AP® CALCULUS AB
2011 SCORING GUIDELINES

Question 2

(a) $H'(3.5) \approx \dfrac{H(5) - H(2)}{5 - 2}$

$= \dfrac{52 - 60}{3} = -2.666$ or -2.667 degrees Celsius per minute

| 1 : answer |

(b) $\dfrac{1}{10}\displaystyle\int_0^{10} H(t)\,dt$ is the average temperature of the tea, in degrees Celsius, over the 10 minutes.

$\dfrac{1}{10}\displaystyle\int_0^{10} H(t)\,dt \approx \dfrac{1}{10}\left(2 \cdot \dfrac{66 + 60}{2} + 3 \cdot \dfrac{60 + 52}{2} + 4 \cdot \dfrac{52 + 44}{2} + 1 \cdot \dfrac{44 + 43}{2}\right)$

$= 52.95$

$3 : \begin{cases} 1 : \text{meaning of expression} \\ 1 : \text{trapezoidal sum} \\ 1 : \text{estimate} \end{cases}$

(c) $\displaystyle\int_0^{10} H'(t)\,dt = H(10) - H(0) = 43 - 66 = -23$

The temperature of the tea drops 23 degrees Celsius from time $t = 0$ to time $t = 10$ minutes.

$2 : \begin{cases} 1 : \text{value of integral} \\ 1 : \text{meaning of expression} \end{cases}$

(d) $B(10) = 100 + \displaystyle\int_0^{10} B'(t)\,dt = 34.18275; \quad H(10) - B(10) = 8.817$

The biscuits are 8.817 degrees Celsius cooler than the tea.

$3 : \begin{cases} 1 : \text{integrand} \\ 1 : \text{uses } B(0) = 100 \\ 1 : \text{answer} \end{cases}$

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