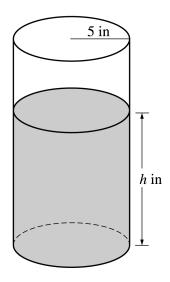
## 2003 AP® CALCULUS AB FREE-RESPONSE QUESTIONS



- 5. A coffeepot has the shape of a cylinder with radius 5 inches, as shown in the figure above. Let h be the depth of the coffee in the pot, measured in inches, where h is a function of time t, measured in seconds. The volume V of coffee in the pot is changing at the rate of  $-5\pi\sqrt{h}$  cubic inches per second. (The volume V of a cylinder with radius r and height h is  $V = \pi r^2 h$ .)
  - (a) Show that  $\frac{dh}{dt} = -\frac{\sqrt{h}}{5}$ .
  - (b) Given that h = 17 at time t = 0, solve the differential equation  $\frac{dh}{dt} = -\frac{\sqrt{h}}{5}$  for h as a function of t.
  - (c) At what time t is the coffeepot empty?
- 6. Let *f* be the function defined by

$$f(x) = \begin{cases} \sqrt{x+1} & \text{for } 0 \le x \le 3\\ 5 - x & \text{for } 3 < x \le 5. \end{cases}$$

- (a) Is f continuous at x = 3? Explain why or why not.
- (b) Find the average value of f(x) on the closed interval  $0 \le x \le 5$ .
- (c) Suppose the function g is defined by

$$g(x) = \begin{cases} k\sqrt{x+1} & \text{for } 0 \le x \le 3\\ mx+2 & \text{for } 3 < x \le 5, \end{cases}$$

where k and m are constants. If g is differentiable at x = 3, what are the values of k and m?

## **END OF EXAMINATION**

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