

## Troop 606 Orienteering Course

### Overview

This Orienteering Course is designed to help Scouts satisfy requirements 4a and 4b for the First Class Rank. These requirements are as follows (as of 2017):

“4a. Using a map and compass, complete an orienteering course that covers at least one mile and requires measuring the height and/or width of designated items (tree, tower, canyon, ditch, etc.).

4b. Demonstrate how to use a handheld GPS unit, GPS app on a smartphone, or other electronic navigation system. Use GPS to find your current location, a destination of your choice, and the route you will take to get there. Follow that route to arrive at your destination.”

The materials in the course kit box will allow you to set up a course anywhere there is adequate space. Scouts start the activity by creating a pace computer that will allow them to easily calculate distances for the compass course that follows using their pace, which they will determine on a 100 foot pace course. Scouts then complete a distance measuring exercise and a drill to teach the basics of using a compass and shooting a relative magnetic bearing.

Next, Scouts navigate an orienteering course involving three stations (with two legs each, if desired), answering questions or solving problems at each one. The final target has a reward (candy).

The activity is designed to take about an hour start to finish.

A great place to set up the course is at Mason Park. If you choose to do this, you can either set it up in the groomed formal park East of Culver, or the more natural park West of Culver. If you choose the formal park, make sure you speak to the Ranger beforehand and get permission to set up the course. Explain that you will only be placing very small stakes in

the ground and will remove them immediately after the activity. That usually suffices to placate any concerns the Ranger may have.

### **Step One: Assemble Pace Computers And Calculate Pace**

The idea for the pace computer originally comes from the back of the 1967 Boy Scout Fieldbook. The pace computer is a handy device that keeps track of the relationship between step length and distance. This is important when Scouts need to determine how far they have gone on a particular leg on an orienteering course or out in the field. Scouts put it together using the components printed on the cardstock sheets in this kit (the original PDF files are available on the Troop 606 website at Training>Trail To First Class>Orienteering Course). Scouts then calibrate their computer to the number of steps they take in a fixed distance (we use 100 feet, measured with the 100 foot tape measure in the kit). Finally, Scouts use the computer to find the number of steps in any distance when they run the Orienteering Course.

Begin the orienteering course by explaining what the pace computer is used for and then have the Scouts build their computers. They are comprised of the following two components:

#### **Pace Computer Center Wheel**

Center wheels are printed six to a sheet on card stock. If copies are not in the kit, print out more on card stock before you begin the course after downloading the files at the website noted above. Have the Scouts cut out the center wheels and attach them to the ...

#### **Pace Computer Back**

Pace computer backs are printed two to a sheet on card stock along with a basic primer for using a compass out two-sided on card stock. Again, if the supply in the box has run out, print out more at the website noted above.

Have the Scouts cut out the pace computer backs as well. Then the Scouts should poke a small hole in the back card and a larger hole (a pen works well for doing this, there are some in the kit) in the center of the wheel.

Attach the wheel to this back using a brad in the kit (brass fastener--that's why the hole in the wheel is larger, so it will turn on the flat tangs of the brad).

**NOTE: as shown below, more than once Scout can use a pace computer if desired, they just need to mark their own pace per 100 feet on the dial as shown in the diagram. This will cut down on the number of computers you need to make if you want to save some time or cut down on the number of printed sheets needed.**

