What I meant by we could “have worked the standard noon formula from the other end and compute what we would have measured if we had been at 25 degrees North” was to assume we were at 25 degrees north and then rearrange the standard noon formula to compute the altitude we would have observed had we actually been at 25 north. This is how it worked.

Date: October 29, 2009
Time: 13:18:46
Declination 13° 36.4' south
Height of eye: 33 feet
Index error: +1.6'
Lower limb observation

Hs   51° 26.4'
I.C.   -1.6'
Dip   -5.6
Ref.   -0.8'
S.D.   +16.1'
Ho   51° 34.5'

(For instructional purposes, I like to do the semi-diameter and refraction corrections separately so the student can see where the numbers are coming from. The total of these two corrections was + 15.3'. If using the sun correction table the combined correction for the lower limb shot was + 15.5'. Doing the corrections separately is more accurate since the sun correction table doesn’t use the actual S.D for the sun on the day of the observation but an average S.D. for a six month period.)

Normal noon sight computation

90° = 89° 60.0'
Ho   - 51° 34.5'
ZD   38° 25.5'
Dec -13° 26.4'
Lat   24° 49.1' north

Introducing the Marc St. Hilaire method by calculating computed altitude using the rearranged noon formula.

A lat 25° 00.0' north
Dec + 13° 36.4'
Assumed ZD 38° 36.4'

89° 60.0'
Assumed ZD -38° 36.4'
Hc 51° 23.6'
Ho 51° 34,5'
Int 10.9 nm toward

Noon Zn is 180° so 10.9' south of the assumed latitude places the 90°-270° LOP at 24° 49.1' north latitude, the same result as the normal noon sight.

Introducing the usual way of doing the same computation with H.O. 229 for the general case:

LHA 0°
A lat 25° north
Dec 13° contrary name
Tab Hc 52° 00.0'
d -60.0' (per degree of declination change)
d corr -36.4'
Hc 51° 23.6'
Ho 51° 34.5'
Int 10.9 nm toward
Zn 180.0°

Using H.O. 249:

A lat 25° north
Dec 13° contrary name
Tab Hc 52° 00'
d -60
d corr -36'
Hc 51° 24'
Ho 51° 35'
Int 11 nm toward
Zn 180°

Using a calculator with the normal Sine - cosine formula

Hc= arc sin((sin lat x sin dec) + (cos lat x cos dec x cos LHA))

For the special case of a noon sight where the LHA is 0°, which has a cosine of 1, the second term reduces to only cos lat x cos dec.

Hc = arc sin ((sin 25° x sin - 13° 36..4') + (cos 25° x cos -13° 36.4' x 1)
Hc = arc sin ((0.422 x -0.235) + (0.906 x 0.972))
Hc = arc sin ((-0.099) + (0.881))
Hc = 51° 23.6'

gl