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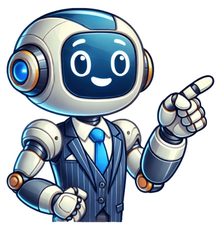

INSTRUCTIONS:NORTHERN HEMISPHERETo use your Pandeia compass sundial watch, hold it level. Then place the dial wing in an upright vertical position. Observe the directionals engraved under the glass on the compass face. Locate the North directional. Align the compass arrow over the North directional. The dial wing will now cast a shadow on the roman numerals, telling you the time. Allow for slight variation depending on the time of year and your location on Earth.SOUTHERN HEMISPHERETo use your Pandeia compass sundial watch, hold it level. Then place the dial wing in an upright vertical position. Observe the directionals engraved under the glass on the compass face. Locate the South directional. Align the compass arrow over the South directional. The dial wing will now cast a shadow on the roman numerals. The dial wing will now cast a shadow. Read the inverse or opposing roman numeral as where the shadow is cast. This now tells you the time. Allow for slight variation depending on the time of year and your location on Earth. Download Article Download Article Sundials have been used to measure time, based on the Sun, for thousands of years. This simple device can be made up of nothing but a flat dial and a gnomon (the “pointer” that casts the shadow), but can still be tricky to read if you’re just starting out. By setting up your sundial correctly and completing a few simple calculations, you can synchronize your sundial to clock time and know the hour no matter where you are. 1 Place your sundial on a flat, horizontal surface. A sundial will only work correctly when it’s on a perfectly flat surface, like the ground, a stand, or a table. Place yours down in a safe spot where it won’t get knocked down or moved.[1] 2 Make sure your sundial will be in direct sunlight all day. This may seem obvious, but it’s crucial! If you want to be able to read your sundial from dawn to dusk, keep it out in an open, unshaded area where sunlight can reach it for as long as possible. You may notice that some sundials show only 12-hour measurements, since they won’t work for the hours that the sun is down. Advertisement 3 Point the gnomon north if you’re in the northern hemisphere. Use a compass or look for the North Star at night to find true north. Then, rotate the face of your sundial until the gnomon, or the pin of the sundial, is pointing straight north.[2] The 12:00 noon notation is aligned with the gnomon, so it will be pointing north as well. 4 Face the gnomon south if you’re in the southern hemisphere. If you live below the equator, you’ll need to point the gnomon of your sundial towards the south, rather than the north. You can use a compass or look for the Southern Cross constellation to find true south and adjust your sundial accordingly. To find the Southern Cross, look for 4 stars shaped like a small kite. The farther south you are, the higher it will be in the sky.[3] 5 Use a vertical sundial if you’re at the equator. The angle of the sun makes it very difficult to use a traditional horizontal sundial along the equator. Instead, use a vertical sundial and follow the packaging instructions to set it up and point the gnomon correctly.[4] At the equator, the sun rises along the eastern horizon and moves straight up, then sets on the western horizon. If you used a horizontal sundial, the shadow would fall mostly west in the morning and mostly east in the afternoon, instead of rotating slowly. Advertisement 1 See where the shadow line falls on your sundial. Once you’ve set up your sundial, take a look at it when it’s casting a shadow in the sunlight. Note the line that the shadow’s outer edge lines up with and use it to read your sundial like a regular clock.[5] You might see different line denotations based on your sundials, but it should be split into even sections by 5 minutes or 10 minutes so you can get an accurate estimate. 2 Find the center longitude of your time zone. Your sundial can be off by up to an hour compared to clock time depending on your longitude. To fix this, first figure out how many hours you are ahead or behind Greenwich Mean Time (GMT), which is at 0° longitude. For every hour that you’re ahead, the center of your time zone will shift by 15° east; for every hour you’re behind, the center of your time zone will be 15° west.[6] For example, Pacific Standard Time (PST) is 8 hours behind GMT. Multiplying 8 hours by 15° gives you 120, so PST’s center longitude is 120° West. You can find the current GMT time by searching online. 3 Find the distance between|your longitude and the center of your time zone. You can find your own longitude by looking it up online or with a GPS device. Then, calculate the distance from your longitude to the central longitude of your time zone, and note whether you’re to the east or west of it. For example, Seattle is at 122.3° West longitude. The central longitude of its time zone (PST) is 120° West, so Seattle is 2.3° away from it. 4 Add or subtract 4 minutes for every degree away from the center. Now, use your calculation to get a more accurate estimation of the time from your sundial. Multiply the difference between your longitude and the central longitude by 4. If you live west of the central longitude, add your answer to the time; if you live east, subtract it.