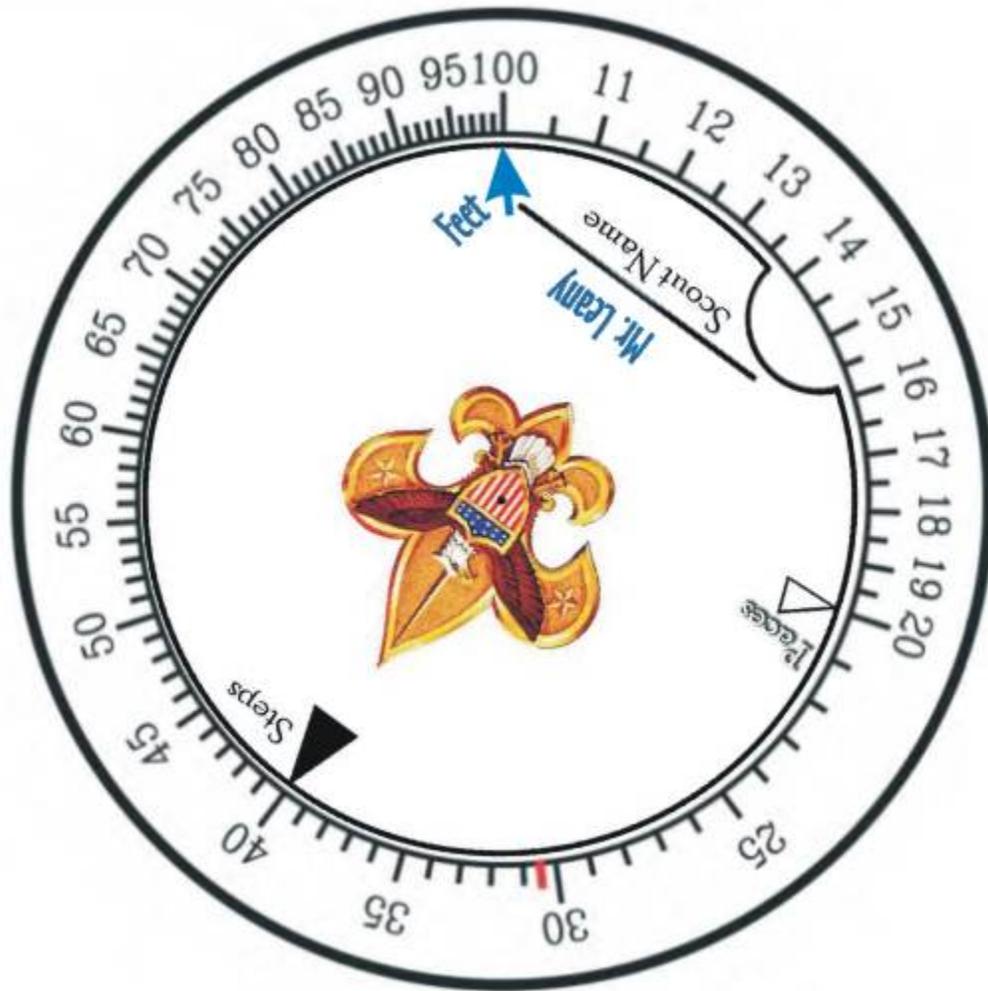
### Calibrating the Pace Computer

Once the pace computers are assembled, have the Scouts calibrate them to their own specific pace. To do this, the Scouts should first lay out a 100 foot straight line using the 100 foot tape measure in the orientation course kit. Then the Scouts should walk this line at a normal pace that you can duplicate every time and count the number of steps it takes them to walk the 100 feet.

Explain to the Scouts that a pace is two steps, not one. So one pace would be counted every time the same foot touches the ground, but you want the Scouts to count their individual steps per 100 feet. Explain that people tend to walk in an exaggerated manner if they are on a course to measure their pace, taking either long strides or short steps; explain they need to relax and walk at a natural pace. Instruct the Scouts to walk the measured distance back and forth two or preferably three times and use an average of number of steps per 100 feet rather than total number of steps. Ask the Scouts to tell you their average to make sure they aren't adding up a total.

After the Scouts have calculated their pace, they should take their pace computers and rotate the inner wheel until the arrow marked "steps" (on

the inner--rotating--wheel) is pointing on the outer wheel to the number of steps it took to cover the 100 feet. Scouts should then make a mark, like an arrow or line, on the inner wheel opposite the "100" on the outer wheel. Once this is done, the Scouts will have established a constant relationship between their steps and the distance they cover on an orientation course or in the wild.



