SUNDIAL INSTRUCTIONS

A sundial is a device that is used to tell the time of day from the angle of a shadow cast by the sun. It can also show the season by the length of this shadow. Sundials of many different forms were widely used before mechanical and then digital watches and clocks. Sundials consist of a dial face, which has marked hour lines, and a gnomon, or shadow caster, of the angle appropriate for your latitude.

These instructions will guide you through the process for making a simple horizontal sundial designed for Columbus, Ohio, or any other location at 40 degrees North latitude. The templates have been adapted from Stoneman's sundial book listed below. You will need a five gallon bucket lid, approximately 12 inches in diameter. A smaller lid of 9" can also be used. You will need some thin material to make your gnomon. This material should be waterproof, but cardboard wrapped in foil can also be used. You will also need a small piece of double sided foam tape to mount the gnomon, some regular tape, and a permanent marker to draw hour lines on the dial face. Several push pins are needed to mark locations from the template to your bucket lid. A small ruler or straight edge will be used to mark the hour lines. Read through the directions before you start, so you can easily proceed from one step to the next.

0. Note for users of the kit from Fairfield County Park District: You will get a bucket lid, a gnomon already made, a small piece of double sided tape, a straight edge, templates and instructions. You will need to follow part 1. and 2. Since your gnomon is already made, you only need to mount it between the T and the X with the double sided tape (see the last line of part 3.).

1. PLACE THE TEMPLATE:

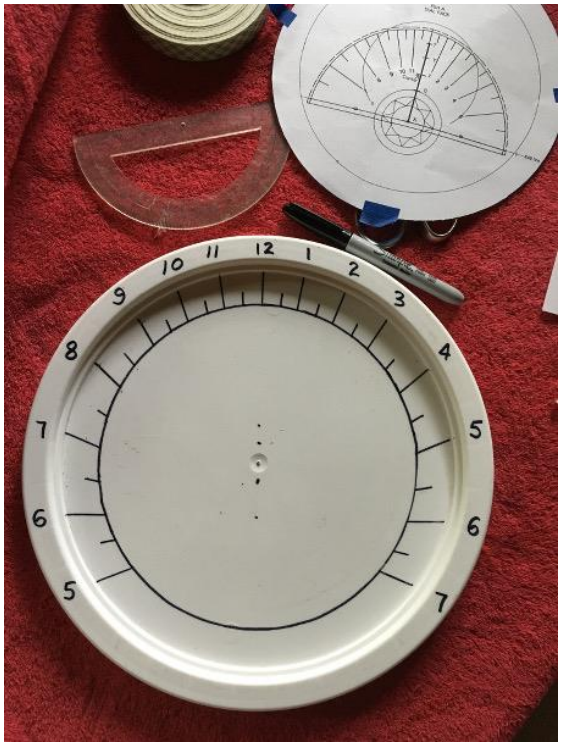
Cut out the Part A Dial Face template along the dashed lines. It should fit on the flat part of your bucket lid. If you have a smaller lid, you can trim the template to fit. just make sure to leave the part with the marked hour lines. In the center of this template is a vertical line, marked with letters T, Y, S, and X. These points will be used to line up the gnomon later. There is also a dial plate center marked. This center must be aligned with the center of your bucket lid. The center of your lid will probably have a small dimple from when the lid was made. Using this dimple as the center point of your dial plate, insert a push pin through the template at the center point on the vertical line, and into the lid at the dimple.Tape the outer edge of the template to the lid at several points, so it won't move.
Now, use a push pin to make a small hole through the template and into the lid at point T, Y, S and X. Remove the push pin from the center, and leave a pin at mark X.

