Non-AP Calculus Ch. 7.2b Volume: Washer Method **Notes and Classwork problems**

Reviewing Disc Method

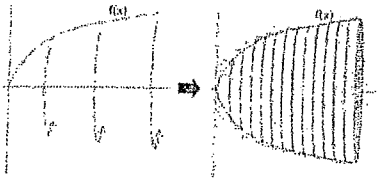
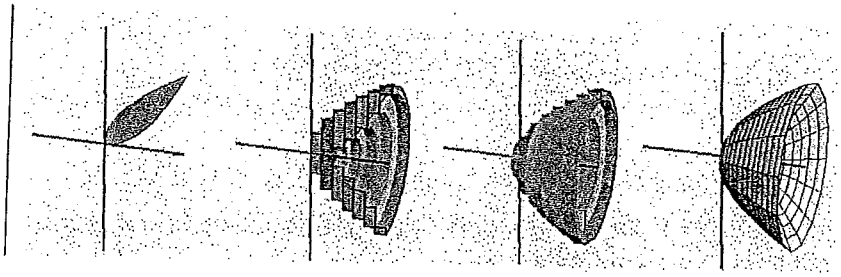


Illustration of Washer Method

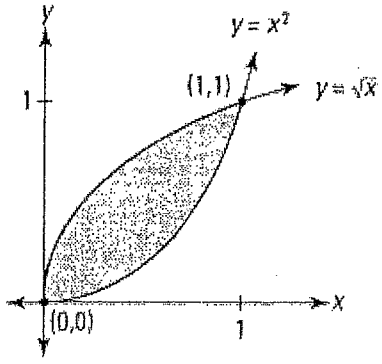


Radius $[R(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***further*** *graph curve*

radius $[r(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***closer*** *graph curve*

Washer Method: *Volume* $= \pi \int_{x_1}^{x_2} [R(x)]^2 - [r(x)]^2 dx$

Example 1: Find the volume of the solid created enclosed region of $y = x^2$ and $y = \sqrt{x}$ revolving about the x-axis



Example 2: Find the volume of the solid created by revolving the function $y = x^2 + 1$ bounded by the line $y = 2$ revolved about the x-axis.

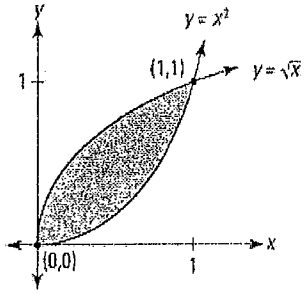
Radius $[R(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***further*** *graph curve*

radius $[r(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***closer*** *graph curve*

Washer Method: *Volume* $= \pi \int_{x_1}^{x_2} [R(x)]^2 - [r(x)]^2 dx$

Example 3: Find the volume of the solid created by revolving the function $y = x^2 + 1$ bounded by the line $y = 2$ and the y-axis about the line $y = 4$

Example 4: Find the volume of the solid created enclosed region of $y = x^2$ and $y = \sqrt{x}$ revolving about the line $y = 1$



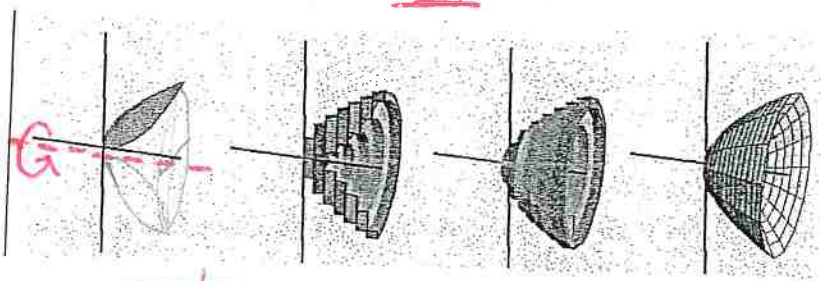
Non-AP Calculus Ch. 7.2b Volume: Washer Method — Notes and Classwork problems

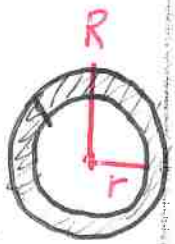
circular rings

Reviewing Disc Method

$V = \pi \int_{x_1}^{x_2} [R(x)]^2 dx$

Illustration of Washer Method





$\pi R^2 - \pi r^2$

$\pi(R^2 - r^2)$

center

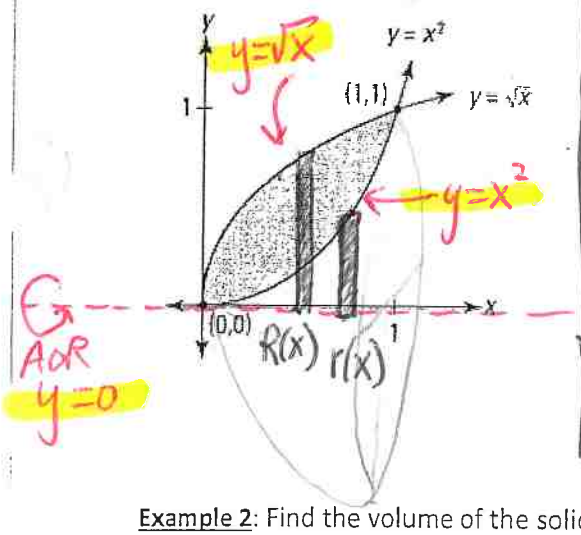
Radius $[R(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***further*** *graph curve*

radius $[r(x)]$ = *distance from the AOR (Axis of Revolution) to the* ***closer*** *graph curve*

