MA 121-002

Tuesday, april 9

this week:

5.6: VOLUMES

5.7: SEPARABLE DIFFERENTIAL EQUATIONS

TEST #4: Thursday, april 18th

FINAL EXAM: Tuesday, april 30th, 1:00 - 4:00pm

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rate of decay: .003%

$(K = -.00003)$

$$\int_0^{\infty} 1 \cdot e^{-.00003t}\, dt$$

convergent integral

find the limiting value of the radioactive build up.

$$\left[\int e^{at}\,dt = \frac{1}{a} \cdot e^{at}\right]$$

1. accum. prob.
2. improper integr.

$$\lim_{A\to\infty} \int_0^{A} e^{-.00003t}\, dt = \lim_{A\to\infty} \left[\frac{1}{-.00003} e^{-.00003t}\right]_0^A$$

$$= \lim_{A\to\infty} \frac{1}{-.00003}\left[e^{-.00003(A)} - e^{-.00003(0)}\right]$$

$$= \lim_{A\to\infty} \frac{1}{-.00003}\left[e^{-.00003A} \to 0 \;-\; 1\right]$$

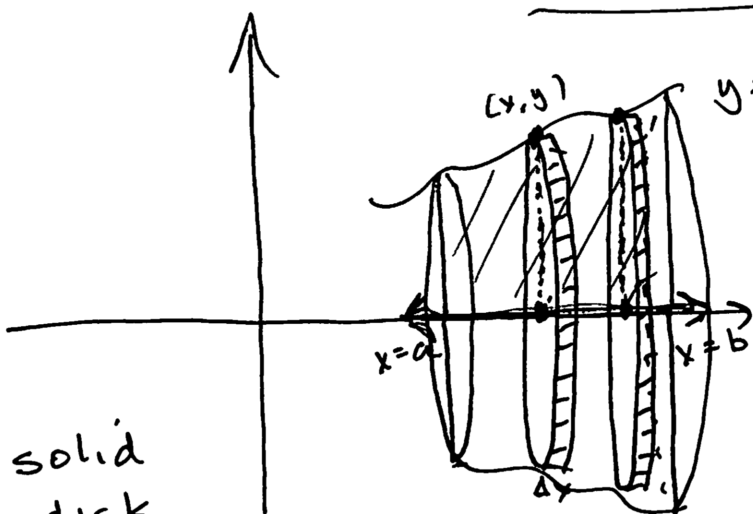
$$\boxed{\frac{1}{e^{.00003A}}}$$

$=$

$$\frac{1}{-.00003}\left[-1\right] = \frac{1}{.00003} =$$

$33{,}333\frac{1}{3}$ lbs

5.6: VOLUMES OF SOLIDS OF REVOLUTION

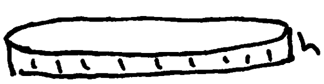


bounded region

REVOLVE ABOUT the x-axis

("slice up" $\perp$ to the axis of rev.)

