

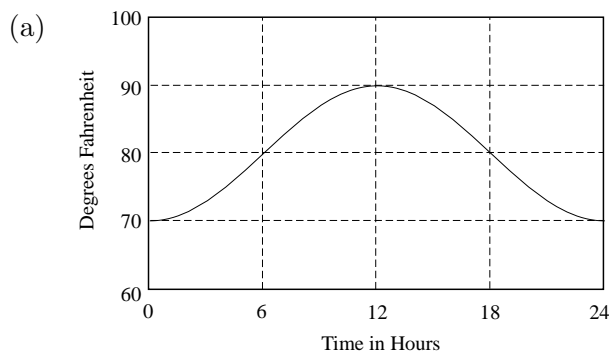
1998 Calculus AB Scoring Guidelines

5. The temperature outside a house during a 24-hour period is given by

$$F(t) = 80 - 10 \cos\left(\frac{\pi t}{12}\right), \quad 0 \leq t \leq 24,$$

where $F(t)$ is measured in degrees Fahrenheit and t is measured in hours.

- Sketch the graph of F on the grid below.
- Find the average temperature, to the nearest degree Fahrenheit, between $t = 6$ and $t = 14$.
- An air conditioner cooled the house whenever the outside temperature was at or above 78 degrees Fahrenheit. For what values of t was the air conditioner cooling the house?
- The cost of cooling the house accumulates at the rate of \$0.05 per hour for each degree the outside temperature exceeds 78 degrees Fahrenheit. What was the total cost, to the nearest cent, to cool the house for this 24-hour period?



(b)
$$\begin{aligned} \text{Avg.} &= \frac{1}{14 - 6} \int_6^{14} \left[80 - 10 \cos\left(\frac{\pi t}{12}\right) \right] dt \\ &= \frac{1}{8} (697.2957795) \\ &= 87.162 \text{ or } 87.161 \\ &\approx 87^\circ \text{ F} \end{aligned}$$

(c)
$$\begin{aligned} \left[80 - 10 \cos\left(\frac{\pi t}{12}\right) \right] - 78 &\geq 0 \\ 2 - 10 \cos\left(\frac{\pi t}{12}\right) &\geq 0 \\ \left. \begin{array}{l} 5.230 \\ \text{or} \\ 5.231 \end{array} \right\} \leq t \leq \left\{ \begin{array}{l} 18.769 \\ \text{or} \\ 18.770 \end{array} \right. \end{aligned}$$

(d)
$$\begin{aligned} C &= 0.05 \int_{\substack{5.231 \\ \text{or} \\ 5.230}}^{\substack{18.770 \\ \text{or} \\ 18.769}} \left(\left[80 - 10 \cos\left(\frac{\pi t}{12}\right) \right] - 78 \right) dt \\ &= 0.05(101.92741) = 5.096 \approx \$5.10 \end{aligned}$$

1: bell-shaped graph
 minimum 70 at $t = 0, t = 24$ only
 maximum 90 at $t = 12$ only

3 { **2:** integral
 1: limits and $1/(14 - 6)$
 1: integrand
1: answer
 0/1 if integral not of the form
 $\frac{1}{b - a} \int_a^b F(t) dt$

2 { **1:** inequality or equation
1: solutions with interval

3 { **2:** integral
 1: limits and 0.05
 1: integrand
1: answer
 0/1 if integral not of the form
 $k \int_a^b (F(t) - 78) dt$