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17. Critical Thinking The average monthly temperature for Phoenix, Arizona can be modeled by $y = 70.5 + 19.5 \sin\left(\frac{\pi}{6}t - c\right)$. If the coldest temperature occurs in January ($t = 1$), find the value of c.

$51 = 70.5 + 19.5 \sin\left(\frac{\pi}{6}(1) - c\right)$

-70.5

$\frac{-19.5}{19.5} = \frac{19.5 \sin\left(\frac{\pi}{6} - c\right)}{19.5}$

$-1 = \sin\left(\frac{\pi}{6} - c\right)$

$\sin^{-1}(-1) = \frac{\pi}{6} - c$

$-1.57 = \frac{\pi}{6} - c$

$-\frac{\pi}{6} \quad -\frac{\pi}{6}$

$-2.09 = -c$

$2.09 = c$

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$A_{mpl} = 4$ $\quad V.S = 77$ $\quad Per = 12 \rightarrow K = \frac{\pi}{6}$

d. ~~$\frac{23}{-4} = 4 \sin\left(\frac{\pi}{6}(2) - c\right) + 77$~~

$-1 = \sin\left(\frac{\pi}{3} - c\right)$

$\sin^{-1}(-1) = \frac{\pi}{3} - c$

$-1.57 = \frac{\pi}{3} - c$

$c = \frac{\pi}{3} + 1.57 \approx 2.62$

$y = 4 \sin\left(\frac{\pi}{6}t - 2.62\right) + 77$

e. Aug $\Rightarrow t = 8$ $\quad y = 81°$

f. May $\Rightarrow t = 5$ $\quad y = 77°$

15. Tides Burntcoat Head in Nova Scotia, Canada, is known for its extreme fluctuations in tides. One day in April, the first high tide rose to 13.25 feet at 4:30 A.M. The first low tide at 1.88 feet occurred at 10:51 A.M. The second high tide was recorded at 4:53 P.M.

max – 13.25
min – 1.88

$12.4 = \frac{2\pi}{k}$

$k = \frac{2\pi}{12.4} = \frac{\pi}{6.2}$

a. $Ampl = \frac{13.25 - 1.88}{2} = 5.7$

b. $V.S. = \frac{13.25 + 1.88}{2} = 7.6$

c. $Per = 12\text{ hr } 23\text{ min} \approx 12.4\text{ hr}$

d. $y = 5.7 \sin\left(\frac{\pi}{6.2}t - c\right) + 7.6$

$13.25 = 5.7 \sin\left(\frac{\pi}{6.2}(4.5) - c\right) + 7.6$

$\frac{5.65}{5.7}$

$\frac{5.65}{5.7} = \sin\left(\frac{4.5\pi}{6.2} - c\right)$

$\sin^{-1}\left(\frac{5.65}{5.7}\right) = \frac{4.5\pi}{6.2} - c$

$1.44 = \frac{4.5\pi}{6.2} - c$

$c = .84$

$y = 5.7 \sin\left(\frac{\pi}{6.2}t - .84\right) + 7.6$