

## Using Ratios to Measure Lat/Lon

Here is another technique for working with latitude longitude coordinates. You will need a calculator and a ruler marked in millimeters that is long enough to reach between two gridded parallels of latitude on your map. This method will work on any large scale map regardless of its scale. The method uses the ratios of distances in millimeters and in minutes and seconds.

Start by locating the two and a half minute grid that contains the point of interest, in our example the red star.

Remember that the United States is in the northern and western hemispheres. Thus latitude values increase from south to north, and longitude values increase from east to west. The right to left increase of longitude is often counter intuitive to beginning navigators.

Start by measuring the latitude of the point of interest.

Using the millimeter ruler, measure the distance to the point of interest from the southern parallel in millimeters. Also measure the full two and a half minute north-south distance in millimeters.

Divide the distance to the point, by the 2.5 minute north-south distance, and then multiply the result by 2.5 minutes. The result is the number of minutes north of the southern parallel.

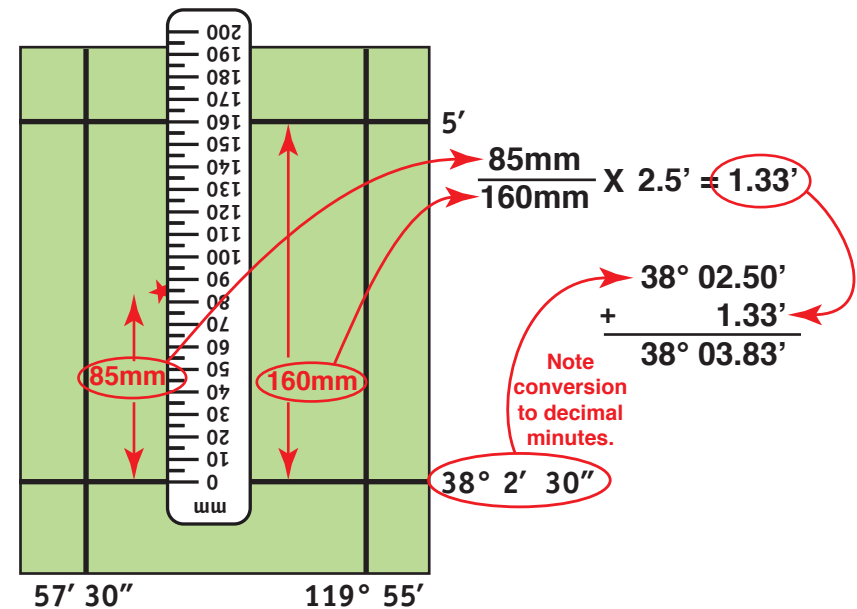
Add this to the latitude of the southern parallel to get the latitude of the point of interest.

Next you will measure the longitude of the point of interest.

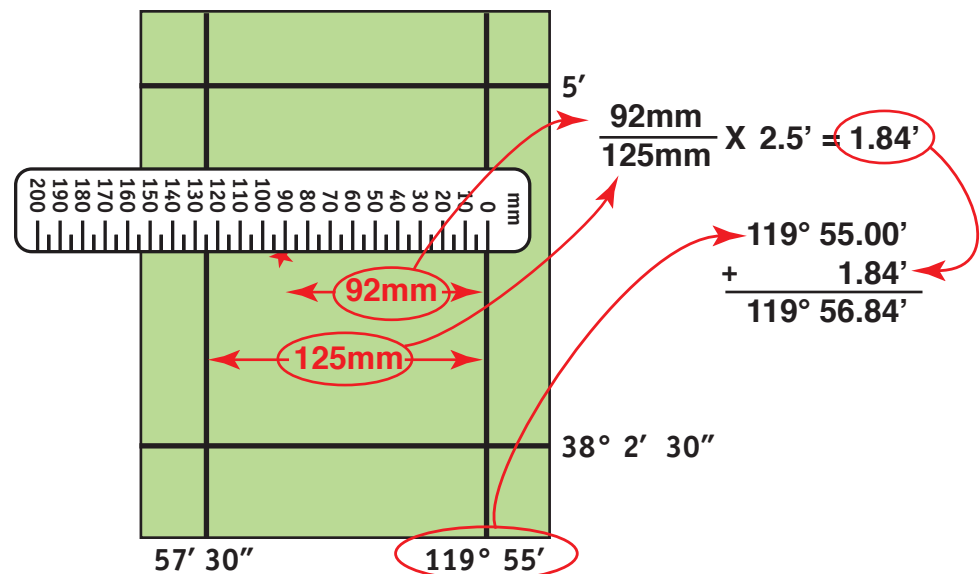
Again using the mm ruler, measure the distance to the point of interest from the eastern meridian. Also measure the full two and a half minute east-west distance.

