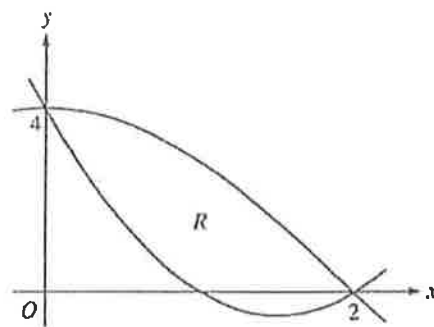


AP[®] CALCULUS AB
2013 SCORING GUIDELINES

Question 5

Let $f(x) = 2x^2 - 6x + 4$ and $g(x) = 4\cos\left(\frac{1}{4}\pi x\right)$. Let R be the region bounded by the graphs of f and g , as shown in the figure above.



- (a) Find the area of R .
- (b) Write, but do not evaluate, an integral expression that gives the volume of the solid generated when R is rotated about the horizontal line $y = 4$.
- (c) The region R is the base of a solid. For this solid, each cross section perpendicular to the x -axis is a square. Write, but do not evaluate, an integral expression that gives the volume of the solid.

$$\begin{aligned} \text{(a) Area} &= \int_0^2 [g(x) - f(x)] dx \\ &= \int_0^2 \left[4\cos\left(\frac{\pi}{4}x\right) - (2x^2 - 6x + 4) \right] dx \\ &= \left[4 \cdot \frac{4}{\pi} \sin\left(\frac{\pi}{4}x\right) - \left(\frac{2x^3}{3} - 3x^2 + 4x\right) \right]_0^2 \\ &= \frac{16}{\pi} - \left(\frac{16}{3} - 12 + 8\right) = \frac{16}{\pi} - \frac{4}{3} \end{aligned}$$

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

$$\begin{aligned} \text{(b) Volume} &= \pi \int_0^2 \left[(4 - f(x))^2 - (4 - g(x))^2 \right] dx \\ &= \pi \int_0^2 \left[(4 - (2x^2 - 6x + 4))^2 - (4 - 4\cos\left(\frac{\pi}{4}x\right))^2 \right] dx \end{aligned}$$

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

$$\begin{aligned} \text{(c) Volume} &= \int_0^2 [g(x) - f(x)]^2 dx \\ &= \int_0^2 \left[4\cos\left(\frac{\pi}{4}x\right) - (2x^2 - 6x + 4) \right]^2 dx \end{aligned}$$

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