$$\text{SHA} = 360^\circ - 15\,\text{RA}$$

$$\text{GHA} = \text{GHA Aries} + \text{SHA}$$

where

GHA is the Greenwich hour angle in degrees;
LHA is the local hour angle in degrees;
GHA Aries is the Greenwich hour angle of the First Point of Aries (the origin of right ascension) in degrees;
SHA is the sidereal hour angle in degrees;
RA is the apparent right ascension (referred to the true equator and equinox of date) in hours;
λ is the local longitude in degrees (east is positive; west is negative);
GAST is the Greenwich apparent sidereal time in hours;
LAST is the local apparent sidereal time in hours.

When using these formulas it may be necessary to add or subtract 360° to reduce the resulting hour angles to the range 0°–360°. Often local hour angle values are reduced to the range –180° to +180°, in which case they are called meridian angles. In all cases positive hour angles are measured westward from the meridian.

Altitude and Azimuth

The following formulas can be used to compute the altitude a and azimuth A of a celestial body:

(1) $\sin a = \cos z = \sin\varphi \sin\delta + \cos\varphi \cos\delta \cos \text{LHA}$

(2) $x = \tan A = \sin \text{LHA} / (\cos \text{LHA} \sin\varphi - \tan\delta \cos\varphi)$

Formula (2) is most efficiently evaluated using a rectangular to polar coordinate conversion function, with the numerator and denominator being the rectangular coordinates. If this is not available, some care must be taken in determining the proper quadrant for A. Since computers and calculators normally give the arctangent in the range –90° to +90°, the correct quadrant for A can be selected according to the following rules:

If $0^\circ \le \text{LHA} \le 180^\circ$,
$A = 180^\circ + \arctan x$, if x is positive,
$A = 360^\circ + \arctan x$, if x is negative.
If $180^\circ \le \text{LHA} \le 360^\circ$,
$A = \arctan x$, if x is positive,
$A = 180^\circ + \arctan x$, if x is negative.

Notation:

a: altitude of body above horizon (if $\sin a$ is negative, the body is below the horizon);