2. DRAW YOUR HOUR LINES:

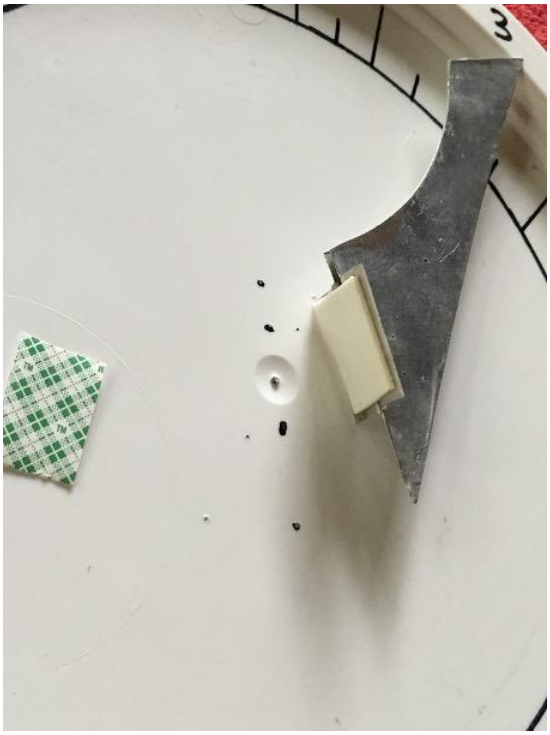
Using the second drawing as a guide, lay your straight edge against the push pin at point X, and lined up along the line labeled with a 7. Draw a line, about 1”, from the edge of the template outward, along your straight edge. You will mark two hour lines, one for 7:00 am on the left, and one for 7:00 pm on the right. Do the same for the line labeled with a 5. These are lines for 5:00 am and 5:00 pm. Now mark lines for 6:00 am and pm along the 6:00 line.

Mark hour lines labeled 8 through 4, keeping the straight edge tight against the pin at X as you go. Use the second drawing as a key. The dark thick lines on this drawing are the hour lines. Next, mark the half hour lines, making them about 1/2” long, between each hour line, again using the straight edge and markings on the template to locate them. Once you are finished marking all the hour and half hour lines, take your marker and draw a circular arc along the outside edge of the template from the 5 am hour line to the 7 pm hour line.

Then write numbers at the outer end of each hour line, as shown on drawing 2. Once you are finished marking the hour lines, remove this template from your lid. Make sure you can still see the pin marks for points T, Y, S and X.



3. MAKE AND MOUNT THE GNOMON:
To make your gnomon, you can use thin cardboard (like a cereal box) or thin metal (like aluminum flashing). If you make it from cardboard, you may want to wrap it in foil before you mount it to make it more weather resistant. You can mount it to the dial face either directly on the face or by cutting a slot, and pushing the mounting tabs through. Whichever way you choose, the important part is that the gnomon is located on the face along the vertical line marked by letters T, Y, S and X, between the T and the X. If you look at the gnomon template, you will see those same letters, showing how the gnomon should be placed. First cut out the gnomon template along the outer lines, the shaded part between S and Y is also part of the gnomon. Next, lay out this template on top of your material. You may want to tape it down in a few places so that it doesn't move while you trace around it. After you trace around the template, cut around the edges of the gnomon material. Next, fold it carefully along the center fold line. If you are using cardboard, you should tape the fold closed and then cover it with foil taped at the edges. If your gnomon is made from metal, you won't need to tape the fold. You can mount the gnomon to the dial face in two ways. You can cut a slot in the bucket lid between points Y and S, and push the shaded tabs through this slot. Then, from the bottom, bend the tabs over against the lid, and secure them with tape. Cutting a slot through the lid requires some sharp tools, and careful work. You can also easily mount the gnomon to the top of the dial face. Bend the shaded tabs at the fold lines, and put a piece of double sided tape on the bottom. Line the ends of the gnomon up with marks T and X on the dial face and press down.



4. PLACE YOUR SUNDIAL:

When you are finished assembling your sundial, you can place it outside and see how it works. Find a flat place, preferably about waist high, that gets sun most of the day. The 12:00 line should be approximately pointing North. Put the sundial down, and notice from your clock what time it is. Rotate the dial to align the shadow so that it falls across where the corresponding hour line crosses the circular arc. You can now enjoy using your sundial as the sun moves across the sky, all year round.

5. QUESTIONS FOR FURTHER THOUGHT:

A. In the USA, and around the world, land is divided up into time zones, giving us “civil time” in each zone. Actually, the 12:00 line on your sundial is “solar noon”, and solar time will be different from civil time. How is it different at your location? Why are there time zones? Why don’t we still use solar time?

B. Can your sundial keep accurate civil time if you align it as described above? When is it most accurate? When is it least accurate?

C. Could a sundial be made on a vertical surface, like a building wall, instead of a horizontal surface like yours? Would the lines have to be different?

D. Can a sundial show the solar time when there are clouds, or at night?

You can find the answers to these questions in the two references given below, as well as much more information and the mathematical formulas used to construct hours lines for different latitudes and different types of sundials.

Additional resources:

Easy to Make Wooden Sundials, Milton Stoneman, Dover Publications, New York, 1982

Sundials, Their Theory and Construction, Albert E Waugh, Dover Publications, New York, 1973.