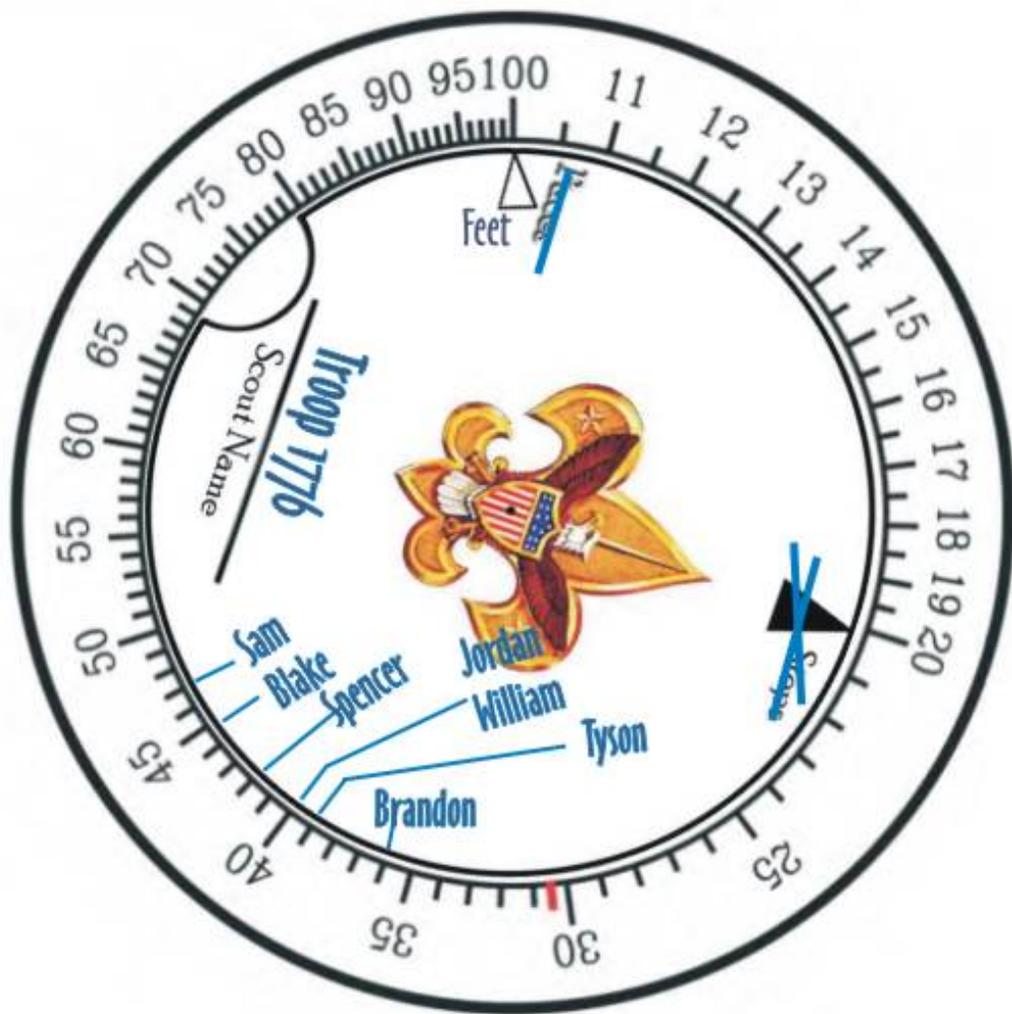
To find the number of steps a certain distance takes using the pace computer, Scouts should put the "feet" marker that they made next to the distance on the outer wheel. The 'steps' marker points to the number of steps to travel that number of feet (see example above). To pace a distance, Scouts would then point the 'steps' marker at how many steps it took them and read the distance next to the 'feet' marker that they made.

Add zeros as needed. For example, 110 feet uses the number 11 on the

scale. Adjust the steps marker accordingly (1100 feet would be something like 420 steps, not 42).

