

Measurement Estimation

Learning to Judge Distance

As a means of checking your estimates, learn the exact length of your pace. If fairly tall, learn to pace an exact yard, heel to heel. On a quiet road, in a field, or out on the prairie, begin judging short distances to various objects, then pacing to check your "guess." Gradually increase the distances. Do this in competition with several other Scouts and you'll find it an interesting game. Remember that the eye measures distance as in an "air line," from eye to object, and does not allow for irregularities of the ground. In other words, ground distance may be greater than visual distance.

Personal Measurements

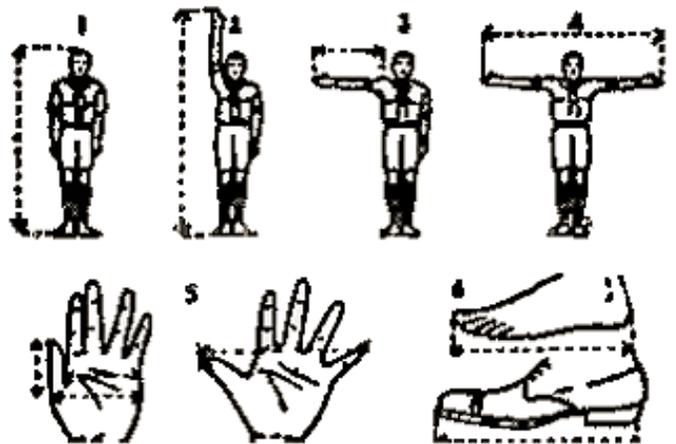
It is important to know your own personal measurements. It also can help to find a measurement on yourself that is exactly one inch or one centimeter (maybe a fingernail or thumbs width), then also find a 1 foot or 10 cm and a 1 yard or 1 meter measurement.

Remember, that Scouts' bodies are still growing so personal measurements should be rechecked on a regular basis.

Here are some more ways of making fairly close estimates of height and distance. You'll be making practical use of some of the basic geometry learned in school.

As an aid in making short measurements you should know a number of your personal measurements. Your known hand-span will often be particularly useful. If fully developed your measurements will be close to this:

- Breadth of thumb, and nail joint of forefinger = 1 inch (2.54 centimeters).
- Span of the thumb and forefinger = 6.5" (or 17 centimeters).
- Span of thumb and any other finger = 8.5" (or 21.6 centimeters).
- Wrist to elbow = 10" (or 25 centimeters).
- Elbow to tip of forefinger = 17" (or 43 centimeters).
- Your reach, arms out-stretched, will nearly equal your height.



Judging Distance

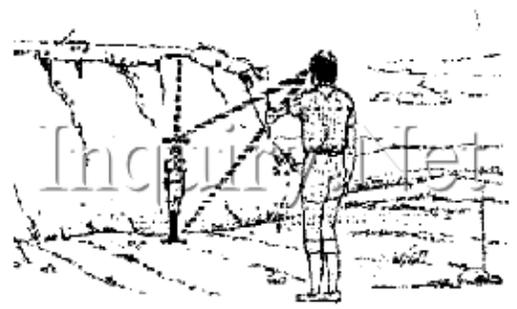
Learn the exact length of your pace. Using a tape measure, mark a 100-meter course on the ground. Walk at a normal pace from one end of the course to the other, counting your steps as you go. If the course is on uneven ground, follow it in the reverse direction and calculate the average of the two tests. Some Scouts find it easier to measure distances by counting every step along the way. Others have better luck counting each time their right foot touches the ground. That is called a pace.

Remember things can appear nearer or further than they really are depending on how clearly you can see the outline. Also, if there is water between you and an object, the distance can be deceptive.

1. Objects seem further away:
 - (a) When they are in the shade,
 - (b) Across a valley,
 - (c) When they are the same color as the background,
 - (d) In a heat haze,
 - (e) When you are lying down or kneeling.

2. Objects seem closer:

- (a) With the sun behind you,
- (b) In very clear air,
- (c) When a different color from the background,
- (d) When the ground is flat (or snow covered),
- (e) When it is larger than other objects nearby,
- (f) When you are looking across water, or a deep valley.



3. Visible objects seem nearer at night than during the day.

Remember, the eye measures distance "as the crow flies", and does not allow for uneven terrain. In other words, actual distance may be greater than visual distance.

Some Further Hints

- At 1/2 mile or approximately 880 yards (or 800 meters) a man looks like a post.
- At 770 yards (or 700 meters) the head is not yet visible.
- At 660 yards (or 600 meters) the head is visible as a dot.
- At 550 yards (or 500 meters) the shoulders appear bottle shaped.
- At 1/4 mile, or approximately 440 yards (or 400 meters) movements of the legs can be seen.
- At 330 yards (or 300 meters) the face can be seen.
- At 220 yards (or 200 meters) buttons and details of clothing are recognizable.
- At 110 yards (or 100 meters) eyes and mouth can be seen clearly.

