



AP[®] Calculus AB 2003 Sample Student Responses Form B

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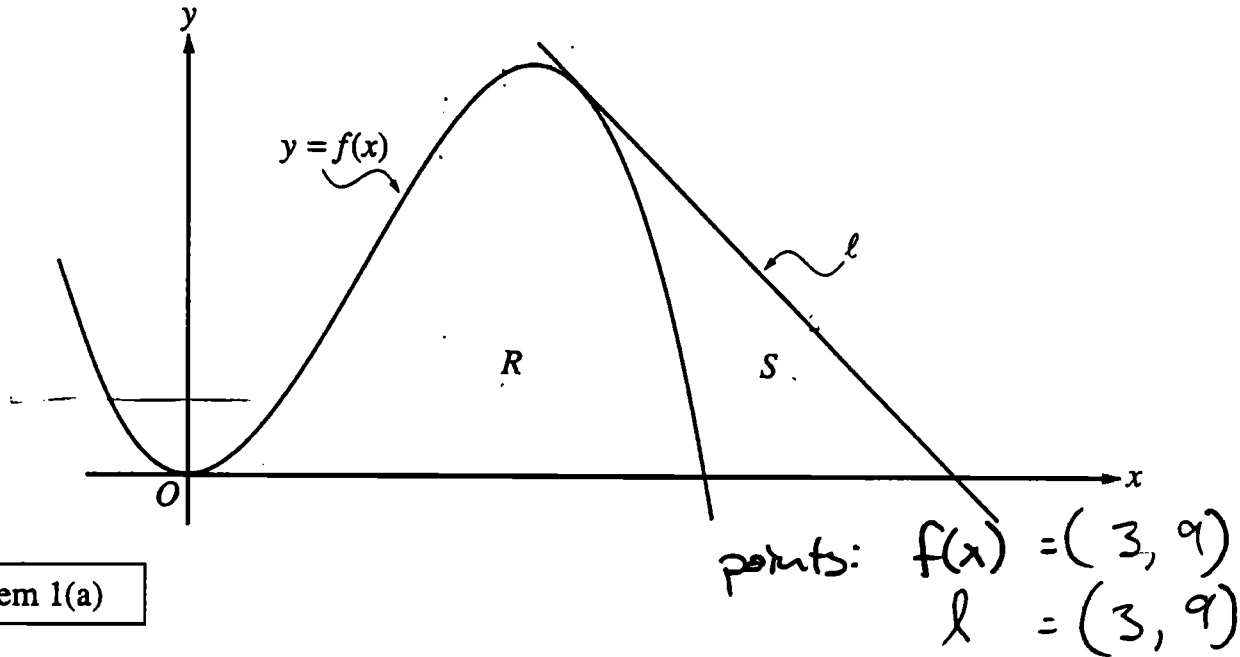
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CALCULUS AB
SECTION II, Part A

Time—45 minutes

Number of problems—3

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



Work for problem 1(a)

value for $f(x)$ at $x = 3$

$$4x^2 - x^3$$

$$4(9) - 27$$

$$36 - 27$$

$$= 9$$

value for l at $x = 3$

$$18 - 3x$$

$$18 - 9$$

$$= 9$$

the points have the same slope and the same point, so they are tangent

slope of $f'(3)$

$$f'(x) = 8x - 3x^2$$

$$24 - 27$$

$$= -3$$

slope of $l = -3$

Continue problem 1 on page 5.

Work for problem 1(b)

$$f(x) = 0 = 4x^2 - x^3$$

$$4 - x = 0$$

$$x = 4$$

$$\left[\int_3^6 18 - 3x \right] - \left[\int_3^4 4x^2 - x^3 \right]$$

$$\left\{ 18x - \frac{3}{2}x^2 \right\}_3^6 - \left\{ \frac{4}{3}x^3 - \frac{1}{4}x^4 \right\}_3^4$$

$$\begin{aligned} (54 - 40.5) \\ (13.5) \end{aligned}$$

$$\begin{aligned} (21\frac{1}{3} - 15.75) \\ (5.583) \end{aligned}$$

$$= 7.917 \text{ units}^2$$

Work for problem 1(c)

