## Exercise 25

The city of New Orleans is located at latitude 30°N. Use Figure 9 to find a function that models the number of hours of daylight at New Orleans as a function of the time of year. To check the accuracy of your model, use the fact that on March 31 the sun rises at 5:51 AM and sets at 6:18 PM in New Orleans.

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**Solution**

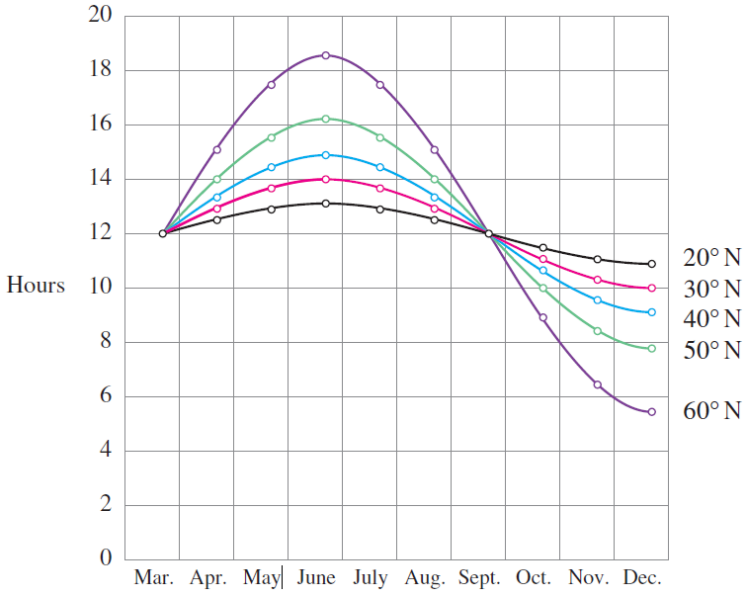


**FIGURE 9**
Graph of the length of daylight from March 21 through December 21 at various latitudes

*Source:* Adapted from L. Harrison, *Daylight, Twilight, Darkness and Time* (New York: Silver, Burdett, 1935), 40.

According to Figure 9, the model function for a city at latitude 30°N is the magenta curve. It's sinusoidal and begins at the equilibrium level, so a sine function will be used.

$$\sin t$$

The amplitude is 2 because the highest number of hours is 14 while the lowest is 10.

$$2\sin t$$

The period is 365 days, so the coefficient of $t$ is $2\pi/365$.

$$2\sin\frac{2\pi}{365}t$$

Since the curve starts on day 80 of the year, $t$ will be replaced by $t-80$ to shift the graph 80 units to the right.

$$2\sin\left[\frac{2\pi}{365}(t-80)\right]$$

Finally, add 12 to the function to shift the graph up by 12 units.

$$2\sin\left[\frac{2\pi}{365}(t-80)\right]+12$$

March 31 is day 90 of the year, and the sun is up for 12 hours and 27 minutes. Check the value given by the model.

$$2\sin\left[\frac{2\pi}{365}(90-80)\right]+12\approx 12.34\approx 12 \text{ hours and } 20 \text{ minutes}$$