[7] In Seattle, for example, you’d multiply 2.3 by 4 to get 9.2. Since Seattle is west of the time zone’s center, sundials in Seattle are 9.2 minutes behind clock time, so you need to add 9.2 minutes to make them equivalent. If your sundial reads that it’s 1:40 pm in Seattle, then, you’d add 9 minutes to estimate that it’s 1:49 pm. Why 4 minutes? Since most time zones are 15° of longitude wide, or 1 hour long, you can divide 60 minutes by 15° to see that it takes about 4 minutes for the sun to move through 1 degree. 5 Add 1 hour if it’s Daylight Saving Time. You’ll need to adjust your time even more during Daylight Saving Time, which runs from early spring to mid-fall. Simply add 1 hour to your sundial’s time to match it to the clocks during this period.[8] Search online to see when Daylight Saving Time starts and ends in your region. 6 Calculate the Equation of Time to find the exact time. The length of one day varies slightly on any given day, which can add up to make your sundial’s time differ from clock time by as much as 15 minutes. If you want the most exact time estimate from your sundial, adjust your measurement using an Equation of Time table. Search for one online and either add to or subtract from the time as instructed.[9] Most calculators require you to enter in your year and longitude or time zone. The calculator will then give you a table telling your how to adjust your sundial time throughout the year. Advertisement Add New Question Question Can a sundial tell time at night? wikiHow Staff Editor Staff Answer This answer was written by one of our trained team of researchers who validated it for accuracy and comprehensiveness. No—a sundial works by casting shadows that indicate the time based on the position of the sun. A sundial won’t work if the sun isn’t visible, so you can only use it during the day when it’s clear enough out for the sun to cast a shadow. However, there is a similar device called a moondial that you can use at night, tracking shadows based on the moon’s position. Question How accurate is a sundial? wikiHow Staff Editor Staff Answer This answer was written by one of our trained team of researchers who validated it for accuracy and comprehensiveness. It depends on how carefully the sundial is designed and oriented. Most of them aren’t truly accurate to within more than about 10 minutes. Question What is a shadow clock? wikiHow Staff Editor Staff Answer This answer was written by one of our trained team of researchers who validated it for accuracy and comprehensiveness. A shadow clock is any kind of timepiece that tracks the passage of time using the movement of shadows, usually cast by sunlight. A sundial is the most common type of shadow clock. There are also moondials, which track shadows cast by the moon at night. See more answers Ask a Question Advertisement Co-authored by: Math and Science Instructor This article was co-authored by Jessie Antonellis-John. Jessie Antonellis-John is a Math and Science Instructor who teaches at Southwestern Oregon Community College. With over 10 years of experience, she specializes in curriculum development. Jessie earned her PhD in Teaching & Teacher Education from the University of Arizona, her Master of Education from Western Governors University, and her BS in Astrophysics from Mount Holyoke College. She’s also co-authored several peer-reviewed journal articles in professional publications. This article has been viewed 262,045 times. Co-authors: 10 Updated: March 10, 2025 Views: 262,045 Categories: Featured Articles | Teaching Children Skills | Clocks Print Send fan mail to authors Thanks to all authors for creating a page that has been read 262,045 times. "I have a brass sundial that I bought years ago and refound trying to set it up in Southern Hemisphere. Had to find the leveler! Thank you."..." more Share your story One of the first time-measuring devices, the sundial has been in use for hundreds of years. Although the sundial may not be accurate according to today's time standards, it will give you a general time frame. The sundial compass is a portable version of a traditional sundial. The compass will help you determine direction while on the move so the sundial can be properly placed while in travel. The time may not be completely accurate, but you'll never need to worry about the batteries running out as with a traditional clock. Place the sundial compass on a level surface. The compass will not read correctly if the surface is uneven, and without the compass working properly, you will not be able to determine the time using the sundial.Flip the gnomon up and lock it into place. The gnomon is used to cast the shadow from the sun so you can determine the time of day.Adjust the gnomon until the tip points in the same direction as north based on your compass. The sundial will not tell the correct time unless the gnomon is facing north.Locate the shadow that is cast on the rim of your sundial. Times are written all around the sundial. Wherever the shadow