$$(4x^2 - x^3)(4x^2 - x^3)$$

$$16x^4 - 4x^5 - 4x^5 + x^6$$

$$\pi \int_0^4 (4x^2 - x^3)^2$$

$$= \pi \int_0^4 16x^4 - 8x^5 + x^6$$

$$= \pi \left(\frac{16}{5}x^5 - \frac{8}{6}x^6 + \frac{1}{7}x^7 \right)_0^4$$

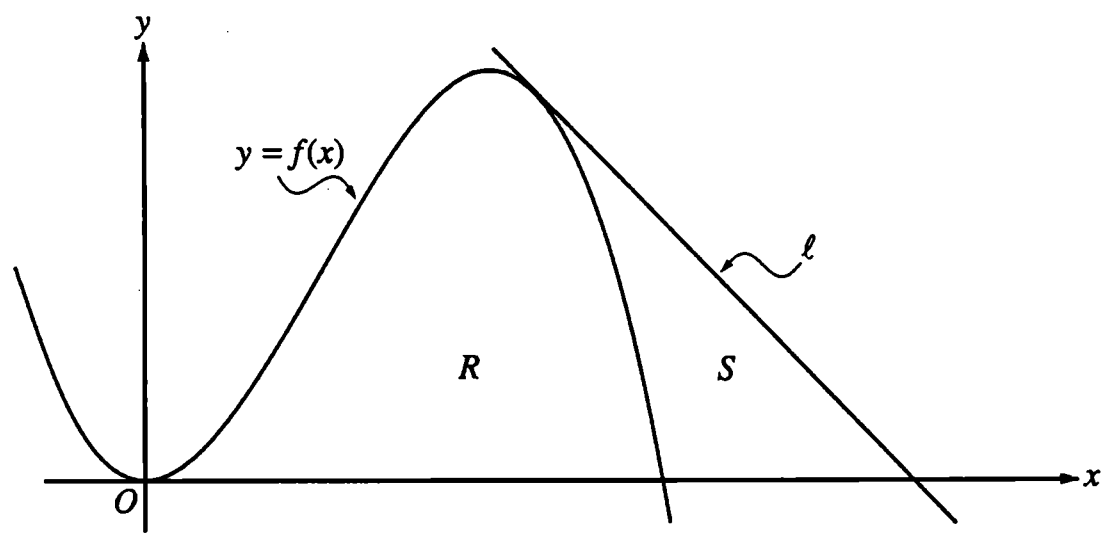
$$= \pi (156.038)$$

$$= 490.208 \text{ units}^3$$

GO ON TO THE NEXT PAGE.

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

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



Work for problem 1(a)

Both equations have to have same value at 3.

$$f(x) = 4x^2 - x^3 \quad x=3$$

$$f(3) = 4(3)^2 - 3^3$$

$$= 36 - 27$$

$$= 9$$

When $x=3$, $y=9$

$$y = 18 - 3x \quad x=3$$

$$y = 18 - 3(3)$$

$$y = 18 - 9$$

$$= 9$$

When $x=3$, $y=9$

So l is tangent to the graph of $y=f(x)$ at the point $x=3$.

Continue problem 1 on page 5.

Work for problem 1(b)

$$f(x) = 4x^2 - x^3$$

$$0 = 4x^2 - x^3$$

$$= x^2(4 - x)$$

$$x = 0, 4$$

$$y = 18 - 3x$$

$$0 = 18 - 3x$$

$$-18 = -3x$$

$$x = 6$$

$$S = \int_3^4 [(18 - 3x) - (4x^2 - x^3)] dx + \int_4^6 (18 - 3x) dx$$

$$= 1.917 + 6$$

$$= 7.917$$

Work for problem 1(c)

$$V = \pi \int_0^4 (4x^2 - x^3)^2 dx$$

$$= \pi \cdot 156.04$$

$$= 490.21$$

GO ON TO THE NEXT PAGE.