Divide the distance to the point, by the 2.5 minute east-west distance and then multiply the result by 2.5 minutes. The result is the number of minutes west of the eastern meridian.

Add this to the longitude of the eastern meridian to get the longitude of the point of interest.



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## Using Ratios to Plot Lat/Lon

Plotting latitude longitude coordinates onto a map is essentially the reverse of the process used to measure the coordinates of a point of interest.

As an example, suppose at our current position, our GPS receiver displays coordinates of

N 38° 03.83'  
W 119° 56.83'

First locate the two and a half minute grid that contains this coordinate.

Subtract the latitude of the southern parallel from the latitude provided by the GPS to determine how many minutes further north the point is located.

Divide the minutes north to the point by 2.5 minutes and then multiply by the 2.5 minute north-south distance in millimeters. The result is the number of millimeters north of the southern parallel to plot the point of interest.

Use the millimeter ruler to measure the resulting distance to the north. Make this measurement at the left and right edges of the grid, placing a small tic mark on each. Then draw a light line across the grid at the desired latitude. The point to be plotted lies along this line.

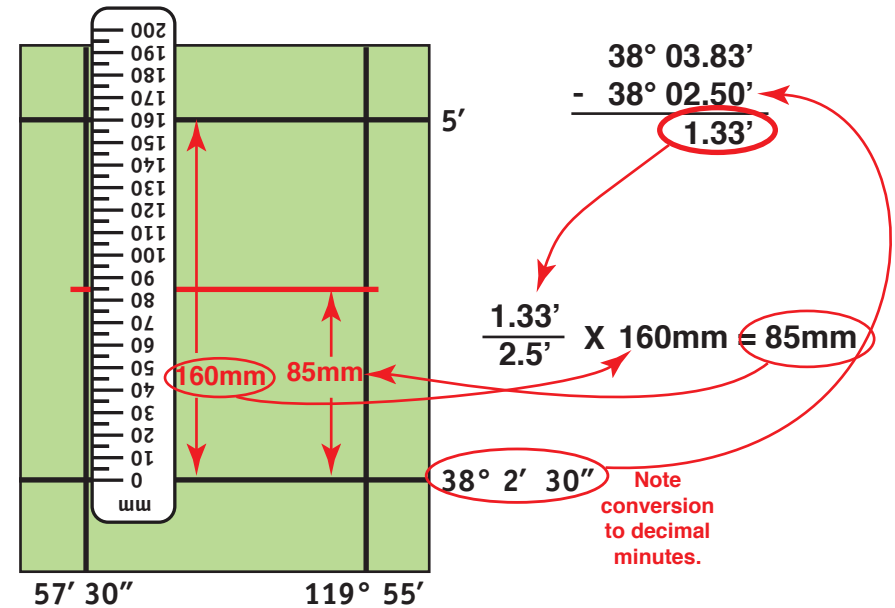
Subtract the longitude provided by the GPS from the longitude of the eastern meridian to determine how many minutes further west the point is located.

Divide the minutes west to the point by 2.5 minutes and then multiply by the 2.5 minute east-west distance in millimeters. The result is the number of millimeters west of the eastern meridian to plot the point of interest.

The ratio method works because the ratio of the distance to the point and the distance to the next grid line is constant regardless of the unit of measure. Thus two ratios in different units will be equal to each other. In this case we are using millimeters and degrees and minutes. You could use other units of measure.

$$\frac{\text{point in mm}}{\text{grid in mm}} = \frac{\text{point in dm.m}}{\text{grid in dm.m}}$$

In each case we know three of the four values, and a bit of algebra solves for the fourth value.



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