is cast on the rim, that is roughly the time of day. This measurement will not be completely accurate, but it will give you a general idea. Step 1: Look at the Equation of Time graph for today and estimate how many minutes you need to adjust by. However, you will need to do the opposite of what it says - if it says to add minutes, you need to subtract them, and vice versa. Make a note of this number. Step 2: If your sundial has longitude adjustment already built in, that is all you need. If not you need to work out the difference between your longitude and your timezone longitude in degrees. Then subtract 4 minutes per degree if you are West of the timezone, or add 4 minutes per degree if you are East of the timezone (the opposite of what you do when reading the sundial). Apply these changes to the value you calculated in Step 1. You now have the adjustment for the date and longitude. Step 3: If it is British Summer Time/ Daylight Savings Time subtract 60 minutes from the result of step 2. You now have the 'Clock Time' to 'Sun Time' adjustment for BST, the date and your longitude. Make a note of the total adjustment you calculated, as this is good for the rest of the day (and in practice the next couple of days too). Now check the time on your phone/watch, apply the adjustment calculated in Step 3 and orientate your sundial so that it shows the 'Sun Time' that you have calculated. Come back in a few hours and check that it still tells the time you expect. If it does, then your dial is correctly set up. -15 -15 -10 -10 -5 -5 0 0 +5 +5 +10 +10 +15 +15 JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC Sundial Compass crazycrow2024-09-29T16:09:25+00:00 FacebookXRedditLinkedInTumblrPinterestVkEmail Imagine you are trekking in the wilderness and desperately need to know the current time (perhaps to determine if there are enough sunlight hours in the day for you to reach the next clean water source, or next decent place to take shelter/setup camp). Your trusty watch stopped working hours ago (smashed, water damaged, or ran out of batteries) and as you stand around thinking about it, you lose more and more of the possible walking time you still might have. Suddenly a thought hits you, and you frantically tear off your pack and dig through the contents. Searching until, there -- sitting snugly in that one, oddly shaped pocket that never seems to be the right size to store anything useful -- you find it. You had completely forgotten that you packed it, or even that you had made it for that matter. And honestly you never thought you'd ever actually need to use it. But that hand crafted, wooden pocket sundial -- that you made in your garage one day because you were bored -- might just save your life today. Your previous feelings of dread and indecision are quickly replaced by a wave of hope as you carefully align the built-in compass and discover that you are once again capable of accessing that eternal and intangible dimension of our universe.....TIME! Or, if the sun has already set, you can burn it to keep you warm (it is made of wood after all). Ok, that is probably not the most likely of scenarios, but a pocket sundial can actually be a fun and useful thing to have. It can tell time fairly accurately while the sun is out, and a built-in compass can be useful at any time. This Instructable will document my experience making one for my self, and show you how to make one of your own. So, lets get started. Here are the necessary tools and materials for this project... TOOLS: - Hacksaw (and/or band saw) - Compass (for making circles) - Scissors - Sandpaper (several grades between 60 and 400) - Dremel rotary tool MATERIALS: - 2 X 4 (I am using pine) - Small compass (for finding North) - Small piece of plastic (about 3" x 3") SAFETY EQUIPMENT: - Shop goggles - Dust mask - Gloves The main feature of the sundial face is, of course, the lines that will eventually be used to indicate the time. It is important that these lines are at correct angles to insure that your sundial will be accurate. The equation to determine the angle of each "time line" (Ø) is this: Ø = Tan-1(Tan(t)*Sin(L)) Where: t = the angle from 12 on a normal clock [t(noon) = 0°, t(1:00) = 15°, t(2:00) = 30° , t(11:00) = 15° , etc.] L = the geographical latitude where you are, or where you intend to use the sundial This will need to be done for every line you intend to put on your sundial. But dont worry, Excel is here to save the day! Above, you can see a screen shot of my spreadsheet with the equations used in each column. Your lines can be at every hour, every half hour, or every 15 min (any more than that is probably beyond the precision of the sundial, and not worth the extra time and math). Mine are every 15 minutes from 4am to 8pm. Your latitude will also be important in making the gnomon (the piece that stands vertically and casts the shadow on the sundial's face). The top edge of the gnomon will be the part of the shadow which will line up with the time lines. The angle between this edge and the face of the sundial must be equal to your latitude. Other than that, the gnomon can be as simple as a right triangle, or a complicated as you want. In