Autumnal Equinox

Equinox = Latin for equal night = *aequus* (equal) and *nox* (night)

On Saturday, September 22, 2018 at 1:54 UTC which is the same as 9:54 pm EST, the imaginary plane that passes through the Earth's equator will also pass through the center of the Sun.

This phenomenon happens twice a year at the Autumnal (Fall) and Vernal (Spring) Equinoxes. Supposedly, on these dates the length of daylight hours and nighttime hours are both 12 hours. This is not quite true but close. It depends on how close to the equator you are located. So, the length of day and night are related to your latitude but they are about equal all over the globe on September 23rd.

In the summer, the Northern hemisphere is tilted towards the sun. On about June 21st the Northern Hemisphere of the Earth is tilted as far as it will ever be toward the sun at about 23.5 degrees. Then the tilt of the earth starts lessening until the Northern Hemisphere starts to tilt away from the sun. That time when a person on the Earth's Equator would be looking directly overhead to see the sun at about noon is called the Autumnal Equinox. Both daylight and nighttime last 12 hours and the Northern hemisphere begins its journey away from the sun.

I live at about 42 degrees, N. latitude. Below is the chart that I found with the length of daylight hours at my latitude at different times of the year.

Date	Jan 1	Jan 16	Feb 1	Feb 16	Mar 1	Mar 16
Hours light	9.21	9.46	9.92	10.48	11.02	11.68

Date	Apr 1	Apr 16	May 1	May 16	Jun 1	Jun 16
Hours light	12.41	13.07	13.68	14.21	14.63	14.82

Date	Jul 1	Jul 16	Aug 1	Aug 16	Sep 1	Sep 16
Hours light	14.81	14.58	14.13	13.59	12.92	12.25

Date	Oct 1	Oct 16	Nov 1	Nov 16	Dec 1	Dec 16
Hours light	11.58	10.92	10.27	9.75	9.37	9.17

You can find a chart of your latitude here: http://www.orchidculture.com/COD/daylength.html

Can you figure out how to use the formula below to calculate the number of daylight hours on a given day where you live?

This formula should come pretty close to finding the number of daylight hours (D) on any day of the year (J : where J = number of days since January 1) at a certain latitude (L).

$$P = \sin^{-1}[.3975 * \cos(.2163108 + 2 * \tan^{-1}(.9671396) * \tan[.00860(J - 186)]]]$$

$$D = 24 - \left(24/\pi\right) * \cos^{-1}\left(\frac{\sin\left(0.83333 * \pi/180\right) + \sin\left(L * \pi/180\right) * \sin(P)}{\cos\left(L * \pi/180\right) * \cos(P)}\right)$$

Sources:
http://mathforum.org/library/drmath/view/56478.html
http://www.timeanddate.com/calendar/september-equinox.html
http://astro.unl.edu/naap/motion1/animations/seasons_ecliptic.html
http://www.orchidculture.com/COD/daylength.html - Latitudes