Washer Method: $Volume = \pi \int_{x_1}^{x_2} [R(x)]^2 - [r(x)]^2 dx$ (Top − Bottom)

$V = \pi \int_{x_1}^{x_2} [R(x)]^2 - [r(x)]^2 dx$

Example 1: Find the volume of the solid created enclosed region of $y = x^2$ and $y = \sqrt{x}$ revolving about the x-axis (AOR $y = 0$)



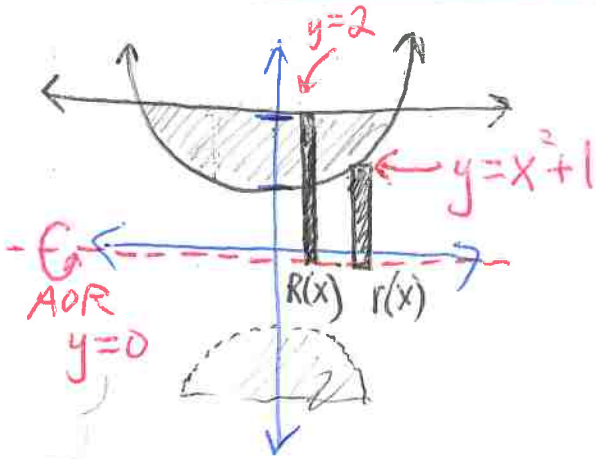
$R(x) = \sqrt{x} - (0) \rightarrow \sqrt{x}$

$r(x) = x^2 - (0) \rightarrow x^2$

$V = \pi \int_0^1 [\sqrt{x}]^2 - [x^2]^2 dx$

$V = 0.3\pi$ or $\frac{3}{10}\pi$ units^3

Example 2: Find the volume of the solid created by revolving the function $y = x^2 + 1$ bounded by the line $y = 2$ revolved about the x-axis. → AOR $y = 0$



$R(x) = 2 - (0) \rightarrow 2$

$r(x) = x^2 + 1 - (0) \rightarrow x^2 + 1$

* find intersection (bounds)

$x^2 + 1 = 2$

$\sqrt{x^2} = \pm\sqrt{1}$

$x = 1, x = -1$

$V = \pi \int_{-1}^{1} [2]^2 - [x^2+1]^2 dx$

$V = \frac{64}{15}\pi$ units^3

Radius $[R(x)]$ = *distance from the AOR (Axis of Revolution) to the* **further** *graph curve*

radius $[r(x)]$ = *distance from the AOR (Axis of Revolution) to the* **closer** *graph curve*

Washer Method: $Volume = \pi \int_{x_1}^{x_2} [R(x)]^2 - [r(x)]^2 dx$

Example 3: Find the volume of the solid created by revolving the function $y = x^2 + 1$ bounded by the line $y = 2$ and the y-axis about the line $y = 4$

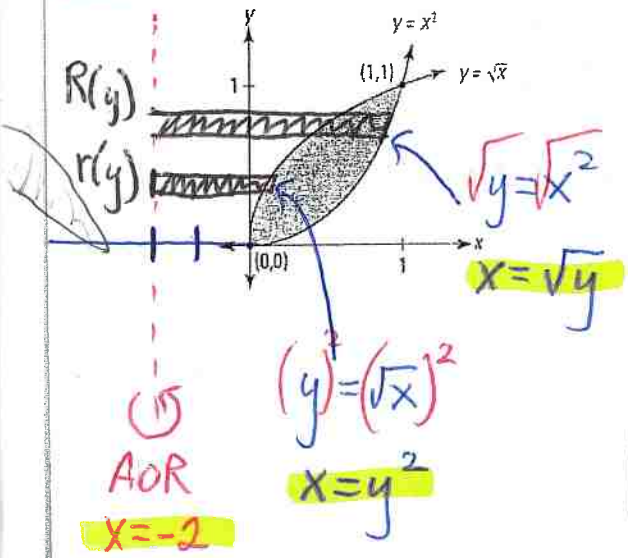
Washer Method (Right - Left)

$$V = \pi \int_{y_1}^{y_2} [R(y)]^2 - [r(y)]^2 dy$$

needs the form "$x =$ ___"

Change Problem

Example 4: Find the volume of the solid created enclosed region of $y = x^2$ and $y = \sqrt{x}$ revolving about the line ~~$y = 1$~~ Revolve about $x = -2$



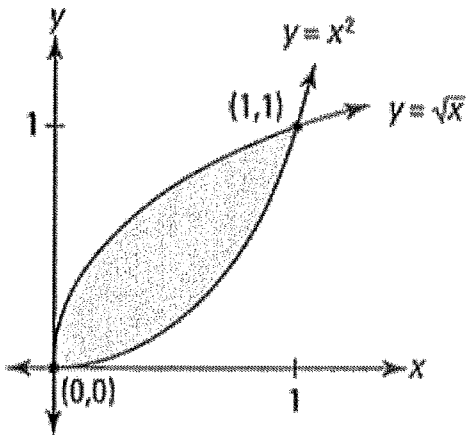
$R(y) = \sqrt{y} - (-2) \rightarrow \sqrt{y} + 2$

$r(y) = y^2 - (-2) \rightarrow y^2 + 2$

$$V = \pi \int_0^1 [\sqrt{y} + 2]^2 - [y^2 + 2]^2 dy$$

$$V = 1.633\pi \text{ units}^3$$

↘ or 5.131 units^3



now revolve this shaded area about the x-axis