addition to your latitude, an other value you will need to know is the magnetic declination of your location. A compass points towards "magnetic north", but for an accurate sundial, you will need to know which direction "true north" is. Again, this will depend on where you are on the earth, and can be determined using the map above, if you are in the continental US. Sorry, to everyone else. However, I am sure that similar maps can be found for other regions of the globe.Sundial Lines.xlsSUNDIAL.ai Once you are satisfied with your design test it out to make sure it works as expected. To test it, print out the face design and glue it to a note card. Then cut out a right triangle gnomon, glue it to a piece of note card and tape it to the face. Find a safe place that will receive direct sunlight for a significant portion of the day (like a windowsill). Position the sundial so that the gnomon points toward true north. Observe the dial for at least one full day, checking how accurate the sundial is (compared to a clock that you know is correct). Keep in mind that the sundial will not change with daylight savings, so it will appear to be one hour behind while daylight savings time is in affect (be sure to remember this when actually using it as well). The sundial might be a bit off, but that does not mean there is something wrong with the design. If the dial seems to be off by the same amount at all times through out the day, that probably means that it is not actually pointed toward true north (which is likely since the magnetic declination was a bit of an estimation). If this is the case, rotate the dial until it is correct and then observe for another day to be sure that it is consistent and accurate. If it seems to be right some times in the day, and way off during others, there is probably a problem with the angles. Finally we get to build it! Cut a 4 inch segment from your 2x4 using a hacksaw (or a band saw if you have one). Then, using your compass, draw a circle that is a bit bigger than the overall size of your design (to allow for sanding and small accidents). Do the same on the other side of the wood. Cut off the corners and edges up to the sides of your circles to get it closer to the right shape ans size. Then, using a dremel (or other rotary tool) with a round sanding attachment to sand the piece even closer the right shape/size. This step should be able to get you to a roughly circular puck. I also decided to round the top and bottom edges a bit. Next, sand the puck using sandpaper, moving up from 60 grit to around 220 grit. Use the 60 to help shape the puck more to the desired size/shape, and use the rest to smooth it out. After doing this I decided to make the top more rounded than the bottom so that I can easily tell them apart. To do this, I used my compass to draw a smaller circle on the top (first pick which side will be to top), to be used as a guide. Then, using the dremel and the sanding attachment bevel, and then round, the edge up to the guide circle. Sand again by hand to get it smooth. This sundial will be a two-piece -- the bottom will have the actual dial, and the top will be a cover -- so the next step is to cut that puck in half. To do that, first draw a line around the outside of the piece by putting a pencil on top of a sturdy object next to the puck, and turn the puck all the way around to create a line that goes all the way around the puck, at a constant height. I used a glass coaster to put my pencil on because it happened to give me the desired height, but a good trick is to use a deck of cards (with out the box) so that cards can be added or removed to get the exact height you need. Then, carefully cut the puck in half, making sure to stay on the line. Again, a hacksaw will work fine (that is what i used) but a band saw will have the advantage of making a cleaner, straighter cut, quicker and with less work. Once it is cut, sand the new surfaces flat and smooth on each half. Now that we have two halves, we will need to shape them so that they fit together nicely. First is the bottom half. We need to cut a groove around the outer edge. Using a compass, draw a circle that is about 0.5 cm from the outer edge. Then use the deck of cards trick to draw a line around the outside to mark the desired depth of the groove (again about 0.5 cm from the top edge). The use a routing attachment and a routing bit with the dremel to cut the groove all the way around the piece. Be sure that the bit depth is matched up with the second line (around the outside surface). Use the routing setup to get close to the circle on top, starting from the out side working inward carefully. Then use the sanding attachment to finish it up and get it the right shape. Next you will need to cut out a hole for the compass to fit into. Print out your design, and cut it out to use as a template to help you put the hole in the right place. Trace around the template or the actual compass, and use this circle as a guide when cutting the hole. Get out the router attachment and bit again and set the bit depth to match the height of the compass. Use the router bit to get the right depth and get close to the circle you drew, then