solid disk



CYLINDER

$V = \pi r^2 \cdot h$

$\int_a^b$ $\pi \cdot r^2 \cdot h$

VOL OF A REPRESENTATIVE DISK

$r = ? = y = f(x)$

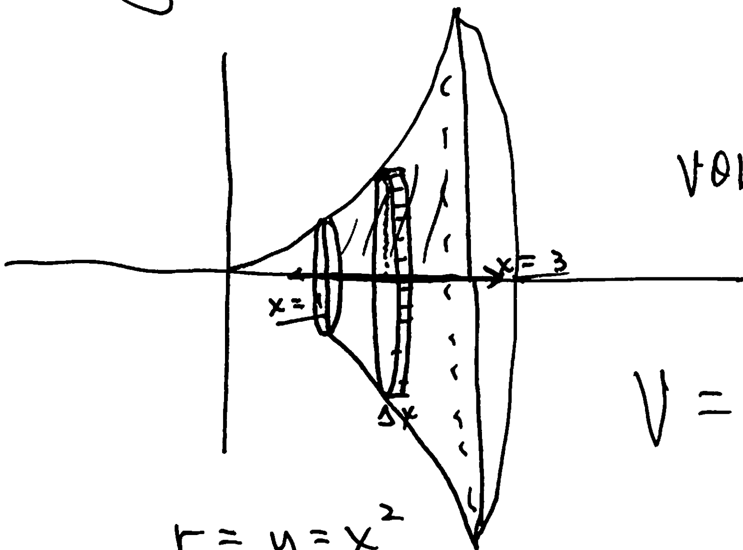
$h = ?$

$r = f(x)$

$h = \Delta x \to dx$

$$\boxed{\text{VOL} = \int_a^b \pi \cdot (f(x))^2 \cdot dx}$$

ex: $y = x^2$ $\quad x = 1 \quad x = 3$



$$\text{VOL} = \int_1^3 \pi \cdot r^2 \cdot h$$

$r = y = x^2$

$h = \Delta x \to dx$

$$V = \int_1^3 \pi (x^2)^2 \cdot dx$$

$$V = \pi \int_1^3 x^4 \, dx$$

$$V = \pi \left[\frac{x^5}{5} \right]_1^3$$

$$V = \pi \left[\frac{3^5}{5} - \frac{1^5}{5} \right]$$

$$V = \pi \left[\frac{243}{5} - \frac{1}{5} \right] = \frac{242\pi}{5} \approx \underline{\qquad\qquad}$$

ex: $f(x)=\sqrt{4-x^2}$ from $x=-2$ to $x=2$

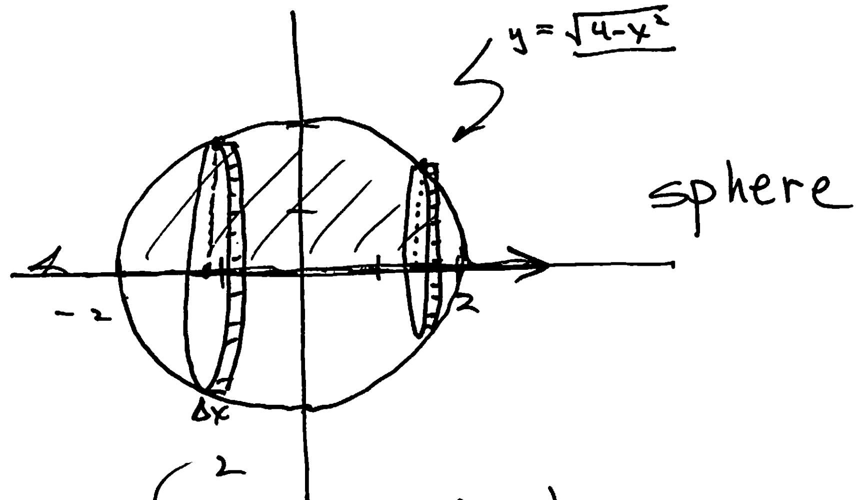
revolve this bounded region about the x-axis

$$\boxed{y=\sqrt{4-x^2}}$$

$y^2=4-x^2$

$x^2+y^2=4$

circle;
center $(0,0)$
$r=2$



$$V=\int_{-2}^{2}\pi\cdot\underbrace{r^2\cdot h}$$

$$V=\pi\int_{-2}^{2}\left(\sqrt{4-x^2}\right)^2\cdot dx$$

$$V=\pi\int_{-2}^{2}(4-x^2)\cdot dx$$

$$V=\pi\left[4x-\frac{x^3}{3}\right]_{-2}^{2}$$

$$V=\pi\left[\left(4(2)-\frac{2^3}{3}\right)-\left(4(-2)-\frac{(-2)^3}{3}\right)\right]$$

$$V=\pi\left[8-\frac{8}{3}+8-\frac{8}{3}\right]=\pi\left[16-\frac{+16}{3}\right]$$

$$V = \pi\left[\frac{48}{3} - \frac{16}{3}\right] = \pi\left[\frac{32}{3}\right] = \frac{32\pi}{3}$$

check w/ GEOMETRY:

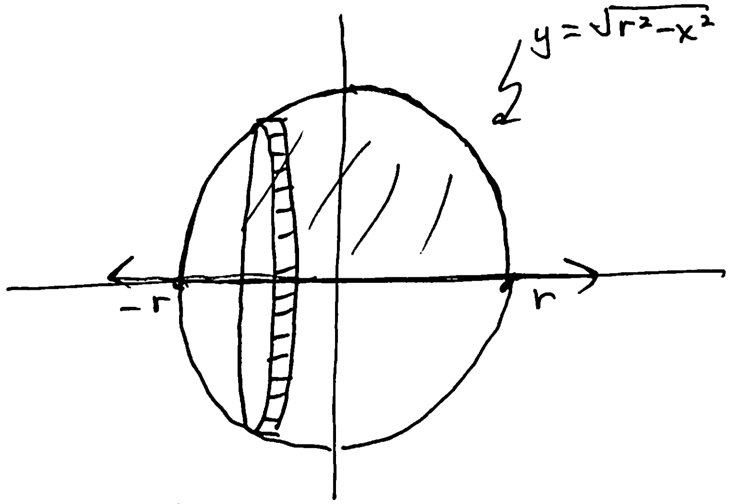
VOL OF A SPHERE:

$$\int_{-r}^{r} \pi\left(\sqrt{r^2 - x^2}\right)^2 dx \qquad V = \frac{4}{3}\pi r^3$$

$$V = \frac{4}{3}\pi(2)^3 = \frac{4 \cdot \pi \cdot 8}{3}$$

$$= \frac{32\pi}{3}$$

VOL OF A SPHERE:



$$V = \pi \int_{-r}^{r} \left(\sqrt{r^2-x^2}\right)^2 \cdot dx$$

$$V = \pi \int_{-r}^{r} (r^2-x^2)\, dx$$

$$V = \pi \left[r^2x - \frac{x^3}{3} \right]_{-r}^{r}$$

$$V = \pi \left[\left(r^2(r) - \frac{(r)^3}{3} \right) - \left(r^2(-r) - \frac{(-r)^3}{3} \right) \right]$$

$$V = \pi \left[\left(r^3 - \frac{r^3}{3} + r^3 - \frac{r^3}{3} \right) \right]$$

$$V = \pi \left[2r^3 - \frac{2r^3}{3} \right] = \pi \left[\frac{6r^3}{3} - \frac{2r^3}{3} \right]$$

$$V = \pi \frac{4r^3}{3} = \frac{4}{3}\pi r^3$$

Name____________________________ Row___Seat____

NORTH CAROLINA STATE UNIVERSITY Department of Mathematics

MA121-002 Quiz #3 Due Thursday, April 11 (at the beginning of class) J. Griggs

Three points per question (1 point for following directions); you are to work **individually** on this quiz; it is permissible to use your.book and/or notes from the class. Show **all** work and any graphs/diagrams on **<u>this</u>** sheet. (use the back, if necessary; *no additional pages*, please)

1.). At age 31, Kelli earns her MBA and accepts a position as the creative team leader at Netflix. Assume that she will retire at the age of 65, having received an annual salary of $200,000 per year, and that the interest rate is 2.9% compounded continuously. What is the accumulated future value of her earnings at her new job?

2.) D(x) is the price, in dollars per unit, that consumers will pay for x units of an item; S(x) is the price, in dollars per unit, that producers will accept for x units. Find the equilibrium point, the consumer surplus (labeled CS) and the producers surplus (labeled PS).

$D(x)=\frac{-5}{6}x+9 \qquad S(x)=\frac{1}{2}x+1$

3.) Integrate using substitution: $\int (2t^5-3)^2\, t^4\, dt$