

# Space Odyssey

## TELLING TIME AT NIGHT

### USING THE BIG DIPPER

Have you ever met anybody who can tell time by the stars? Here's how. This project involves a little arithmetic and a little imagination.

Find the Big Dipper and the North Star (see page 3). The last two stars in the bowl of the Dipper are the "Pointers." A line through them passes close to the North Star (figure 1).

Imagine that the North Star is the center of the clock, and an hour hand passes up to the Pointer stars (figure 2). But this is a 24-hour clock, and the hour hand turns backward! Midnight = zero hours or 24 hours and is at the top of the clock, 6:00 A.M. = 6 hours and is on the left, Noon = 12 hours and is at the bottom, and 6:00 P.M. = 18 hours and is on the right.

The clock above reads 23 hours. On the night of March 6, you can read the time directly off the clock. If you saw the Big Dipper in the position of the diagram above on the night of March 6, the time would be 23 hours, or 11:00 P.M.

On any other night of the year, take the reading off the "Dipper clock" and subtract two times the number of months after March 6 from the reading.

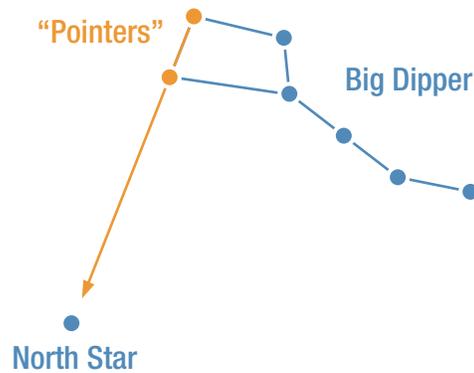


Figure 1 The Big Dipper and North Star

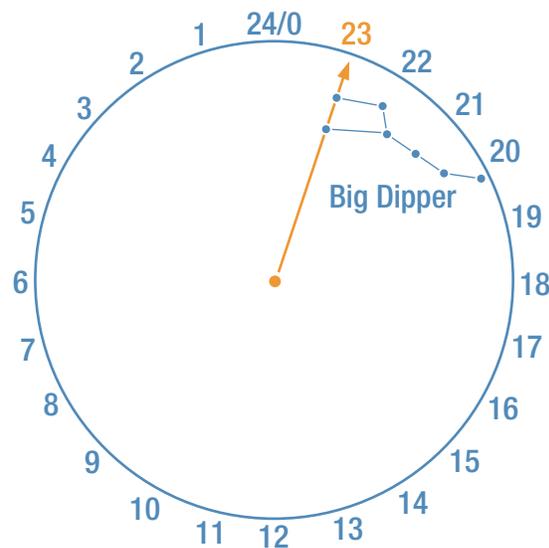
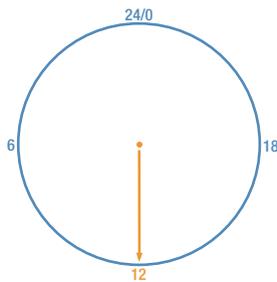


Figure 2 Imaginary clock

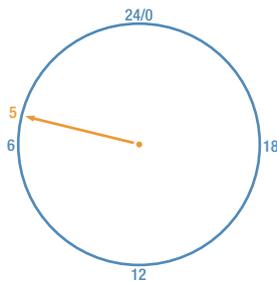
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$$\text{Time} = \text{Dipper clock reading} - 2 \times (\text{number of months after March 6})$$

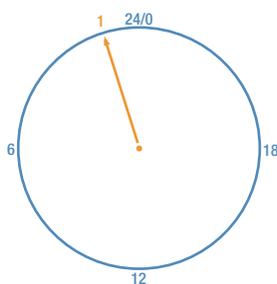
Multiplying by two and subtracting isn't so bad, but how do you figure out how many months your date is after March 6? That's the hard part. Here are several examples:



**Example 1:** The Dipper clock reads 12 hours on August 8. August 8 is about 5 months after March 6. The time is therefore  $12 - 2 \times 5 = 2$  hours = 2:00 A.M.



**Example 2:** The Dipper clock reads 5 hours on June 20. June 20 is about  $3 \frac{1}{2}$  months after March 6. The time is therefore  $5 - 2 \times 3 \frac{1}{2} = -2$  hours = 2 hours before midnight = 10:00 P.M.