To estimate greater distances, judge the farthest probable distance, then the nearest possible, and "split the difference."

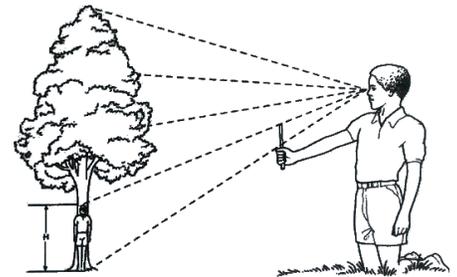
Judging Height

With practice, you will be able to estimate height up to 1,000 yards or meters.

Stick Method

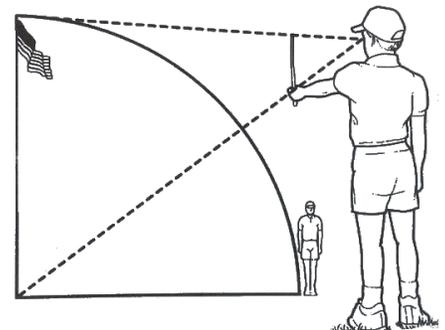
A simple method for measuring the height of trees and ordinary buildings is the Stick Method.

1. Have a friend whose height you know stand beside the object you want to measure; a tree for example. Step back and hold a straight stick upright at arm's length in front of you.
2. With one eye closed, sight over the stick so that the top of it appears to touch the top of your friend's head. Place your thumbnail on the stick where it seems to touch the base of the tree.
3. Now move the stick up to see how many more times this measurement on the stick will "fit" into the height of the tree. Multiply that number by your friend's height and you will know the approximate height of the tree.



Felling Method

1. Back away from the object you want to measure—a flagpole, for example.
2. Hold a stick upright at arm's length. Adjust the stick so that its tip appears to touch the top of the flagpole while your thumb seems to be at its base.
3. Swing the stick 90 degrees to the horizontal position, as if the flagpole were falling.
4. Keep your thumb in line with the base of the pole and notice where the tip of your stick appears to touch the ground. Measure the distance from that point on the ground to the base of the flagpole to get the flagpole's height.



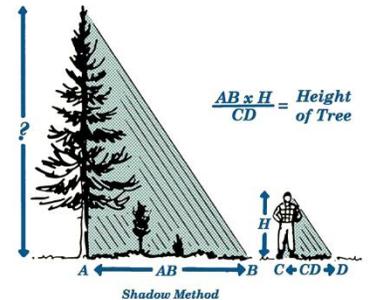
Height by Shadow Method

You need your staff, notched in feet and inches (or meters and centimeters); or a straight stick of known length (measured by the spread of your fingers). Proceed thus (see above illustration):

1. Stand the staff (b c) upright in the sun and measure the length of its shadow (a b).
2. Measure the length of the shadow of the tree.
3. Multiply by the length of the staff.
4. Divide by the length of the staff shadow.
5. The result is the height of the tree.

For example, say the length of the tree's shadow is 40 feet or meters, the staff's shadow ten feet or meters and the staff is the normal length of 1.73 feet or meters, the formula will be as follows:

$$40 \times 1.73 = 69.2 \text{ divided by } 10 = 6.92$$

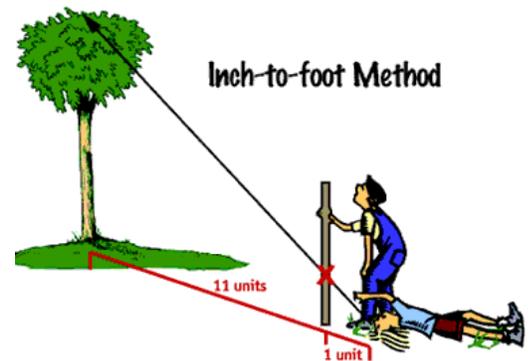


Another example, if the stick's length is 2 m, the tree's shadow is 20m long, and the stick's shadow is 5m long:

$$2 \times 20/5 = 40/5 = 8 \text{ so the tree is 8 meters high}$$

"Inch to the Foot Method" or "One in Twelve"

Here you start from the base of the object which you are measuring, mark off eleven units of any length, say eleven staff-lengths, here set up a Scout staff with a companion to hold it. Measure off one more one unit beyond the upright staff and there, getting your eye as close to the ground as possible, sight the top of the object. Where that sighting line crosses the staff have your companion make a mark on the upright staff, then measure the number of INCHES from that mark to the ground. This will equal the height of the object in FEET.



