

How to Use a Lat/Long Ruler (for the numerically challenged)

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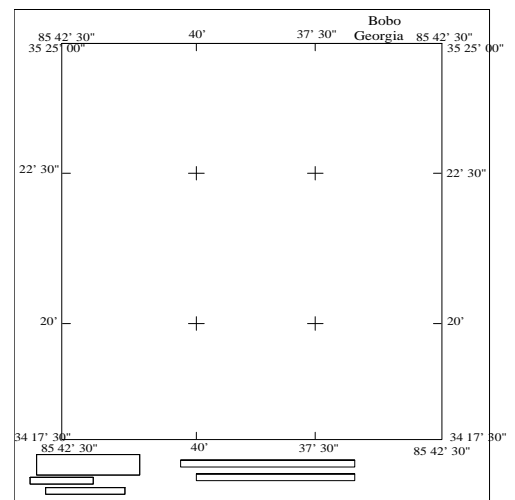
A 7½"x7½" topo is a nearly rectangular map, which has a scale for East-West (longitude) measurements and a different scale for North-South (latitude) measurements. The 1989 GSS Bulletin contains an excellent article by Kenneth Huffines about the mathematical treatment using these scales to convert degrees, minutes, & seconds into inches and plotting caves. Unfortunately there are two things that will force you to calculate a different set of conversion scales for each topo. Topo's are printed on paper that shrinks over time, and different maps are printed at different scales when converting from degrees into feet on the map (by definition these topos are printed at 1":24000'). The Lat/Long ruler is a variable scale ruler that allows you to directly read degrees, minutes, and seconds on the topo (using only addition and subtraction to get the actual reading).

A little on numbers first:

- The USGS (on topos) shows 85 degrees, 57 minutes, and 25 seconds as 85°57'30"
- The GSS listing would show the same number as 855730
- Sometimes the USGS only shows the minutes and seconds for a point, requiring you to look to the edge of the topo to find the degrees portion.
- Degrees, minutes and seconds are each broken up into 60 divisions (just as hours, minutes, and seconds on a clock). So there are 60 minutes in one degree and 60 seconds in one minute.
- On topos (in the US) latitude increases as you move North and longitude increases as you move West.

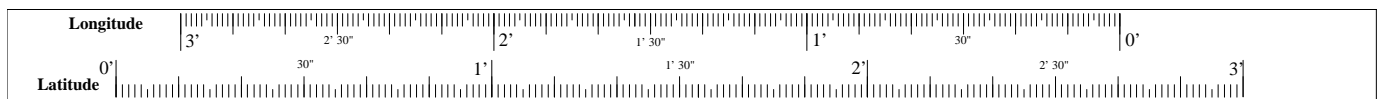
Starting with a topo (it helps if you have one to look at):

In each corner of the topo there are two numbers indicating the latitude and longitude of the corner. The numbers closest to the right or left edges of the topo are latitude and the numbers closest to the top or bottom edges are longitude. At about 1/3 and 2/3 of the way on each edge of the topo you will see another number in minutes and seconds with a **black tick on the inside** of the map. Ignore numbers with blue ticks, dashed ticks, ticks that extend outside the topo, and thin lines, these are UTM grid and State Plane grid coordinates. Corresponding to the ticks at 1/3 and 2/3 you will find small crosses in the topo. These divide the topo into nine sections each of which is 2' 30" wide and 2' 30" high.



A little on the Lat/Long ruler:

There are two scales, one labeled Latitude and one labeled Longitude. Both read from 0 minutes (0') to 3 minutes (3'), the small ticks are seconds with a slightly darker tick every ten seconds. Notice that the ruler only reads minutes and seconds (no degrees), and only 0' to 3' at that. To use the ruler you will have to add the reading on the ruler to the latitude or longitude of the starting point.



Plot a Cave (Using GPO 7 White River cave as a sample):

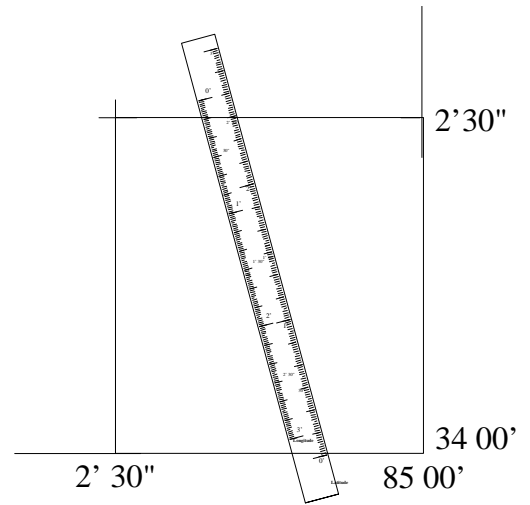
The GSS printout lists the location of this cave as latitude 340204 longitude 850044 elevation 820.