**Example 3:** The Dipper clock reads 1 hour on January 15. January 15 is about  $10 \frac{1}{4}$  months after March 6. The time is therefore  $1 - 2 \times 10 \frac{1}{4} = 19 \frac{1}{2}$  hours =  $19 \frac{1}{2}$  hours before midnight = 4:30 A.M.

(To interpret “ $19 \frac{1}{2}$  hours before midnight,” subtract  $19 \frac{1}{2}$  from 24 hours.) Instead of considering January 15 to be  $10 \frac{1}{4}$  months *after* March 6, you could have considered it to be  $1 \frac{3}{4}$  months *before* March 6, and then add instead of subtract:  $1 + 2 \times 1 \frac{3}{4} = 4 \frac{1}{2} = 4:30$  A.M.

This gives you an approximate local solar time, which might be an hour or so off the time zone time, depending on where you are in the time zone. To correct for Daylight Saving Time, add one hour to your final result.

$$\text{Daylight Saving Time} = \text{Dipper clock reading} - 2 \times (\text{number of months after March 6}) + 1 \text{ hour}$$

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## FIND THE DIPPER AND THE NORTH STAR

The ability to find the North Star (Polaris) is useful for finding your way at night and for orienting yourself to constellations in the night sky.

Start from a location shielded from bright lights with a clear northern horizon. Initially, use a magnetic compass or a map to determine the north direction.

Once you have determined the north direction, look up about one-third\* of the way from horizon to zenith, the top of the sky. The North Star is fairly bright (second magnitude) and visible from the city, but not as bright as the brightest stars (first magnitude).

The Big Dipper rotates around the North Star through the night and throughout the seasons. Its stars are the same brightness as the North Star. The last two stars of the Dipper are called the "Pointers." A line from them passes near the North Star (figure 3).

Once you have become familiar with the shape of the Big Dipper, you can usually locate it quickly and use it to find the North Star. The position of the Dipper around the North Star depends on the time of night and the month of the year. A rotating star chart can give you this information or use the diagram to the right, which shows the position of the bowl of the Dipper in early evening according to the month (figure 4).

The height of the North Star above the true horizon is equal to the latitude of the location (about 40 degrees for Denver).

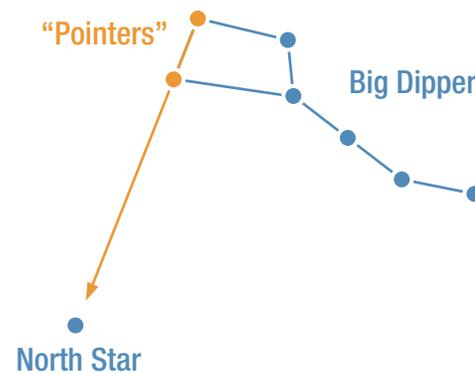


Figure 3 The Big Dipper and North Star



Figure 4 The monthly positions of the Big Dipper

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In the fall it is more difficult to see the Dipper. Then, the “W” of Cassiopeia may help to orient you toward the North Star (figure 5).

The North Star is the last star in the handle of the Little Dipper (figure 6).

The Little Dipper is a dimmer constellation, and not all of its stars are visible from the city. The North Star and the last two stars of the bowl are usually visible. Note that the handle of the Little Dipper has the reverse curve of the handle of the Big Dipper.



Figure 5 Using Cassiopeia to locate the Big Dipper

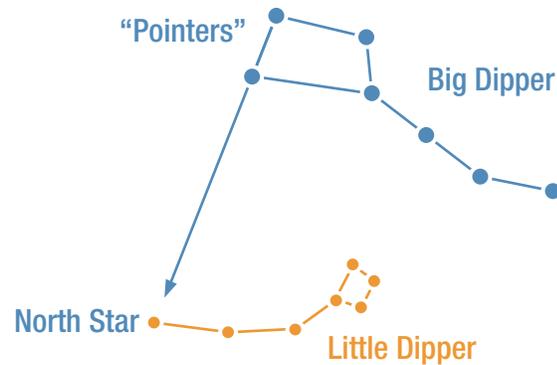


Figure 6 The Little Dipper