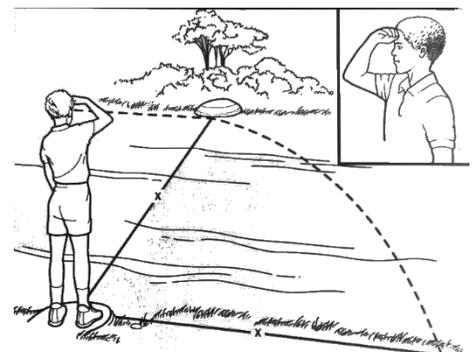
1. Measure along the ground from the base of the building out far enough so you can sight the top of the building from ground level at a comfortable angle.
2. Mark this distance off in nine units of equal length say, nine measured stick lengths.
3. Nine stick lengths out from the building, stand your stick upright and have a friend hold it.
4. Measure off one more unit past the stick.
5. Put your head to the ground and, getting your eye as close to the ground as possible, sight the top of the building.
6. Where your sighting line cuts the stick, have your friend make a mark.
7. Measure the number of centimeters from that mark to the ground. This will closely equal the height of the building in meters

Estimating Widths

Here is a handy estimating method for width of a river or creek without getting your feet wet.

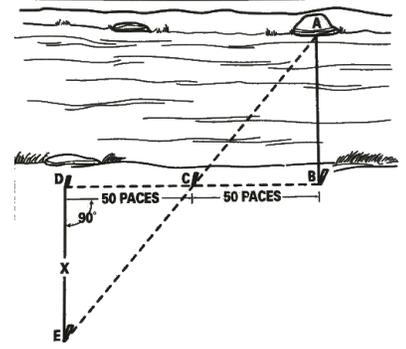
Salute Method

1. Stand on the shore and hold your hand to your forehead in a salute. Move your head down until the front edge of your hand seems to touch the opposite shore.
2. Without changing the position of your head or hand, make a quarter turn. Notice the point at which the edge of your hand seems to touch the ground. Measure the distance to that point, and you will know the width of the stream.



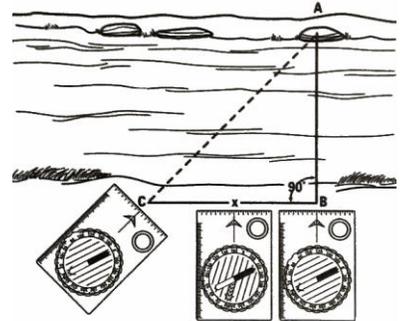
Stick Method

1. Locate an object on the far side of the stream; a rock, for example (A).
2. Push a stick into the ground next to where you are standing, opposite the rock (B).
3. Walk along the shore at a right angle to AB. Take any number of paces (Twenty, for example), and mark that point with another stick (C).
4. Continue walking along the shore in the same direction for the same number of paces as before (in this case, twenty more). Put a stick there (D).
5. Finally, walk away from the stream at a right angle to BD. When you can sight a straight line directly over stick C to the rock on the far shore, stop and mark your spot (E).
6. Measure DE to get the width of the stream.



Compass Method

1. Locate an object—a rock, for example—(A) on the far shore directly opposite from where you are standing (B).
2. Take a bearing by pointing the direction-of-travel arrow of your compass at the rock and turning the compass housing until the needle lies over the orienting arrow. Read the degrees (in this case, 120).
3. Add 45 degrees (120 degrees plus 45 degrees equals 165 degrees). Set your compass at the new reading (in this case, 165).
4. Walk along the shore, pointing the direction-of-travel arrow toward the rock. When the compass needle again lies over the orienting arrow, stop and mark your spot (C). Distance BC is the same as the width of the stream.



Judging Distance by Sound

Distance can sometimes be judged by sight and sound. If you see a gun fired, for instance, and count the seconds between the flash and report, you can tell how far the sound has come, if you remember that sound travels at 365 yards a second.

During a thunder and lightning storm you may be able to quiet nervous people by pointing out to them the time between the flash of lightning and the roll, or crash of a bolt -this proving that the bolt in reality struck several miles away. Distance from lightning in miles = number of seconds \div 5. If you have a watch, begin timing as soon as you see the lightning and stop as soon as you hear the thunder start. If you don't have a watch, do your best to count the seconds accurately. Say "One one thousand, two one thousand etc." in your mind for each second. Example: If it's 10 seconds from lightning sighting to thunder, you are 2 miles away.

Length of a Building

This is your scale drawing of the base line which you have paced out (e.g. 50 foot).

Scale 1" = 10' (One inch equals 10 feet)

1. Place markers (say 50 feet apart). This is your base line.
2. Make a scale drawing of it (5").
3. At points A and B on the sketch, draw in the North point bearing.
4. Take bearings from North at A for each side of the church at X and Y.
5. Take bearings of X and Y at B.
6. Mark in these bearings on your sketch using a protractor.
7. Join up line X and Y between the two points where the lines cross....
8. If the line XY measures 2" then the church is 20 feet long.

