

**2004 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS (Form B)**

**CALCULUS AB  
SECTION II, Part A**

**Time—45 minutes**

**Number of problems—3**

**A graphing calculator is required for some problems or parts of problems.**

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1. Let  $R$  be the region enclosed by the graph of  $y = \sqrt{x-1}$ , the vertical line  $x = 10$ , and the  $x$ -axis.
- (a) Find the area of  $R$ .
  - (b) Find the volume of the solid generated when  $R$  is revolved about the horizontal line  $y = 3$ .
  - (c) Find the volume of the solid generated when  $R$  is revolved about the vertical line  $x = 10$ .
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2. For  $0 \leq t \leq 31$ , the rate of change of the number of mosquitoes on Tropical Island at time  $t$  days is modeled by  $R(t) = 5\sqrt{t} \cos\left(\frac{t}{5}\right)$  mosquitoes per day. There are 1000 mosquitoes on Tropical Island at time  $t = 0$ .
- (a) Show that the number of mosquitoes is increasing at time  $t = 6$ .
  - (b) At time  $t = 6$ , is the number of mosquitoes increasing at an increasing rate, or is the number of mosquitoes increasing at a decreasing rate? Give a reason for your answer.
  - (c) According to the model, how many mosquitoes will be on the island at time  $t = 31$ ? Round your answer to the nearest whole number.
  - (d) To the nearest whole number, what is the maximum number of mosquitoes for  $0 \leq t \leq 31$ ? Show the analysis that leads to your conclusion.
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