



## **AP<sup>®</sup> Calculus BC (Operational) 2004 Sample Student Responses**

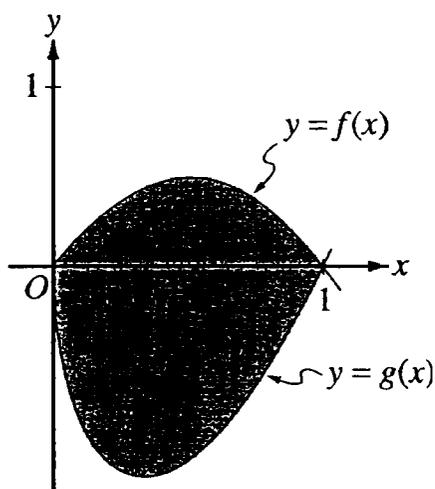
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Work for problem 2(a)

$$\int_0^1 (2x(1-x)) - (3(x-1)\sqrt{x}) dx = 1.133$$

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Continue problem 2 on page 7.

Work for problem 2(b)

$$\pi \int_0^1 (2 - 3(x-1)\sqrt{x})^2 - (2 - 2x(1-x))^2 dx =$$

16.179

Work for problem 2(c)

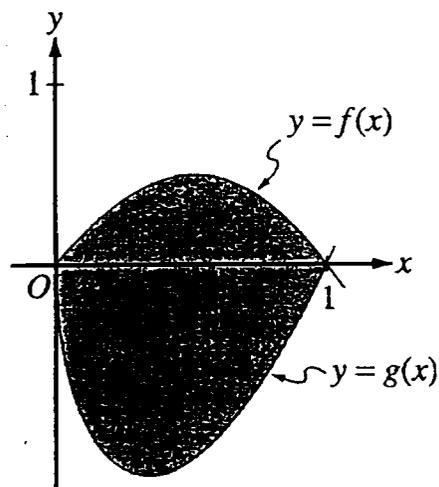
$$h(x) = kx(1-x) \quad 0 \leq x \leq 1$$

$$\int_0^1 \left[ \sqrt{kx(1-x)} - (3(x-1)\sqrt{x}) \right]^2 dx = 15$$

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$$0 \leq x \leq 1$$

$$f(x) = 2x(1-x)$$

$$g(x) = 3(x-1)\sqrt{x}$$

Work for problem 2(a)

$$\text{Area under } f(x) = \int_0^1 2x(1-x) dx \approx .333 = \frac{1}{3}$$

$$\text{Area under } g(x) = \int_0^1 3(x-1)\sqrt{x} dx \approx -.8$$

make Area under  $g(x)$  positive for total area

$$|-.8| = .8$$

$$\text{Area enclosed by } f(x) \text{ \& } g(x) = \frac{1}{3} + .8$$

$$\text{Area " " } = \frac{17}{15} \approx 1.1333 \checkmark$$

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Continue problem 2 on page 7.

Work for problem 2(b)

Volume of solid

$$\pi \int_0^1 R^2(x) - r^2(x) dx$$

(outside function)  
R(x)

$$2 - g(x)$$

$$R(x) = 2 - 3(x-1)\sqrt{x}$$

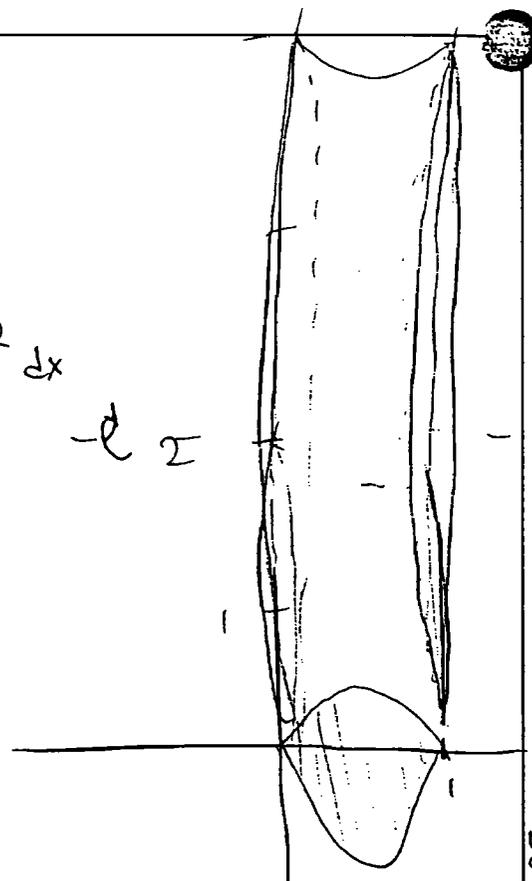
$$\pi \int_0^1 (2 - 3(x-1)\sqrt{x})^2 - (2 - 2x(1-x))^2 dx$$

$$= \frac{103\pi}{20} \approx 16.179$$

(inside function)  
r(x)

$$2 - f(x)$$

$$r(x) = 2 - 2x(1-x)$$



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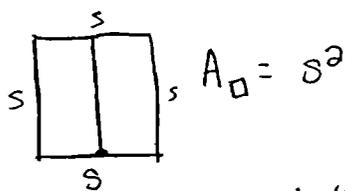
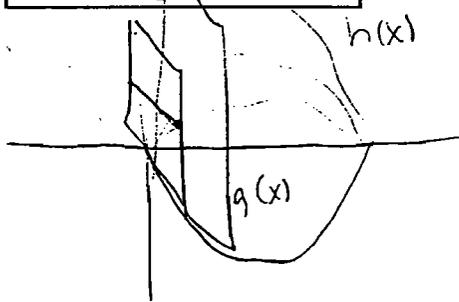
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Work for problem 2(c)

$$0 \leq x \leq 1$$

$$h(x) = kx(1-x)$$

k > 0



$$s = h(x) - g(x)$$

$$A_{\text{me } \square} = \pi \int_0^1 kx(1-x) - 3(x-1)\sqrt{x} dx$$

$$16 = \pi \int_0^1 kx(1-x) - 3(x-1)\sqrt{x} dx$$

↑ use to find a 'k' value.

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