

**2003 AP<sup>®</sup> CALCULUS AB FREE-RESPONSE QUESTIONS (Form B)**

**CALCULUS AB  
SECTION II, Part B**

**Time—45 minutes**

**Number of problems—3**

**No calculator is allowed for these problems.**

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4. A particle moves along the  $x$ -axis with velocity at time  $t \geq 0$  given by  $v(t) = -1 + e^{1-t}$ .
- (a) Find the acceleration of the particle at time  $t = 3$ .
  - (b) Is the speed of the particle increasing at time  $t = 3$ ? Give a reason for your answer.
  - (c) Find all values of  $t$  at which the particle changes direction. Justify your answer.
  - (d) Find the total distance traveled by the particle over the time interval  $0 \leq t \leq 3$ .