

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

CALCULUS AB  
SECTION II, Part A

Time—30 minutes

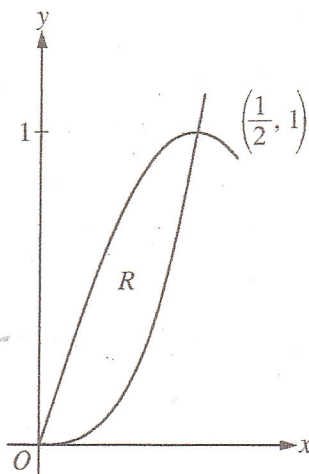
Number of problems—2

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  $x(0) = 2$ .
- Is the speed of the particle increasing or decreasing at time  $t = 5.5$ ? Give a reason for your answer.
  - Find the average velocity of the particle for the time period  $0 \leq t \leq 6$ .
  - Find the total distance traveled by the particle from time  $t = 0$  to  $t = 6$ .
  - For  $0 \leq t \leq 6$ , the particle changes direction exactly once. Find the position of the particle at that time.

WRITE ALL WORK IN THE EXAM BOOKLET.

No calculator is allowed for these problems.



3. Let  $R$  be the region in the first quadrant enclosed by the graphs of  $f(x) = 8x^3$  and  $g(x) = \sin(\pi x)$ , as shown in the figure above.
- Write an equation for the line tangent to the graph of  $f$  at  $x = \frac{1}{2}$ .
  - Find the area of  $R$ .
  - Write, but do not evaluate, an integral expression for the volume of the solid generated when  $R$  is rotated about the horizontal line  $y = 1$ .

WRITE ALL WORK IN THE EXAM BOOKLET.