use the sanding attachment to finish it up and make it nice and clean Next, you will need to shape the top half so that the two halves will fit together. To do this, first put the two halves together, making sure that they are aligned correctly, and use a pencil to trace around the raise circular area of the bottom piece. This will make a nice out line to follow when cutting out a hole in the top piece. Next, using the routing setup on the dremel, with the bit set slightly longer than before, start in the center of the top piece and begin removing material. Do not go all the way to your line just yet. Then, use the sanding attachment and the sandpaper to clean it up and get closer to the line. Be sure to check its fit with the bottom half frequently. You want it to fit snugly but still be easy to pull apart. Once you have two halves that fit together well, you can sand the out side surfaces with the two together, to make them match up even better My method for making and attaching the gnomon is to design it to have two small pegs that will line up with slots in the dial face to keep it in place and properly aligned. With this method it is also possible, and easy, so make several gnomon that can be used interchangeably for either a different look or incase one breaks The gnomon can be made from just about any sturdy material, however many metals will screw up the compass reading and should not be used in any part of the sundial. I used a stiff piece of plastic (polypropylene actually) that I cut from the lid to a large plastic jar. Whatever material you use, make sure that it will not break or bend too easily, and be sure that it is flat. Print the design and tape it to the piece of material (I like to use double sided tape), and the cut the shape out of the material. Be very sure that the "latitude corner" is at the right angle, and be sure you know which corner it is. To make the slots, I used the tool that comes with the dremel for opening and closing the collet. The end of the tool with the flat head is just the right size and shape tor create the slots. Before making the slots, be sure to draw a vertical line along where the noon line will be, and mark where the two slots should go (from the point where all the time lines meet, up to where the time lines are visible in your design). It is a good idea to use a print out of you design as a guide. Then, use a hammer to pound this end of the tool into the face a bit. Check with your gnomon to see if it is deep enough. If its not, keep pounding it in a small amount at a time until the gnomon sits flush and the pegs cannot be seen. At this point, check again that the angle is correct (sanding can fix it if it is a little off). It is a good idea to test this method on a scrap piece of wood first. The last thing to do is to put the time lines and numbers onto your sundial. Before beginning this step, be sure that the surface is sanded smooth the way you want it. Now, you will need to trace the design in pencil and then test your sundial with the pencil lines to make sure it works before making anything permanent. Place it in a safe sunny place like before. After a day of observation, if everything seems to be working as it should, you can now transfer the design to the wooden face. You can also leave a pencil mark next to the compass to indicate where the compass arrow should point for an accurate reading. There are several ways to get your design onto the face of our sundial. You can carve it in, paint it on, or burn it into the wood. Remember, no matter which method you choose, its always a good idea to test it out on a piece of scrap wood so make sure it will look the way you want it to. At this point you have a working sundial, but there are a few more things that can be done that will make it look nicer, last longer, and make it easier to use. First, you can apply a finish to the wood to make it look nice and protect it from damage. Again be sure to test your finish on a scrap piece to make sure it will look how you want it to. Also, make sure the compass and gnomon are removed first. You can also paint or carve some designs onto the outside of the two halves. Once you have the wood the way you want it, you should glue down the compass in its hole. You can use superglue, a hot glue gun, or some epoxy. Another useful addition is to add an elastic strap to the inside of the top half to secure the gnomon when not in use. Also, if the two halves fit a little loose, an elastic band or small pouch can be used to hold them together better. The sundial is now finished. The only thing left to do is use it. To use your new sundial, take off the top half, remove the gnomon and put it in place on the dial. Make sure that the sundial is in direct sunlight, and either hold it level or place it on a level surface (this is important and will affect the accuracy of the sundial). The compass might have a small air bubble (mine does), which can make it pretty easy to see if it is level (the bubble should be in the center of the compass. Aim the gnomon toward true north and take a reading to find out what time it is (dont forget to adjust for daylight savings time if necessary).