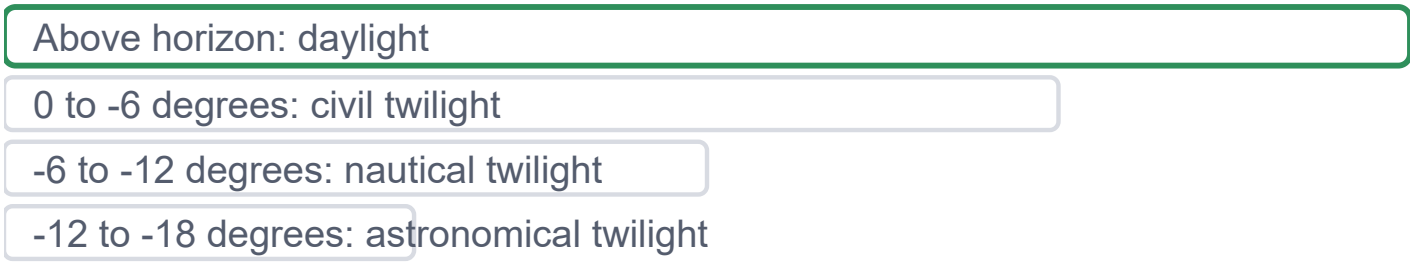
Sunrise, Twilight, and Golden Hour Are Defined by Sun Angle, Not a Fixed Clock Offset

> Sunrise is not "6 AM plus an offset," it is the specific moment the sun crosses a defined angle below the horizon, which shifts by minutes each day and by much more with latitude.

Sunrise, sunset, and the various twilight and golden-hour windows are all defined relative to the sun's angular position below or above the horizon at a specific location and date, not as a fixed clock-time offset from noon or midnight. This is why sunrise time drifts gradually through the year, why it differs meaningfully between two cities in the same time zone, and why the daylight and twilight windows are dramatically different lengths depending on latitude and season.

Sun angle relative to the horizon (0 degrees)



Sunrise and each twilight phase are defined by the sun's angle below the horizon, a fixed astronomical threshold, not a fixed clock time.

Why sun-angle definitions are used instead of a clock-based rule

A sun-angle definition captures the actual physical phenomenon (how much of the sky is lit, whether direct sunlight has begun) in a way that stays meaningful across every location and every day of the year, whereas a fixed clock-time rule would only be valid for one specific place on one specific day. Sunrise itself is standardly defined as the moment the sun's upper edge crosses the horizon (0 degrees, adjusted for atmospheric refraction), while civil, nautical, and astronomical twilight are defined at 6, 12, and 18 degrees below the horizon respectively, each marking a different practical threshold of natural light.

Why the clock time swings by more than a location's time-zone offset would suggest

Because the sun's path across the sky changes with the Earth's axial tilt through the year, the actual clock time of sunrise and sunset drifts by several minutes a day around the solstices and equinoxes, and that drift is more pronounced the further a location sits from the equator. Locations at high latitude can see sunrise and sunset times swing by hours across a year, while a location very close to the equator sees comparatively little seasonal drift at all, independent of whichever time zone either location happens to use.

What golden hour actually is

Golden hour is a photography- and outdoor-planning-oriented window (roughly when the sun sits low enough in the sky for warm, soft light but is still above the horizon), not one of the three formally standardized twilight phases. It is typically approximated as a specific sun-angle range above the horizon just after sunrise or just before sunset, which is why the Solar Noon / Golden Hour Calculator computes it from the same underlying sun-angle model as sunrise and twilight rather than as a separate, unrelated calculation.

Key takeaway. Sunrise, sunset, and every twilight phase are defined by the sun's angle relative to the horizon, a fixed astronomical threshold that translates to a different clock time every day and at every location. Never assume a location's daylight schedule from its time zone alone.

Frequently asked

Why does WhenMath need my location for a sunrise calculation instead of just a time zone?

Because sun angle depends on precise latitude and longitude, not just which time zone a location happens to observe. Two cities in the same time zone can have meaningfully different sunrise times if their longitudes (or latitudes, for seasonal effects) differ enough.

What happens at very high latitudes in summer or winter?

Inside the polar circles, the sun can remain entirely above the horizon (polar day) or entirely below it (polar night) for extended periods, in which case a literal sunrise or sunset simply does not occur that day. The Sunrise / Sunset Calculator detects and reports this explicitly rather than returning an invalid time.

Is the sunrise/sunset calculation exact to the second?

It follows the standard NOAA solar position formulas used across most sunrise/sunset calculators, verified in WhenMath's case against equinox and polar-day/polar-night reference cases and a live check against real published solstice times. Atmospheric conditions on a given day can shift the visually observed moment by a small amount beyond the model's idealized prediction.

WhenMath is a browser-local calculation tool, not a legal, payroll, or scheduling authority. This guide explains a calculation convention; it is educational, not a determination that any specific contract, employer, or jurisdiction follows it.