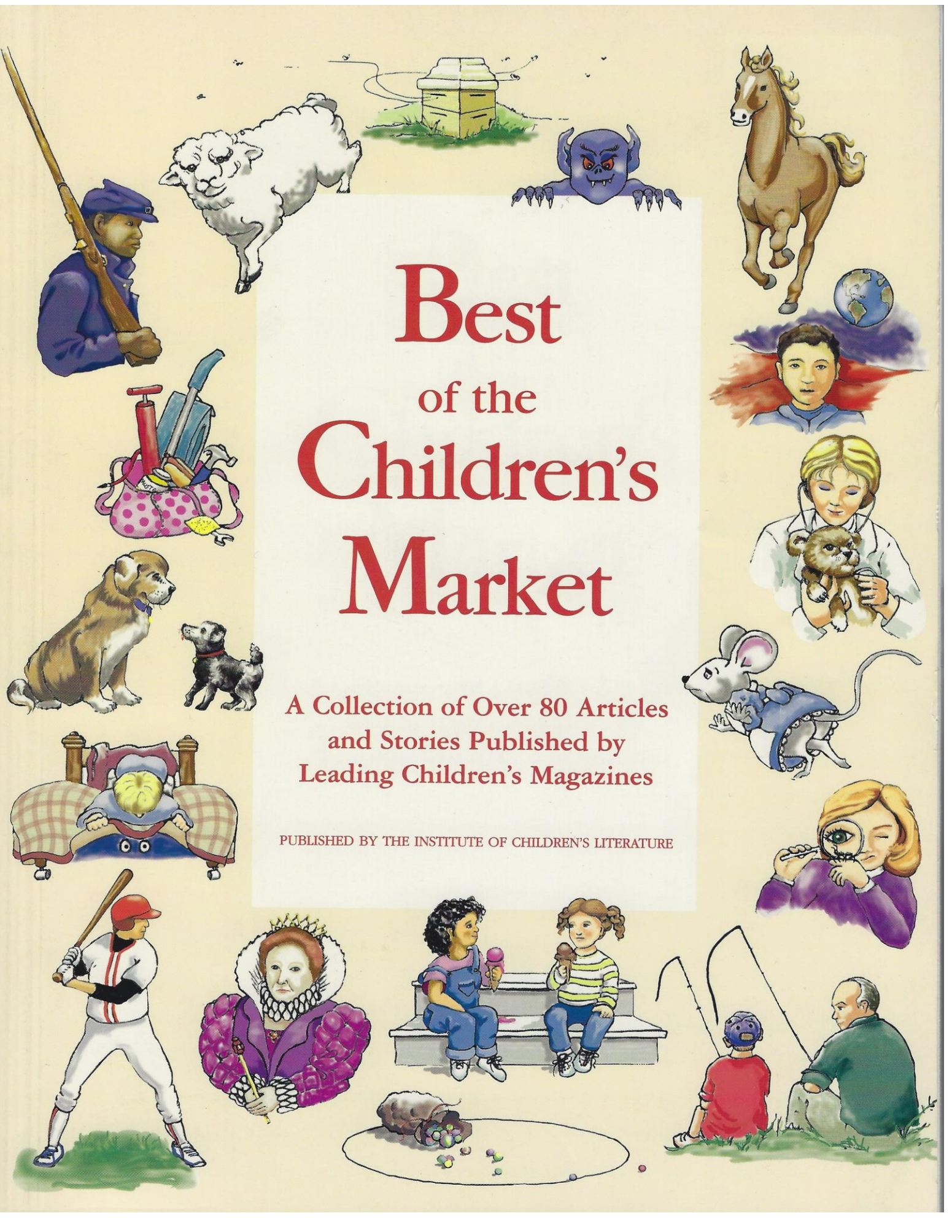




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# Navigating by the Stars

## Make a Cross-Staff and Find Your Latitude

By Mary Morton Cowan

**O**f all the stars we see from the northern hemisphere, the North Star is unique. Long ago people named it Polaris, for it always stays close to the North Pole. In the 1400s, sailors used Polaris to help locate their position on the high seas. A simple instrument that was already available for this purpose in 1494 was a cross-staff, that is, a board marked with angle readings and a crosspiece for sighting. With it, sailors and navigators anywhere north of the equator could determine the angle between the horizon and Polaris. The larger the angle, the farther north they were. They were actually measuring their degree of latitude.

Try your hand now at making a cross-staff and measuring the approximate latitude where you live.