The little red line by the 30 on the outer scale (back of the pace computer) is for meters. If Scouts wanted to have a reference for meters they can put their "feet" mark on 100 and make a mark on the inner wheel at the red line (30.48--the number of meters in 100 ft.). This would work for any units they wanted, for example yards (33/100 ft.)

As noted above, the Scouts can have one computer for their whole patrol if they want. For this to work, the Scouts only need marks that relate distance to steps. So point the paces arrow to 100, cross out the word "paces" and write in "feet," then each patrol member's step with his name.



## **Step 2: The Pacing And Bearing Shot Exercise**

After the Scouts have put together and calibrated their pace computers, the next exercise is to teach them basic compass use and how to take basic magnetic bearings.

### **Explain Basic Compass Use**

Have the Scouts take out their compasses. Remind them that they are part of the 10 essentials. Explain why compass apps on phones should not be used for navigation (phones with GPS measure true, not magnetic north, and require batteries, which dedicated analog compasses do not). Explain the difference between magnetic north and true north, and how compasses point to magnetic north. Explain that magnetic north differs depending on where you are in the US and that it moves around over time. Explain what declination is (the difference between magnetic and true north), and the difference between west and east declination. Explain that currently there is a line down the middle of the US from Michigan south approximately that represents zero degrees declination (no difference between true and magnetic north), and that points west of that line have west declination, and points east have east declination. Explain that there is around 14 degrees of west magnetic declination in California. Explain that when you transfer magnetic bearings taken on a compass to a map you need to take this into account, but that is beyond the scope of this course. Just introduce the Scouts to these concepts. The main thing they need to learn at this stage is how to take (or set) magnetic bearings and follow them.

Use the diagrams and photos on the cards for the compass backs to show the Scouts how to dial in a bearing they want to follow by turning the inner part of the compass so the desired bearing lines up with the direction of travel arrow on the compass. Then show the Scouts how to turn the whole compass so the red magnetic north arrow on the compass lines up with zero degrees/north on the inner part of the compass (tell the Scouts this is called “putting red in the shed”). Then show the Scouts how

you can site along the arrow of travel to your desired bearing, which will now be accurate as long as “red is in the shed” (i.e. the red compass need continues to point to magnetic north). Show them also how to line up magnetic north with the “shed” and rotate the direction of travel arrow until it points at an object if they want to take a bearing on an object.

### **Set Up The Pacing And Bearing Shot Exercise**

The next step in this activity is to have the Scouts run the pacing and bearing shot exercise. However, you need to set this up in advance, preferably when the Scouts aren't around so they can't see what you are doing.

To set up this exercise, you will need the laminated page marked “Setup Diagram Not For Use In The Exercise.” You will also need at least five stakes (a couple more is fine too). One of the stakes should have blue electrical tape wound around the top, and one should have red electrical tape. (If not, wrap some around corresponding stakes using the colored electrical tape in the kit). These will be the red and blue flags in the setup diagram.

The first thing you need to do is set up the red and blue flags, and **then** the start stake. You want to end up with the red and blue flags being 80 feet apart, such that the red flag is on a bearing line of  $312^\circ$  from the start stake and the blue is on a bearing of  $18^\circ$  from the stake (see setup diagram). For simplicity all bearings used in this course are magnetic.

It's also a lot easier to set up the course with two adults (which you will need anyway to satisfy Youth Protection Guidelines when you run the course with Scouts). First you plant the red flag. Have your helper go 80' on a  $60^\circ$  bearing from the red flag and plant the blue flag. From the blue flag shoot a bearing of  $198^\circ$  (the back course of  $18^\circ$ ). To make things easier, shoot the bearing from the flag and have your helper hold the start stake along that line (about 100' feet along or so, about where you think the start marker will be). Don't plant the start stake in the ground yet.

