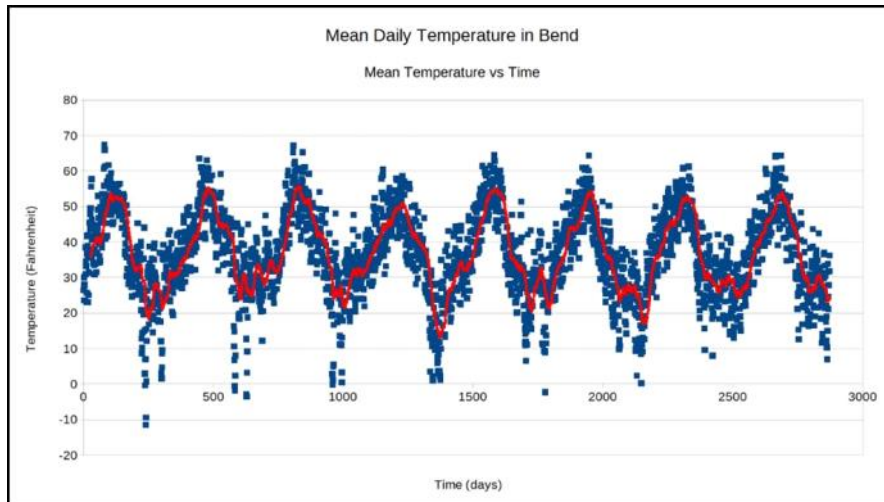


Week 8 Quiz

Thursday, February 25, 2021 10:43 AM

The average daily temperature in the town of Bend, OR is plotted with blue dots in the graph below. The time $t = 0$ days corresponds to April 12th 2013, and the last measurement was taken February 22nd 2021. The red line represents a trendline.



Rubric

~~ Part (a) ~~

1.0 pt - explanation

0.5 pts - correct answer

~~ Part (b) ~~

1.5 pts - correct answer

~~ Part (c) ~~

1.5 pts - correct answer

~~ Part (d) ~~

1.0 pt - $\omega = 2\pi/T$ eq.

1.0 pt - Sinusoidal form

1.0 pt - Initial conditions (+ sine function)

1.0 pts - constant offset

1.5 pts - application of period and amp

(a) Is the average daily temperature in Bend, Oregon an example of simple harmonic oscillation? Use words, diagrams, equations, etc... to support your answer.

No, a SHO undergoes a sinusoidal oscillation. The above oscillation appears to be more triangular

(b) Approximately, what is the average daily temperature's period of oscillation?

$$T = \frac{(2900 - 250) \text{ days}}{7 \text{ osc.}} = 379 \frac{\text{days}}{\text{osc.}} \leftarrow \text{which is close to expected value of } 365 \frac{\text{days}}{\text{year}}$$

(c) Approximately, what is the amplitude of the average daily temperature's oscillation?

$$\text{Range} \approx (55 - 15)^\circ\text{F} = 40^\circ\text{F}, \quad \text{Amp} = \frac{\text{Range}}{2} \approx 20^\circ\text{F} \equiv A$$

(d) Use the red trendline to construct an equation that *approximately* describes the oscillation of the temperature as a function of time only, i.e. $T(t) = ?$

Solution Form: $T(t) = \pm A \begin{matrix} \sin \\ \text{or} \\ \cos \end{matrix} (\omega t) + T_0$, where $T_0 = \begin{matrix} \text{average temp} \\ \text{offset from} \\ \text{zero} \end{matrix} \approx 35^\circ\text{F}$

Applied: $T(t) = 20^\circ\text{F} \sin\left(\frac{2\pi}{379 \text{ days}} t\right) + 35^\circ\text{F}$ + $\omega = \frac{2\pi}{T} \leftarrow \text{period}$