

Make a Sundial!

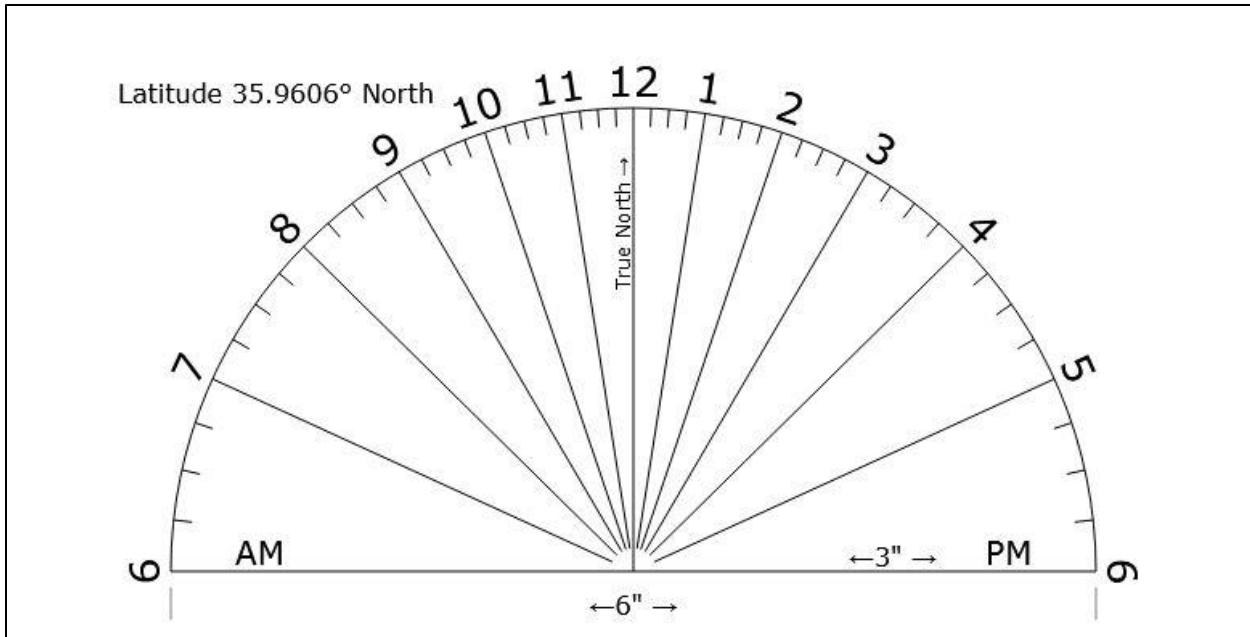
How to make a sundial for use in Knoxville, Tennessee.

Materials

- Foam or paper cup.
- Tongue depressor or art stick
- Fine-tip markers
- Protractor
- Ruler
- Scissors (if using a paper cup)
- A compass

Instructions:

- (1) For foam cups: Place your cup upright on a hard surface. Push the tongue depressor down into the center of the cup until it hits the hard surface. Flipping the cup upside down, continue pushing the tongue depressor through the center of the bottom of the cup. Be careful not to cut/tear sideways. Expand the gash most of the way across the cup, leaving about $\frac{1}{2}$ cm or $\frac{1}{4}$ inch on either side before the edge of the cup. Fold your tongue depressor to break it in half. Cut off any mess at the end.
For paper cups: With your cup upside down, use your ruler to find the center of the cup. Mark it with a marker. Draw a line the length of the base of the tongue depressor with the point in the middle of the line. Use your scissors to cut along the line most of the way across the cup, leaving about $\frac{1}{2}$ cm or $\frac{1}{4}$ inch on either side before the edge of the cup.
- (2) Use your ruler or protractor to visually extend the line of the cut – Do not actually increase the size of the hole! – until you reach the end of the cup. Mark a dot at the rim and label it 12.
- (3) Use your ruler to find the center of the cup again. Mark this point with a small X with one line of the X in the direction towards the dot marked 12. Use your ruler or protractor to visually (not drawing) where the other line of the X reaches the rim of the cup. Draw dots at these two locations. These two points should be at opposite sides of the cup! Label both points as “6”.
- (4) Check with the diagram on the next page to make sure your dots are in the right place.



(Source: <https://www.blocklayer.com/sundialeng.aspx>)

- (5) Use your protractor to find where each hour (from the figure) should be around the base of your cup. When putting your protractor on the base of your cup, make sure the straight line from 0 to 180 is on a line between the two "6" points and that "12" falls on the line that ends at 90. Mark a dot along the edge of the cup where each number occurs. When you're done, half of the base of your cup should have all of the numbers from 6 to 12 and from 1 to 6 as shown below.



- (6) Insert your tongue depressor into the cup. Using your protractor, tilt the tongue depressor until it is about 36 degrees from horizontal – 36 degrees up from the flat of

the bottom of the cup. See example below. Put a small mark on the tongue depressor where it hits the cup.



- (7) Remove the tongue depressor from the cup and decorate both.
- (8) Once you like your decoration, put the gnomon (the tongue depressor) back into the cup and make sure to tilt it again to 36 degrees.
- (9) Place your new sundial in a flat surface near a window that gets a lot of sun during the day. Using your compass, rotate your sundial until the 12 points north. If you don't have a compass, you can visually rotate the sundial until the shadow is over the correct number. Come back at the next hour and adjust to make sure your clock is correct. Your sundial can now tell you the time without using a watch!