Do the same thing from the red flag--sight along a bearing of 132° (back course of 312°) and have your helper move along the first line, start stake still in hand, to come in line with your bearing from the red flag. Check back and forth until your helper is right at the intersection of the two lines--one from the red flag to the 132° (312°) stake and another from the blue flag to the 198° (18°) stake. Then plant the start stake.

Next, plant 2-3 “decoy” stakes in random locations. Make sure the decoys do **NOT** correspond to real locations on the bearing shot exercise sheets the Scouts will get (laminated copies are in the kit). To make the exercise more difficult, it is helpful to put another stake on the same 198° bearing from the blue stake as the start stake, for reasons that will become clear in the explanation of the exercise below.

### **Run The Pacing And Bearing Shot Exercise**

After the pacing and bearing shot exercise has been set up, have the Scouts run it after they have reviewed basic compass use. Explain the purpose of this exercise is to make sure they can use their pace computers correctly to calculate distances based on their steps/paces, and to make sure they know how to follow magnetic bearings on their compasses.

The first thing you want the Scouts to do is to figure out how far apart the red and blue flags are by counting off the distance with their steps and using their pace computers. The answer to how far apart they are (80 feet) is the answer to Question No. 1 on the answer sheets each group of Scouts who will run the course together should be given. Laminated copies of the answer sheets are in the kit as well. **Make sure you use the dry erase markers in the kit – not sharpies or pen -- to write down answers on the answer sheets so they can be cleaned and reused afterward.**

The second thing you want the Scouts to do is to figure which dot on their bearing exercise chart corresponds to an actual stake (other than the

blue and red flags) in the real world. The Scouts need to choose the correct answer and write it as the answer to question no. 2 (the answer is the stake is in location "D"). Explaining this to Scouts can be a bit difficult – the easiest way I have found is to tell them that only **ONE** of the stakes planted on the course corresponds to a dot on their charts, and that their chart is not accurate because the other dots do not correspond to the stakes they see before them on the field.

To obtain the answer, tell the Scouts they need to shoot bearings from each of the stakes (random and the actual starting stake) to each of the flags to determine which one is actually depicted on the chart.

For example, the scout would stand at the stake and point the compass' direction of travel arrow at the blue flag. Then he turns the bezel until the 'N' aligns with the red magnetic needle. From the line going to the course arrow he reads "18°." That tells him that the stake lies along that line, so it has to be C or D (this is why having one of the random, decoy stakes on this line in addition to the start stake makes the exercise more difficult, but in a way also work better).

Next he turns to the red flag and repeats the process, pointing the compass at the flag, turning the bezel to line up with the needle, and reading "285°" on the bezel. The location of the stake has to be at the intersection of those two lines (location D).

The principle behind the bearing shot exercise is that any line can be defined by two points; For any given two points there is only one line that will pass through both of them. This is the basic principle of triangulation.

### **Step 3: The Orienteering Course**

The next step in this exercise is to run the mile-long orienteering course, building on the skills taught and developed thus far.

## **Setting up the course**

After obtaining permission from the Ranger (if at the groomed portion of Mason Park), you need to lay out the course before the Scouts arrive. Plan on taking an hour or so to do this, in addition to a half hour to lay out the bearing course described above.

You will need to set up four stations along the course, including a final station. For each of the four stations, you need to set up the actual, correct marker and a decoy. This way if the Scout's navigation is off, they will pick the wrong station. Both the correct and decoy stations have laminated cards tacked to them with questions and answer choices (tacks and cards included in the kit and available on the website if they become lost), but the correct answer on the decoy cards will not correspond to the correct answer they need to write down on their answer sheets.

You will need two stakes for each station (real and decoy), or eight total, the station cards (real and decoy), and your laminated answer key (marked "Key – Setup Only" in these materials). You will also need tacks to attach the station cards to the stakes, and some line to tie knots around the stakes. You will also need a hammer or small sledge to drive the stakes in to the ground.

