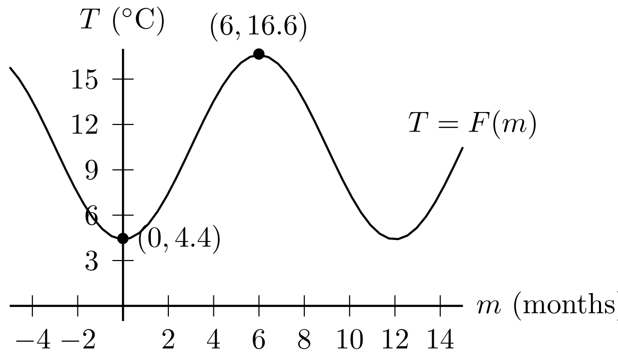
4. [12 points]

a. [7 points]

The average temperature, T, in degrees Celsius, for the city of Forks, Washington, can be modeled by the sinusoidal function $F(m)$, where m is measured in months after January 1 (so $m = 0$ represents January 1). A portion of the graph of $T = F(m)$ is shown on the right.



Find the period, amplitude, midline, and a formula for the sinusoidal function $F(m)$ shown above. (*Include units for the period and amplitude.*)

Period: 12 **months**

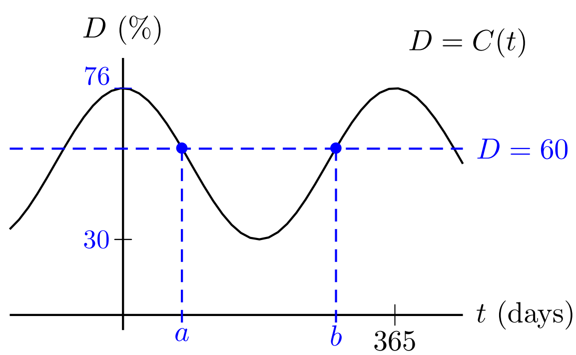
Amplitude: 6.1°**C**

Midline: $T = 10.5$

Formula: $F(m) =$ $-6.1\cos(\frac{\pi}{6}m) + 10.5$ **(many possible answers)**

b. [5 points]

Suppose the chance of significant cloud cover in Seattle on day t of the year is D%. D can be approximated by the function $C(t) = 23\cos(0.0172t) + 53$. A portion of the graph of $D = C(t)$ is shown to the right. A family in Forks wants to visit Seattle when the chance of significant cloud cover is at least 60%. Find ALL solutions to the equation $C(t) = 60$ for $0 \le t \le 365$.



For full credit, you should solve this problem algebraically and show each step clearly. Your answer(s) should either be in exact form or be accurate to at least 2 decimal places.

Solution: Using the line $D = 60$ in the graph above, we see that there are two solutions for $0 \le t \le 365$ (labeled a and b above). By symmetry, we see that $b = 365 - a$. Solving the equation $23\cos(0.0172t) + 53 = 60$ we find $23\cos(0.0172t) = 7$ so $\cos(0.0172t) = \frac{7}{23}$. So *one* solution is given by $0.0172t = \cos^{-1}(\frac{7}{23})$, i.e. $t = \frac{\cos^{-1}(\frac{7}{23})}{0.0172} \approx 73.346$. This is the solution a shown in the graph. So, the two solutions are $a = \frac{\cos^{-1}(\frac{7}{23})}{0.0172} \approx 73.346$ and $b = 365 - \frac{\cos^{-1}(\frac{7}{23})}{0.0172} \approx 291.654$.

Answer(s): $\frac{\cos^{-1}(\frac{7}{23})}{0.0172}(\approx 73.346)$ **and** $365 - \frac{\cos^{-1}(\frac{7}{23})}{0.0172}(\approx 291.654)$