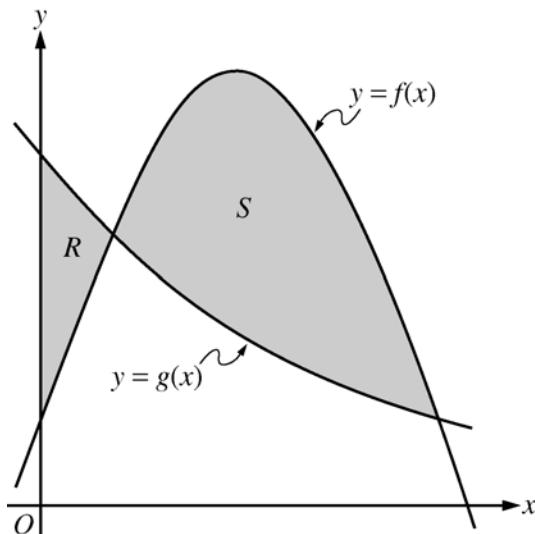


2005 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS

**CALCULUS BC
SECTION II, Part A
Time—45 minutes
Number of problems—3**

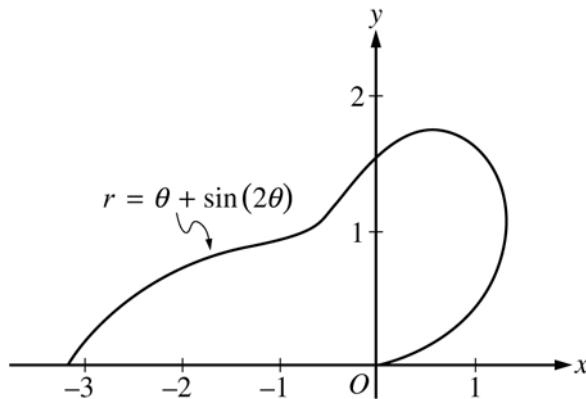
A graphing calculator is required for some problems or parts of problems.



1. Let f and g be the functions given by $f(x) = \frac{1}{4} + \sin(\pi x)$ and $g(x) = 4^{-x}$. Let R be the shaded region in the first quadrant enclosed by the y -axis and the graphs of f and g , and let S be the shaded region in the first quadrant enclosed by the graphs of f and g , as shown in the figure above.
 - (a) Find the area of R .
 - (b) Find the area of S .
 - (c) Find the volume of the solid generated when S is revolved about the horizontal line $y = -1$.
-

WRITE ALL WORK IN THE TEST BOOKLET.

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2. The curve above is drawn in the xy -plane and is described by the equation in polar coordinates $r = \theta + \sin(2\theta)$ for $0 \leq \theta \leq \pi$, where r is measured in meters and θ is measured in radians. The derivative of r with respect to θ is given by $\frac{dr}{d\theta} = 1 + 2\cos(2\theta)$.
- (a) Find the area bounded by the curve and the x -axis.
 - (b) Find the angle θ that corresponds to the point on the curve with x -coordinate -2 .
 - (c) For $\frac{\pi}{3} < \theta < \frac{2\pi}{3}$, $\frac{dr}{d\theta}$ is negative. What does this fact say about r ? What does this fact say about the curve?
 - (d) Find the value of θ in the interval $0 \leq \theta \leq \frac{\pi}{2}$ that corresponds to the point on the curve in the first quadrant with greatest distance from the origin. Justify your answer.
-

WRITE ALL WORK IN THE TEST BOOKLET.

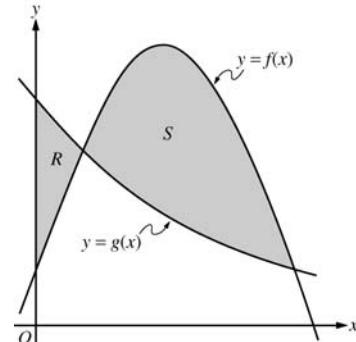
**AP[®] CALCULUS BC
2005 SCORING GUIDELINES**

Question 1

Let f and g be the functions given by $f(x) = \frac{1}{4} + \sin(\pi x)$ and $g(x) = 4^{-x}$. Let

R be the shaded region in the first quadrant enclosed by the y -axis and the graphs of f and g , and let S be the shaded region in the first quadrant enclosed by the graphs of f and g , as shown in the figure above.

- (a) Find the area of R .
- (b) Find the area of S .
- (c) Find the volume of the solid generated when S is revolved about the horizontal line $y = -1$.



$f(x) = g(x)$ when $\frac{1}{4} + \sin(\pi x) = 4^{-x}$.

f and g intersect when $x = 0.178218$ and when $x = 1$.

Let $a = 0.178218$.

(a) $\int_0^a (g(x) - f(x)) dx = 0.064$ or 0.065

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

(b) $\int_a^1 (f(x) - g(x)) dx = 0.410$

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

(c) $\pi \int_a^1 ((f(x) + 1)^2 - (g(x) + 1)^2) dx = 4.558$ or 4.559

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