

Team A

sec. 5.3-6.5

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Definite Integrals:

set limits of integration (i.e. \int_a^b)

Indefinite Integrals:

no set limits of integration (i.e. \int_a^b)

Fundamental Theorem of Calculus

$$\int_a^b f(x) dx = F(b) - F(a) = F(x) \Big|_a^b$$

Substitution Rule:

$$\int_a^b f(g(x))$$

① let $u = g(x)$

$$du = g'(x) dx$$

②

plug u & du into original integral

③

Solve integral

④

Resubstitute $g(x)$ for u

Power Rule:

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

Area Between Curves:

$f(x)$ → upper curve

$g(x)$ → lower curve

$$A = \int_a^b (f(x) - g(x)) dx$$

if the functions are rotated on x-axis

subtract left curve from right (i.e. right-left)

To find limits of integration:

Set two functions equal to each other & solve

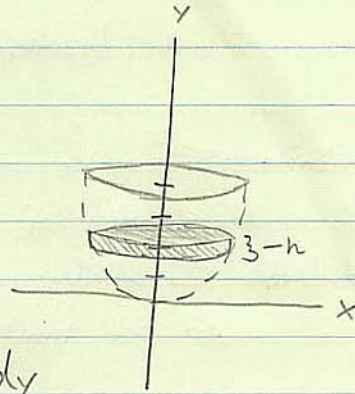
Volumes:

ex

Rotated about y-axis: $y = x^2$

$0 \leq x \leq 2$

$\Rightarrow x = \sqrt{y}$



$h = dy$
 $r = x$

$A_T = \sum_{i=1}^n \pi y_i dy$ | $A_{\text{washer}} = \pi r^2 h = \pi y dy$

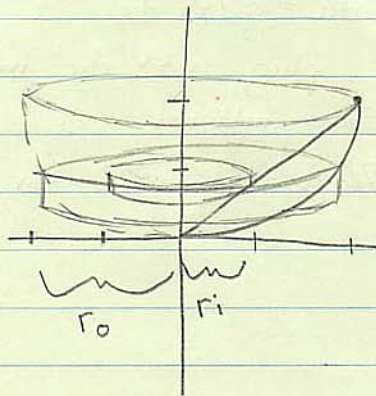
$A = \int_0^4 \pi y dy = \pi \frac{1}{2} y^2 \Big|_0^4 = \pi (\frac{1}{2} \cdot 16) - 0 = 8\pi$

ex 2

$y = x, y = x^2$, rotate enclosed curve about y-axis

$x = x^2$

$x(x-1) = 0$



$V_{\text{washer}} = \pi r_o^2 h - \pi r_i^2 h$

$V_w = (r_o^2 - r_i^2) \pi h$

$V_w = (x_o^2 - x_i^2) \pi \Delta y$

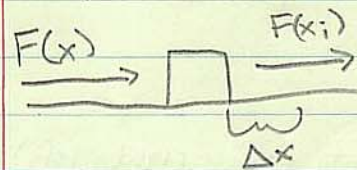
$x^2 = y$ | $x = y$
so $x^2 = y^2$

$V_w = (y - y^2) \pi \Delta y$

$V_T = \int_0^1 (y - y^2) \pi dy$

Work

$W = Fd$



$W_i = F(x_i) \Delta x$

$W_T = \sum_{i=1}^n W_i \Rightarrow \sum_{i=1}^n F(x_i) \Delta x$

if $n = \infty \Rightarrow \int_a^b F(x) dx = W$

constant:

$W = Fd$

variable:

$W = \int_a^b F(x) dx$