To satisfy First Class rank requirement no. 4a, the course needs to be at least a mile long, so you will need to space out the stations accordingly. It is easiest to make the last station the starting point, but if you need more distance you can make it wherever you want. I find it easiest to use a dedicated GPS (or GPS phone app) to keep track of distance as I go. You will need to have a dedicated GPS or GPS phone app with you anyway to help the Scouts complete First Class rank requirement no. 4b (described below).

Make sure you write down bearings and distances on your answer key as you go. I included the option of including two course legs between stations if you want to have the Scouts navigate to, say, a tree along the

way and then take another bearing to a station with a stake. That can also help you increase the length of the course. But usually I just like to have one leg for each part.

### **Station One**

To set up the first station, take a bearing from your starting point on the location where you want your first stake (or leg) to be. The starting point needs to be marked with a stake or rock or something similar because your bearings can be wildly off if you start from even a few feet to either side. Show the Scouts how this is so by taking a bearing from the starting point before they head off down the course, and explain that a compass error of even a few degrees can translate to miles off course over a relatively short distance.

Mark the bearing to your chosen location on your setup key chart using erasable marker. Then, using your GPS, pace off the distance from your starting point to where you want the first station (or leg) to be. Mark this distance on the key as well. Keep track of this distance on your GPS and on paper so you will know when you hit a mile total as required for the course. I like to aim for a big tree off in the distance near the entrance station at Mason Park, and then I like to plant the first station stake behind the tree out of sight. Then I plant the first decoy station in plain sight from the starting point, but off to the side about 50 yards or so. I then continue this pattern of deception along the course. Get creative!

You will need to tie knots onto the stakes for both the decoy and correct stations. For the correct station, attach the station code card with code C at the top to a stake. Tie four knots onto each and label each A-D on the stake above each knot with a sharpie (in the kit). Make sure the second knot (labeled “B”) is two half hitches. Tie whatever other knots can be fastened around a stake above and below that knot (for example a bowline, square knot, and clove hitch are good). That way, when the Scouts find this station, they will write down the correct station code (C) on their answer card and write down B in response to question 3 – “Which

knot is two half hitches?” Plant this stake in the ground in the correct location.

Then attach to the decoy stake the card with “Station Code D” at the top and the question “Which of this knots is a clove hitch?” as question 3. **(NOTE: all decoy station cards have “Station Code D” at the top – D is for “decoy,” get it? ;^)** Tie four knots to this stake too, including a clove hitch, but make sure the clove hitch is labeled something other than “B.” Then plant the decoy stake.

If you want to include a second leg before setting up the first station, just note the information on the setup key. Trees, rocks, benches, and other stationary objects (not parked cars!) make good interim objects to use for legs on the course if you want to go that route. Just make sure to note the relative bearings and distances for each leg on your setup key in erasable marker. This applies to all subsequent stations as well, so I won’t discuss setting up legs again.

### **Station Two**

To set up the second station, follow the same protocol in terms of choosing a destination, taking a bearing on it, pacing off the distance to the destination, and noting the information down on your answer sheet.

For the correct station, attach the station card reading “Station Code A” on top with the question “Which is the sixth point of the Scout law?” For the decoy, use the station card reading “Station Code D” on top with the question “Which is the ninth point of the scout law?”

### **Station Three**

To set up the third station, again same protocol for choosing a location etc. However this time you will attach the same contour map with letters on it to **both** the correct and decoy stations stakes. However, above the map on the correct stake, tack the station card reading “Station

Code B” on top with the text “Questions 8 and 9: Identify the markers on the map that point to . . . the scale [and] a contour line.” On the decoy stake, attach the station card above the map that that reads “Station Code D” at the top with the text “Questions 8 and 9: Identify the markers on the map that point to . . . a road [and] a magnetic declination indicator.”

### **Station Four**

This is the finish, which I like to make near the starting point to make things easy. Put a bucket with Tootsie Rolls at the finish as that provides the correct answer for the final station. You can set up a decoy with candy that is a wrong answer on the answer key – Tootsie Pops or mints. Up to you.

