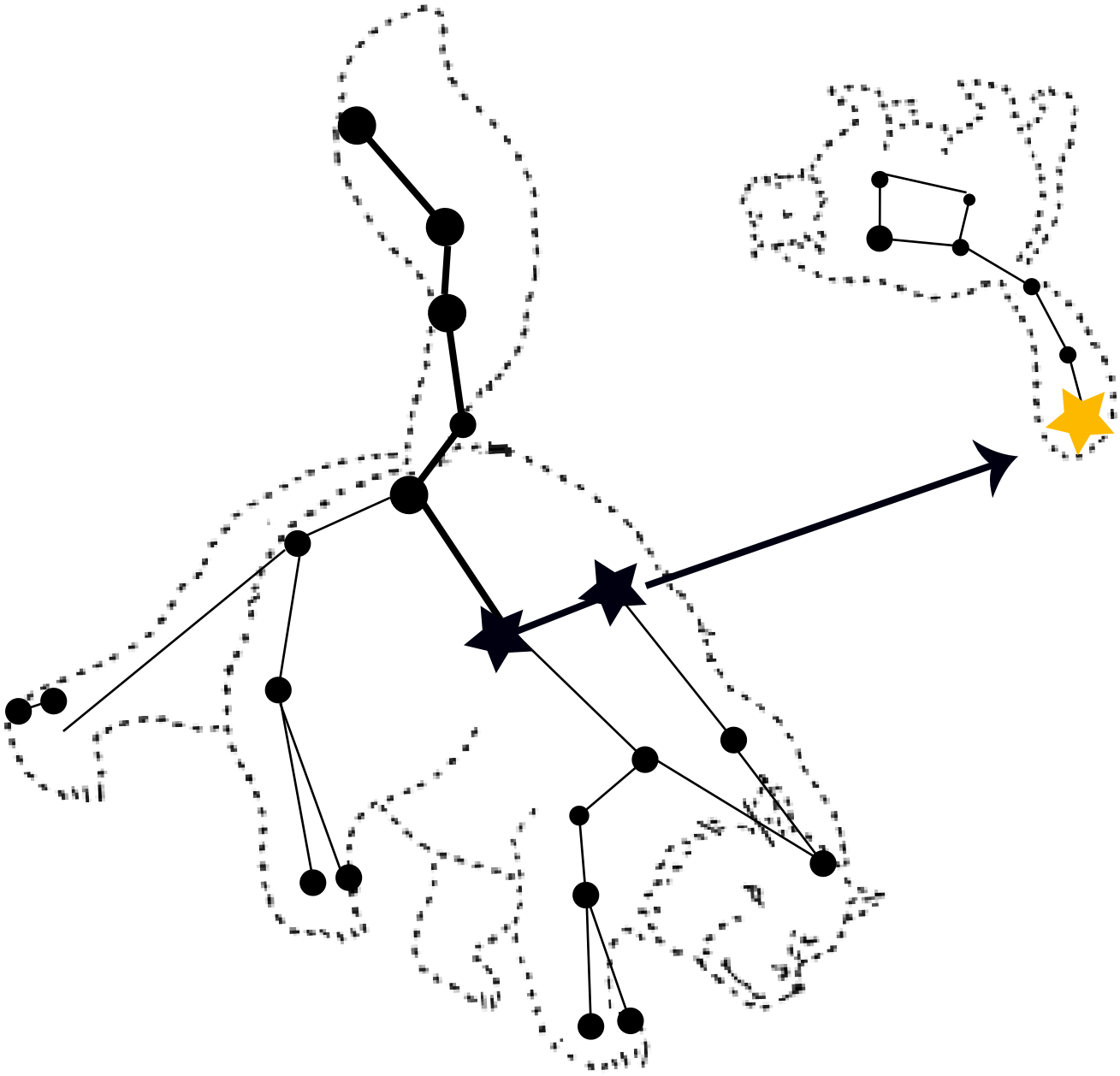
Virgo, Goddess of Justice

# Orion, The Hunter



# How to find Polaris, the North Star

Polaris appears to hold still in our sky, always pointing the way due north



If you can find the Big Dipper, you can find Polaris!
The two outer stars in the bowl of the Big Dipper always point to Polaris, the end of the handle of the Little Dipper.