### You Need:

- a 54-inch-long board (about 2 inches wide and 1/2 inch thick)
- thin cardboard (from the back of a pad of paper)
- nails (long enough to nail 3 boards together)
- saw, hammer, and clamps
- scissors, string, protractor, thumbtack, and pencil

### To Make Your Cross-Staff:

1. Saw your board into 5 pieces: one 26" shaft, one 18" crossbar, one 6" bar, and two 2" spacers. Cut 2 cardboard filler pieces, each the size of the 2" spacers.
2. Assemble the crosspiece. Place the 18" crossbar on your work surface. Lay the shaft across the center of it, forming a cross. Put the 2

small spacers on the 18" board, next to the shaft. Add the cardboard filler pieces. Place the 6" bar on top. Be sure to keep the crosspiece at right angles to the long board. Clamp it in place while you nail it together (2 nails on each side). Do NOT allow nails to touch the long board. That board should slide freely through the opening.

3. Mark your scale of degrees. Poke a thumbtack into one end of the board and knot a string around it. Push the centerpiece close to the other end. Stretch a string over the top of the crosspiece and hold it firmly. Center your protractor at the corner of the long board, with the angle line on zero, and read the angle. Mark a pencil line on the board where the crosspiece intersects it, and write the number of degrees next to the line.
4. Move the crosspiece closer to the protractor and mark every five angle degrees (25°, 30°, 35°, 40°, etc.), keeping the string tight as you work. The closer you get to the protractor, the larger the angle will be. When finished, remove the string.

Locate Polaris. Wherever you are in the Northern Hemisphere, Polaris is the only star that is in the same place in the sky every night (and all day, too, but you can't see it then!).

In the northern United States, you can see circumpolar constellations all year long. Circumpolar means that they circle Polaris, sort of like a compass that draws circles around a point. Two important circumpolar constellations to know are the Big

Dipper and Cassiopeia. The easiest one to spot is the Big Dipper. The two stars on the outside edge of its bowl (farthest from the handle) point directly to Polaris. (Polaris itself is part of a dimmer constellation—the Little Dipper.) Across from the Big Dipper's handle, past Polaris, is another bright constellation, called Cassiopeia. It is shaped like an "M" or a "W." In the far southern United States, the Big Dipper is below the horizon in the fall so that you cannot see the pointer stars. In that case, look for Cassiopeia. Polaris will be below it.

Once you have found Polaris, take your reading. Standing still, hold your cross-staff up to your eye. BE CAREFUL not to poke your eye or glasses. Keeping the board horizontal, move the centerpiece back and forth until its tip meets Polaris. The angle reading should be close to your degrees north latitude.

You may want to check an atlas to see how close your reading came to your actual latitude. If you travel far from home, take your cross-staff with you

and check the latitude where you're visiting!



*Calliope*  
8–14 years  
665 words

### From the Author

Since completing my first Institute course, I have had 40 articles and stories published, plus one historical novel.

I write frequently for the *Cobblestone* group. I review their theme lists and choose topics that interest me. Specific themes trigger ideas, and query deadlines force me to work efficiently. Sometimes, now that the editors are familiar with my work, they request a piece. Such was the case with this article.

*Calliope's* editor suggested an activity about celestial navigation. She assigned a page limit and a deadline. Within that framework, I was free to explore. That issue's theme was the 1494 Treaty of Tordesillas. Research showed that 15th-century navigators used cross-staffs to locate their latitude. Why not show middle-grade students (*Calliope's* target audience) how to make one?

Before I wrote my article, I made a cross-staff. I would never describe how to make something I had not actually put together and tested.

Most of any how-to article is taken up in step-by-step instructions. You may think research time is wasted for a few opening sentences, but it's a *must* for gathering ideas and knowing your topic—and it's fun!

My first drafts tend to be about twice the maximum length. This article took five or six revisions, but the result was worth it. The editor made very few changes. To help an artist illustrate it, I submitted detailed sketches and diagrams. They appeared almost exactly as I had drawn them. My bibliography listed five primary and supplementary sources.

Because *Calliope's* readership is nationwide, describing how to locate Polaris was a challenge. Circumpolar constellations aren't always visible everywhere in the U.S. Also, I had to make sure my cross-staff was long enough to cover the southern latitudes. My biggest challenge was testing the cross-staff—the week before my article was due, the weather was atrocious! Not a single star could be seen for five consecutive nights!

The final version of "Navigating by the Stars" excluded a lot of interesting details, because a short article can include only the most pertinent facts. But I saved my research folder. There are other ideas in there!