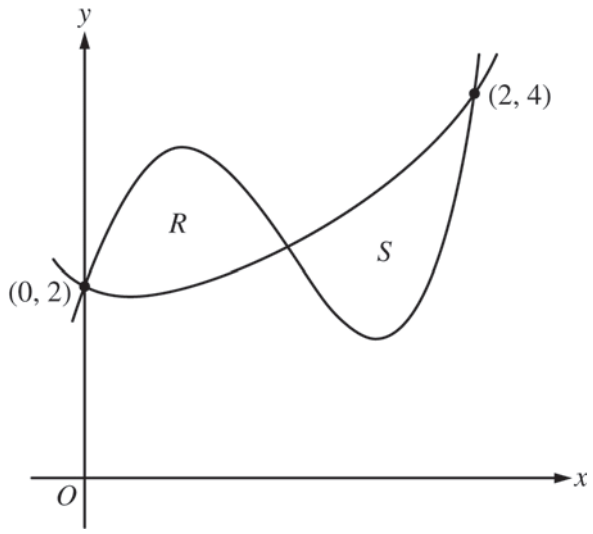



2. Let $f$ and $g$ be the functions defined by $f(x) = 1 + x + e^{x^2-2x}$ and $g(x) = x^4 - 6.5x^2 + 6x + 2$. Let $R$ and $S$ be the two regions enclosed by the graphs of $f$ and $g$ shown in the figure above.

   (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 $x = 1.8$.

   **(d) Find the volume when region S is revolved about the line y = 5**

# AP® CALCULUS AB
# 2015 SCORING GUIDELINES

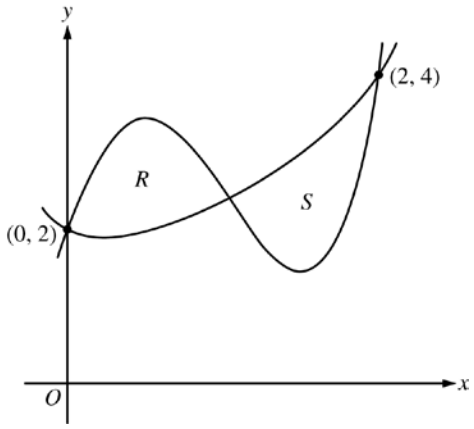
## Question 2

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 $x = 1.8$.

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

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

4 : { 1 : limits; 2 : integrands; 1 : answer }

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

3 : { 2 : integrand; 1 : answer }

(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 $-3.811$)

2 : { 1 : considers $h'$; 1 : answer }