Another overall tip: I like to set some course destinations on the other side of ponds, past lines of bushes, on the other side of structures, over bridges, etc. to mimic the real world.

The following is a sample course laid out for reference:



Blue Flag

Red Flag



Base of Operations Table

Start Stake

100' Marker

Final Prize

Decoy Prize

Decoy Prize

Station 3

Decoy Marker

Station 1 Marker "C" Knots

Decoy Marker

Station 2 Marker "A" Scout Law

## **Running the Course**

When you are ready to run the course, review a sample topographical map (in kit) – go over key features such as contour lines, roads, magnetic declination indicator, and scale, especially since those are covered in questions in station 3 on the course as indicated above.

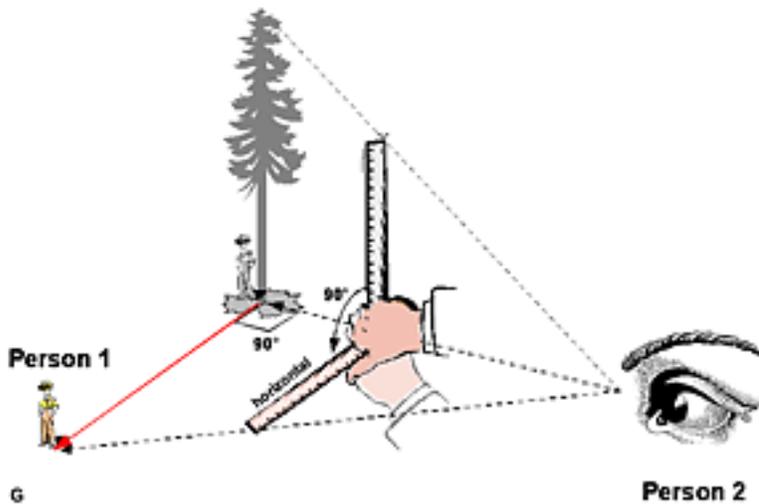
Then give each team an answer sheet and erasable marker. You can stagger the teams by having one start the bearing exercise and another start the course if you want. Have the teams head write down the bearings and distances to each station that you have calculated. If you want, you can warn the teams that some stations are decoys, or not say anything to make things harder. Up to you!

## **Step Four: Calculating the Height of an Object**

At the end of the orienteering course, show the Scouts how to measure the height of an object (a tree is easiest), and then have them measure the height of another one on their own. This will satisfy the last part of requirement 4a for the First Class rank.

The easiest way to do this is to grab a stick six inches long or so. Have a Scout walk over next to a tree a hundred yards or so away. Take the stick and hold it out in front of you at right angles, with the stick pointing straight up with your arm extended. Aim your arm holding the stick at the tree you want to measure and choke up on the stick until the top of the stick is even with the top of the tree according to your eye. Your hand should be aligned with the bottom of the tree. Then, holding your arm steady, flip the stick sideways 90 degrees so it is horizontal to the ground and your hand holding the stick is still aligned with the bottom of the tree. Have the Scout next to the tree walk away from the tree in

the direction your stick is now pointing until they are aligned with the end of the stick according to your eye. The Scout will now be the same distance away from the tree as the tree's height, and you can measure this distance by counting steps back to the base of the tree. The following diagram illustrates this:



There are other methods to do this, but I like this one best as it is the easiest to teach.

### **Step Five: Using a GPS or Phone With GPS App**

The final activity is to show Scouts how to use either a dedicated GPS or a handheld GPS app on their phones. This is one instance in which it is OK to use a phone on a Scout outing! Have them locate where they are, pick a destination, set a waypoint and navigate to it. The instructions for how to do this varies with each GPS and/or app, so I'll leave that part up to you!

YIS,

Greg Nylén

Many thanks to Troop 695 in Utah for inspiration and source material for this course.