Important variables

Earth's axial spin:

$$t = number\ of\ hours\ from\ the\ start\ of\ each\ day; 0 \leq t < 24$$

$$\Delta t = (sunset\ time) - (sunrise\ time)$$

$$\omega = angular\ velocity\ (spin\ rate) = \frac{360°}{24} = 15\ degrees/hour$$

$$= \frac{(2\pi)^c}{24} = \frac{\pi}{12} radians/hour$$

Earth's solar orbit:

$$\theta = the\ (angular)\ component\ of\ Earth's\ axial\ tilt\ relative\ to\ the\ Sun; -23.5° < \theta < 23.5°$$

$$T = number\ of\ days\ since\ the\ last\ summer\ solstice; 0 \leq T < 365$$

$$\Omega = angular\ velocity\ (orbital\ rate) = \frac{360°}{365} = \frac{71}{72}\ degrees/day$$

$$= \frac{(2\pi)^c}{365} = \frac{2\pi}{365} radians/day$$

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Important Equations

$$\tan\theta = \tan(\theta_{max})\cos(\Omega T)$$

$$\cos\left(\frac{\omega\Delta t}{2}\right) = -\tan\alpha\tan\theta$$

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