8.) **Essay Question.** *All* answers should be in complete sentences.

Average daily temperature for any city in the United States can be approximated with reasonable accuracy by a function of the form $f(t) = A \sin(b(t - h)) + k$, where t is in days after January 1.

For example, a model for average daily temps in the following cities is given by:

Phoenix, AZ: $\qquad f(t) = 20 \sin\left(\dfrac{2\pi}{365}(t - 109)\right) + 71$

Honolulu, HI: $\qquad f(t) = 4 \sin\left(\dfrac{2\pi}{365}(t - 141)\right) + 75$

Bismarck, ND: $\qquad f(t) = 30 \sin\left(\dfrac{2\pi}{365}(t - 110)\right) + 40$

(a) (3 pts) Explain why it is appropriate to use $b = \left(\dfrac{2\pi}{365}\right)$.

The average temperature in Pittsburgh can be modeled by the function

$$f(t) = 22 \sin\left(\dfrac{2\pi}{365}(t - 118)\right) + 40 \ .$$

(b) (3 pts) According to this model, what is the highest average temperature in Pittsburgh, and in approximately what month during the year does that occur?

(c) (3 pts) What is the lowest average temperature in Pittsburgh, and in what month does that occur?

[This problem is continued on the next page.]

The model for average daily temperature from the previous page was given as

$$f(t) = A \sin(b(t - h)) + k.$$

(d) (3 pts) In this model, what does the parameter A tell you about the prevailing climate in a city?

(e) (3 pts) What is the effect of the parameter h in the context of these models (*i.e.,* in terms of temperature and days)?

(f) (3 pts) What does the parameter k indicate in terms of climate?