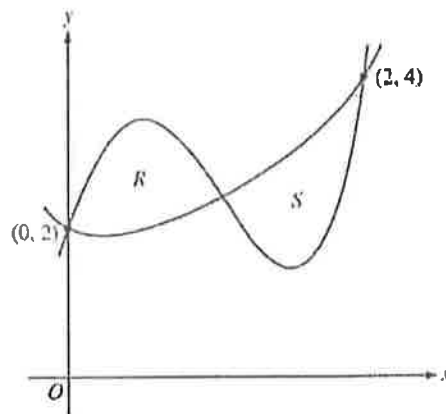


**AP<sup>®</sup> CALCULUS AB**  
**2015 SCORING GUIDELINES**

**Question 2**

Let  $f$  and  $g$  be the functions defined by  $f(x) = 1 + x + e^{x^2 - 2x}$  and  $g(x) = x^4 - 6.5x^2 + 6x + 2$ . Let  $R$  and  $S$  be the two regions enclosed by the graphs of  $f$  and  $g$  shown in the figure above.

- (a) Find the sum of the areas of regions  $R$  and  $S$ .
- (b) Region  $S$  is the base of a solid whose cross sections perpendicular to the  $x$ -axis are squares. Find the volume of the solid.
- (c) Let  $h$  be the vertical distance between the graphs of  $f$  and  $g$  in region  $S$ . Find the rate at which  $h$  changes with respect to  $x$  when  $x = 1.8$ .



- (a) The graphs of  $y = f(x)$  and  $y = g(x)$  intersect in the first quadrant at the points  $(0, 2)$ ,  $(2, 4)$ , and  $(A, B) = (1.032832, 2.401108)$ .

$$\begin{aligned} \text{Area} &= \int_0^A [g(x) - f(x)] dx + \int_A^2 [f(x) - g(x)] dx \\ &= 0.997427 + 1.006919 = 2.004 \end{aligned}$$

- (b) Volume =  $\int_A^2 [f(x) - g(x)]^2 dx = 1.283$

- (c)  $h(x) = f(x) - g(x)$   
 $h'(x) = f'(x) - g'(x)$   
 $h'(1.8) = f'(1.8) - g'(1.8) = -3.812$  (or  $-3.811$ )

4 :  $\begin{cases} 1 : \text{limits} \\ 2 : \text{integrand} \\ 1 : \text{answer} \end{cases}$

3 :  $\begin{cases} 2 : \text{integrand} \\ 1 : \text{answer} \end{cases}$

2 :  $\begin{cases} 1 : \text{considers } h' \\ 1 : \text{answer} \end{cases}$