LATITUDE BY THE ALTITUDE OF POLARIS.

The latitude may be found from the observed altitude of Polaris at its upper or lower transits by the methods given in the two preceding cases. The latitude however may be easily computed from the altitude observed at *any time* of the night, by applying certain corrections to the true altitude.

The principal of these depends on the hour angle of Polaris, or its position with respect to the meridian at the instant of observation. The other, which is a much smaller correction, depends partly on the hour angle, and partly on the latitude of the place; but as its amount is not materially affected by a change of several degrees in the latitude, for the sake of simplicity it has been computed for latitude 45°.

The two corrections, which have been computed for the position of Polaris in 1872, are combined together and are given in table IX for every 4 m. of hour angle, or for every 4 m. of the right ascension of the meridian, from which the hour angle differs by a constant angle.

Rule (1).—From the approximate mean time of the place expressed astronomically, and the approximate longitude in time, find the Greenwich date roughly to the nearest hour.

(2) From table VII take the Right Ascension of the mean sun at the Greenwich noon next preceding the Greenwich date, and add to it 10 seconds for every hour of the Greenwich date. The sum will be the right ascension of the mean sun at the time of observation.

(3) Add to this the astronomical time of the place. The sum (rejecting 24 hours if it be more than 24 hours), will be the right ascension of the meridian.

(4) Correct the observed altitude of Polaris for index error, (dip if necessary) and refraction, and apply to the true altitude the correction given in table IX. The result will be the latitude of the place.

Example.—Sept. 10, 1872, at 11h. 2m. P. M., in long. 85° west, the observed altitude of Polaris taken with a theodolite was 47° 40′ 0″, and the index correction was 0. Required the latitude.

	h.	m.	s.
Sept. 10.......	11	2	
Long. in t.....	5	40	
Gr. Sept. 10	16	42	
R. A. Gr. Noon Sept. 10.	11	19	18
correction......		2	50
corrected R. A..	11	22	8
time of place...	11	2	
R. A. of mer...	22	24	

	°	′	″
obsd. alt....	47	40	0
refr.........		— 0	53
	47	39	7
corr. from table IX..	—1	0	45
Lat.........	46	38	22

It is somtimes the practice to observe the altitude of Polaris at the time of its *greatest elongation* east or west from the meridian, and to take this altitude as the latitude of the place. This point in the star's course is the *worst* that could be chosen, as the change of altitude is then most *rapid*, and consequently any error in the time of observation is most effective in vitiating the result.

TO FIND THE DIRECTION OF THE MERIDIAN.

The true bearing or azimuth of a terrestrial mark is known from the horizontal angle between the mark and some celestial object whose azimuth has been determined.

A star evidently bears north or south at the instant of its passage over the meridian; but as this is the point in the diurnal path of a star when its azimuth changes most rapidly, the error in the azimuth occasioned by any error in estimating the time of observation will then be the *greatest* possible. The very slow motion of Polaris in azimuth renders it more suitable than other bodies for this purpose; but in any case, unless the observation be made very accurately at the true time of transit, the direction of the meridian derived from it will not be correct.

The times best adapted for observing the azimuth of a body, is when its diurnal path touches a vertical circle; for the error in the azimuth dependent on any error in the time is at that instant the *least* possible.

The times proper for observing the azimuth of Polaris may be found partly from table X, in which are given the astronomical times of its upper transit on every day in the year, and also from table XV, which shews the interval of time between its transit and its greatest elongation east or west from the meridian. The intervals are computed for every degree of latitude, from 42° to 51°, and are accompanied by the differences in the lengths of the intervals corresponding to differences of 10′ in the latitude, by aid of which, the intervals proper to any intermediate latitude may be easily found.

In table XV are given the azimuths of Polaris for each quarter and for every degree of latitude, from 42° to 51°, together with the differences to be added to the azimuth for every 10′ of latitude.

The mode of applying these tables is shewn by the following example.

Example.—Required the time of greatest western elongation of Polaris and the corresponding azimuth on Jan. 4, 1872, in lat. 47° 20.

	h. m. s.		h. m. s.		° ′ ″
Time of Mer. pass. Jan. 4..	6 16 25	Interval Lat. 47°..	5 53 9	Azth. Lat. 47..	2 0 31
Interval............	5 53 5	— 2.0 X 2.........	— 4	23″ X 2....	+ 46
Time of greatest elongation	12 9 30	for lat. 47° 20′.....	5 53 5	azth. lat. 47° 20′	2 1 17

	h. m. s.
Hence the time of greatest western elongation is............	12 9 30;
and the azimuth at the same time is........................	2° 1′ 17″;

(*Continued on page* 33