Math 243

Q5 $\int_0^1 7e^{x^2}\,dx$ error < 0.0001

Simpsons $|E_s| \le \frac{K_4(b-a)^5}{180n^4}$ $a=0$ $b=1$

K_4? ← largest 4^{th} deriv. of $7e^{x^2}$ on $[0,1]$

$f = 7e^{x^2}$

$f' = 14xe^{x^2}$

$f^{(2)} = 14e^{x^2} + 28x^2e^{x^2} = (14+28x^2)e^{x^2}$

$f^{(3)} = 56xe^{x^2} + 2(14+28x^2)xe^{x^2}$

$f^{(3)} = (84x + 56x^3)e^{x^2}$

$f^{(4)} = (84 + 168x^2)e^{x^2} + 2(84x+56x^3)xe^{x^2}$

$f^{(4)} = \left[(84+168x^2) + (168x^2 + 112x^4)\right]e^{x^2}$

K_4? $f^{(4)} = \left[84 + 336x^2 + 112x^4\right]e^{x^2}$ over $[0,1]$

K_4 let $x=1$ ("Biggest")

bigger is OK

let $K_4 = [84 + 336 + 112](3) = \cancel{1596}$

$\cancel{1600}$

1800

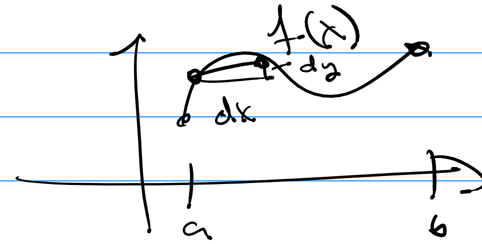
$|E_s| \le \frac{K_4(b-a)^5}{180n^4} = \frac{1800}{180n^4} = \frac{10}{n^4} \sim 0.0001$

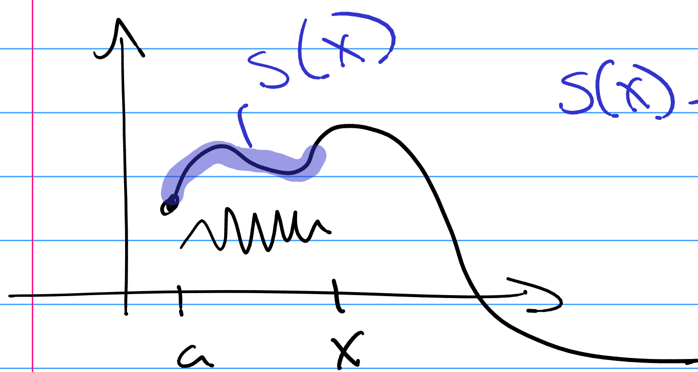
Apps

$\int f(x)\,dx$, $\int_a^b f(x)\,dx$

8.1

$L = \int_a^b \boxed{\sqrt{1+(f'(x))^2}\,dx}$

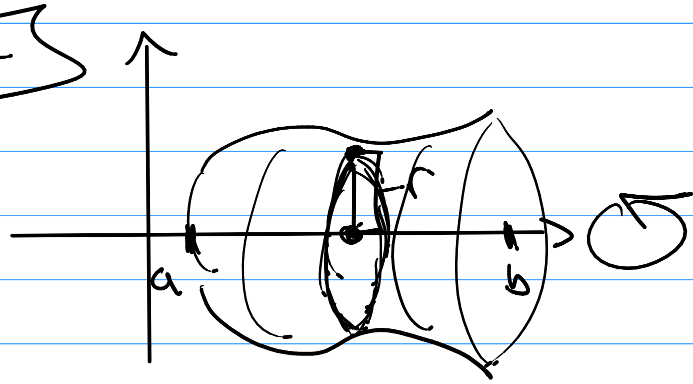




$s(x) = \int_a^x \sqrt{1+(f'(t))^2}\,dt$

8.2

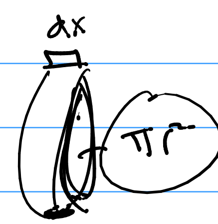
(review chapter 5)



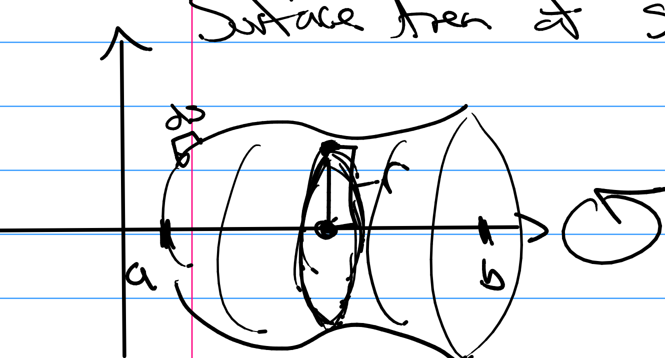
Volume by disks/washers/ or shells

(by slicing)

$V = \int_a^b 2\pi r^2\,dx$



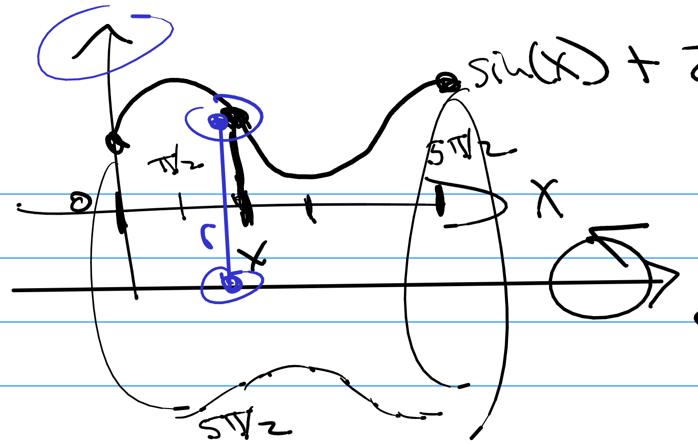
Surface Area of surface of revolution



$\int_a^b 2\pi r\,ds$ with respect to arc length

$= \boxed{\int_a^b 2\pi r \sqrt{1+(f')^2}\,dx}$

ex



$\sin(x) + 2 = f \qquad f' = \cos x$

$$SA = \int_0^{5\pi/2} 2\pi\left((\sin(x)+2) - (-2)\right)\sqrt{1+\cos^2 x}\, dx$$

8.2 $\quad SA = 2\pi \int_0^{5\pi/2} (\sin x + 4)\sqrt{1+\cos^2 x}\, dx$

calc I ch. 5 $\quad V = \int_0^{5\pi/2} \pi r^2\, dx = \pi \int_0^{5\pi/2} (\sin x + 4)^2\, dx$

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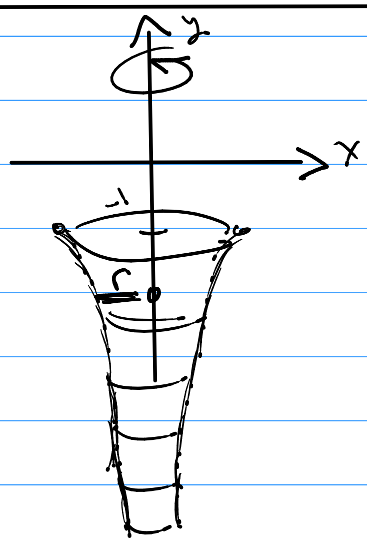
ex

$y = 1/x$



$$V = \int_{-\infty}^{-1} \pi r^2\, dy$$

$$SA = \int_{-\infty}^{-1} 2\pi r \sqrt{1 + (f'(y))^2}\, dy$$