



AP[®] Calculus BC 2002 Sample Student Responses Form B

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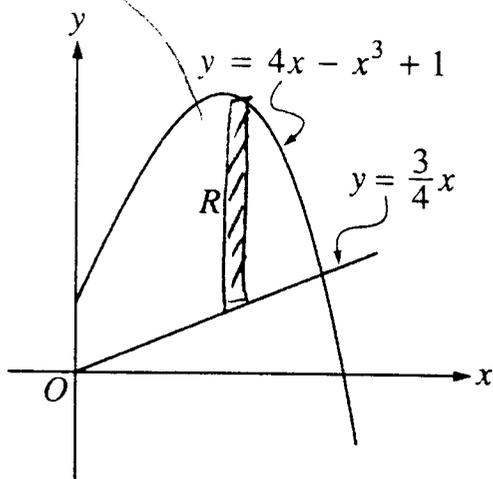
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B₁

$$\left. \begin{array}{l} \text{elemental strip} \\ (4x - x^3 + 1) - \left(\frac{3}{4}x\right) \\ dx \end{array} \right\}$$

$$dV = (4x - x^3 + 1) - \left(\frac{3}{4}x\right) dx$$



Work for problem 3(a)

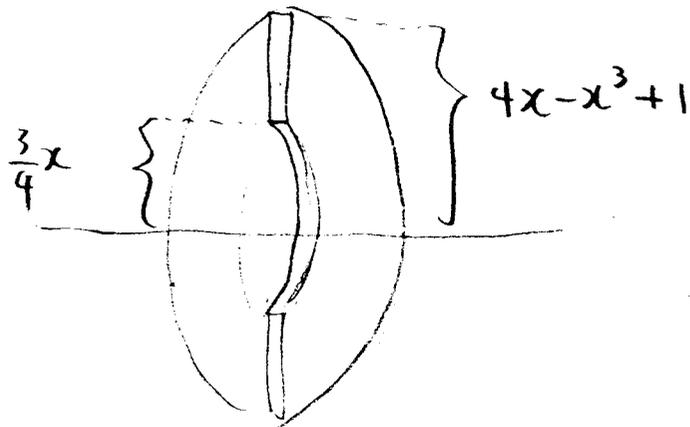
intersection: (1.9404, 1.4553)

$$A_R = \int_0^{1.9404} (4x - x^3 + 1) - \left(\frac{3}{4}x\right) dx$$

$$= \boxed{4.515 \text{ units}^2} \text{ (calculator)}$$

Work for problem 3(b)

elemental washer

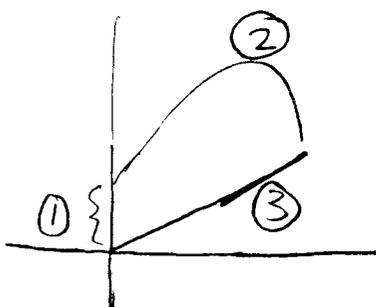


$$V_R = \pi \int_0^{1.9404} (4x - x^3 + 1)^2 - \left(\frac{3}{4}x\right)^2 dx$$

$$= \boxed{57.463 \text{ units}^3}$$

$$dv = \pi \left((4x - x^3 + 1)^2 - \left(\frac{3}{4}x\right)^2 \right) dx$$

Work for problem 3(c)



$$\textcircled{1} = 1$$

$$\textcircled{2} = \int_0^{1.9404} \sqrt{1 + [f'(x)]^2} dx$$

$$= \int_0^{1.9404} \sqrt{1 + [4 - 3x^2]^2} dx$$

$$\textcircled{3} = \sqrt{(1.4553 - 0)^2 + (1.9404 - 0)^2}$$

$$= 2.4255$$

$$\text{Perimeter} = \int_0^{1.9404} \sqrt{1 + [4 - 3x^2]^2} dx + 3.426$$

3

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3

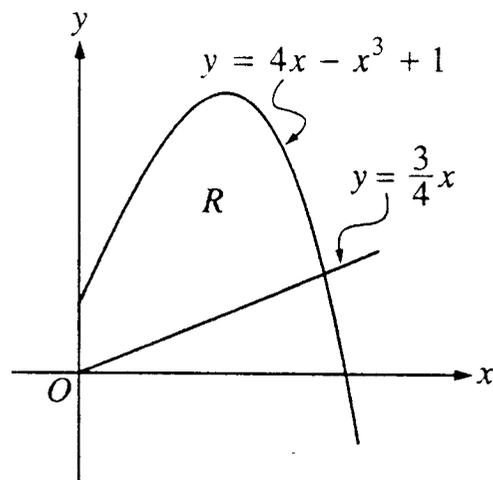
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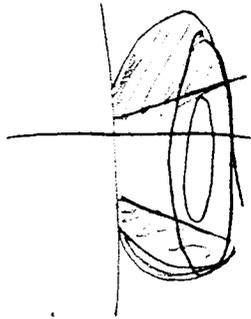
3



Work for problem 3(a)

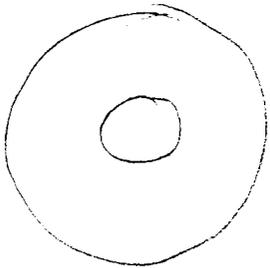
$$\begin{aligned}
 &= \int_0^{1.9404496} \left[(4x - x^3 + 1) - \left(\frac{3}{4}x \right) \right] dx \\
 &= \int_0^{1.9404496} 4x - x^3 + 1 \, dx - \int_0^{1.9404496} \frac{3}{4}x \, dx \\
 &= \left. 2x^2 - \frac{1}{4}x^4 + x \right|_0^{1.9404496} - \left. \frac{3}{8}x^2 \right|_0^{1.9404496} \\
 &= 5.9266838 - 1.4120042 \\
 &= 4.515 \text{ units}^2
 \end{aligned}$$

Work for problem 3(b)



$$\begin{aligned}
 V &= \pi r^2 \\
 V &= \pi \int_0^{1.9404496} \left(4x - x^3 + 1\right)^2 - \left(\frac{3}{4}x\right)^2 dx \\
 &= 19.661088\pi - 1.3699615\pi \\
 &= 18.291\pi \text{ units}^3.
 \end{aligned}$$

Work for problem 3(c)



like a bowl.

$$= 2\pi \int_0^{1.9404496} \sqrt{1 + (4 - 3x^2)^2} dx + 2\pi \int_0^{1.9404496} \sqrt{1 + \left(\frac{3}{4}x\right)^2} dx$$