Determine which of the nine sections the cave will be in.

Looking at the section of Rockmart North, GA. topo (page ?), in the lower right corner, 34°00' is closest to the right side of the topo, this is the latitude of the bottom edge of the topo. Following up the edge of the topo, the first number you see with a tick entirely on the inside of the map is 2'30". This is an abbreviation for 34°02'30" and is the latitude of a line crossing the topo. The latitude of White River cave is 34°02'04" which is between 34°00' and 34°02'30". Looking along the bottom of the topo, written closest to the bottom edge is 85°00'. That is the longitude of the right edge of the topo and the next tick along the bottom is at 85°02'30". Again the longitude of the cave (85°00'44") is between 85°00'00" and 85°02'30". This is the section the cave will be in. Lightly draw a line from the cross in the upper left hand corner of the map segment to make a box around this section.

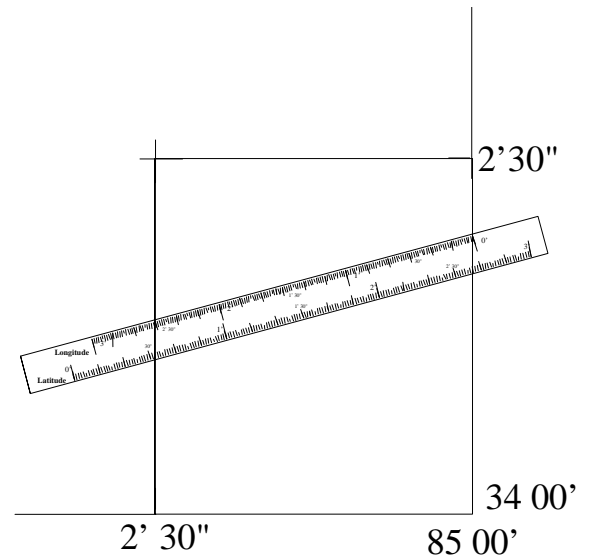
Plot latitude:

- Use the latitude scale on the ruler.
- Place the ruler pointing away from you on the topo. (North-South)
- Align 0' latitude with the bottom edge of the section (measure to the top or North).
- Slightly rotate the ruler until the line at the top of the section and 2'30" latitude on the ruler align.
- The ruler now directly reads minutes and seconds on the topo.
- 34°02'04" is 02'4" more than the latitude of the bottom edge of the section (34°00'00").
- Place a mark on the topo four ticks beyond 2' on the ruler (the latitude of the cave).
- Slide the ruler about 1" to the side and place a second mark.
- Draw a light line through the two marks.



Plot longitude:

- Use the longitude scale on the ruler.
- Place the ruler on the topo pointing side to side (East-West)
- Align 0' longitude with the right edge of the section (measure to the right or West).
- Slightly rotate the ruler until the line at the left of the section and 2'30" longitude on the ruler align.
- The ruler now directly reads minutes and seconds on the topo.
- 85°00'44" is 0'44" more than the longitude of the right edge of the section (85°00'00").
- Place a mark on the topo 14 ticks beyond 30" on the ruler (the longitude of the cave).
- Slide the ruler about 1" down and place a second mark.
- Draw a light line through the two marks.



- Intersect the two lines for the location of the cave (now erase all those lines you drew).

Remarkably the cave plots up right on top of the mine symbol on the topo (hopefully) but as a double check, the elevation of the cave should be 820'.

Additional tricks that may make it easier (or harder) for you to plot:

The ruler measures from 0' to 3', the measurements of any section of a topo will start and end at either 00" or 30". If instead of always aligning the ruler at 0' you match the seconds of the starting point with the seconds on the ruler you can simplify the addition and subtraction.

Seconds Reading at lower or right line	Align Ruler at lower line or right line	Align Ruler at top or left line	Minutes & Seconds measured
00"	0' 00"	2' 30"	2' 30"
30"	0' 30"	3' 00"	3' 20"

Example: if the lower latitude of a section is 34°02'30" and you start the ruler at 30" latitude, when the ruler reads 1' that corresponds to 34°03'00". If you didn't align the ruler thus, 1' on the ruler would correspond to 34°03'30" (60" more than 34°02'30").

on the next page is a copy of the ruler I use. I got mine laminated (10mil) to make it sturdier. Feel free to copy and use ruler provided here, or if you want they are available commercially for about \$25. For more information about using Latitude/Longitude rulers the USGS has a book on the subject.

