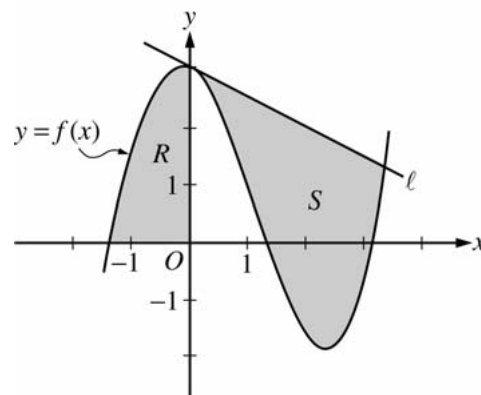


AP[®] CALCULUS AB
2006 SCORING GUIDELINES (Form B)

Question 1

Let f be the function given by $f(x) = \frac{x^3}{4} - \frac{x^2}{3} - \frac{x}{2} + 3\cos x$. Let R be the shaded region in the second quadrant bounded by the graph of f , and let S be the shaded region bounded by the graph of f and line ℓ , the line tangent to the graph of f at $x = 0$, as shown above.



- Find the area of R .
- Find the volume of the solid generated when R is rotated about the horizontal line $y = -2$.
- Write, but do not evaluate, an integral expression that can be used to find the area of S .

For $x < 0$, $f(x) = 0$ when $x = -1.37312$.
 Let $P = -1.37312$.

(a) Area of $R = \int_P^0 f(x) dx = 2.903$

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

(b) Volume = $\pi \int_P^0 ((f(x) + 2)^2 - 4) dx = 59.361$

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

(c) The equation of the tangent line ℓ is $y = 3 - \frac{1}{2}x$.

The graph of f and line ℓ intersect at $A = 3.38987$.

Area of $S = \int_0^A \left(\left(3 - \frac{1}{2}x \right) - f(x) \right) dx$

3 : $\begin{cases} 1 : \text{tangent line} \\ 1 : \text{integrand} \\ 1 : \text{limits} \end{cases}$