

**2011 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS**

**CALCULUS AB  
SECTION II, Part A**

**Time—30 minutes**

**Number of problems—2**

**A graphing calculator is required for these problems.**

1. For  $0 \leq t \leq 6$ , a particle is moving along the  $x$ -axis. The particle's position,  $x(t)$ , is not explicitly given. The velocity of the particle is given by  $v(t) = 2\sin(e^{t/4}) + 1$ . The acceleration of the particle is given by  $a(t) = \frac{1}{2}e^{t/4}\cos(e^{t/4})$  and  $x(0) = 2$ .
- (a) Is the speed of the particle increasing or decreasing at time  $t = 5.5$ ? Give a reason for your answer.
- (b) Find the average velocity of the particle for the time period  $0 \leq t \leq 6$ .
- (c) Find the total distance traveled by the particle from time  $t = 0$  to  $t = 6$ .
- (d) For  $0 \leq t \leq 6$ , the particle changes direction exactly once. Find the position of the particle at that time.
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**WRITE ALL WORK IN THE EXAM BOOKLET.**