t (minutes)	0	2	5	9	10
$H(t)$ (degrees Celsius)	66	60	52	44	43

2. As a pot of tea cools, the temperature of the tea is modeled by a differentiable function H for $0 \le t \le 10$, where time t is measured in minutes and temperature $H(t)$ is measured in degrees Celsius. Values of $H(t)$ at selected values of time t are shown in the table above.

 (a) Use the data in the table to approximate the rate at which the temperature of the tea is changing at time $t = 3.5$. Show the computations that lead to your answer.

 (b) Using correct units, explain the meaning of $\dfrac{1}{10}\displaystyle\int_0^{10} H(t)\, dt$ in the context of this problem. Use a trapezoidal

 sum with the four subintervals indicated by the table to estimate $\dfrac{1}{10}\displaystyle\int_0^{10} H(t)\, dt$.

 (c) Evaluate $\displaystyle\int_0^{10} H'(t)\, dt$. Using correct units, explain the meaning of the expression in the context of this problem.

 (d) At time $t = 0$, biscuits with temperature 100°C were removed from an oven. The temperature of the biscuits at time t is modeled by a differentiable function B for which it is known that $B'(t) = -13.84e^{-0.173t}$. Using the given models, at time $t = 10$, how much cooler are the biscuits than the tea?

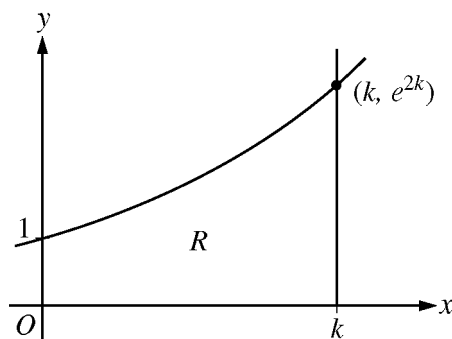**WRITE ALL WORK IN THE EXAM BOOKLET.**

END OF PART A OF SECTION II

GO ON TO THE NEXT PAGE.

CALCULUS BC
SECTION II, Part B
Time—60 minutes
Number of problems—4

No calculator is allowed for these problems.

3. Let $f(x) = e^{2x}$. Let R be the region in the first quadrant bounded by the graph of f, the coordinate axes, and the vertical line $x = k$, where $k > 0$. The region R is shown in the figure above.

   (a) Write, but do not evaluate, an expression involving an integral that gives the perimeter of R in terms of k.

   (b) The region R is rotated about the x-axis to form a solid. Find the volume, V, of the solid in terms of k.

   (c) The volume V, found in part (b), changes as k changes. If $\dfrac{dk}{dt} = \dfrac{1}{3}$, determine $\dfrac{dV}{dt}$ when $k = \dfrac{1}{2}$.

WRITE ALL WORK IN THE EXAM BOOKLET.