Section 6.1

After viewing the lecture videos and reading the textbook, you should be able to answer the following questions:

1. Consider the region that is bounded by the graphs of $y = 1 + \sqrt{x}$, $x = 4$, and $y = 1$. If we revolve the region about the $x$-axis, it forms a solid of revolution whose cross sections are washers.

![Graph of the region](image.png)

a) What is the outer radius, $R(x)$, of a cross section of the solid at a point $x$ in $[0,4]$?
b) What is the inner radius, $r(x)$, of a cross section of the solid at a point $x$ in $[0,4]$?
c) What is area, $A(x)$, of a cross section of the solid at a point $x$ in $[0,4]$?
d) Write an integral for the volume of the solid.
2. The Disk/Washer Method about a horizontal line: 

\[ V = \int_{a}^{b} \pi \left( R(x)^2 - r(x)^2 \right) dx \]

Set up the integral to find the volume of the solid generated by rotating the region bounded by the curve \( y = f(x) \) and the \( x \)-axis over the interval \([a, b]\) about:

a) the \( x \)-axis.

b) the line \( y = L \).

c) the line \( y = K \).
3. The Disk/Washer Method about a vertical line: \[ V = \int_{c}^{d} \pi \left( (R(y))^2 - (r(y))^2 \right) dy \]

Find the volume of the solid generated by rotating the region bound by the curve \( x = u(y) \) and the \( y \)-axis over the interval \([c, d]\) about:

a) the \( y \)-axis.

b) the line \( x = M \).

c) the line \( x = N \).
4. The Washer Method about a horizontal line: 
\[ V = \int_{a}^{b} \pi \left( (R(x))^2 - (r(x))^2 \right) dx \]

Find the volume of the solid generated by rotating the region bound by the curves \( y = f(x) \) and \( y = g(x) \) over the interval \([a, b]\) about:

a) the \( x \)-axis.

b) the line \( y = L \).

c) the line \( y = K \).
5. The Washer Method about a vertical line: 

\[ V = \int_c^d \pi \left( (R(y))^2 - (r(y))^2 \right) dy \]

Find the volume of the solid generated by rotating the region bound by the curves \( x = u(y) \) and \( x = v(y) \) over the interval \([c, d]\) about:

a) the \( y \)-axis.

b) the line \( x = M \).

c) the line \( x = N \).

**NOTE:** For the disk/washer method, your “cuts” (the line drawn through the region at either a random value of \( x \) or at a random value of \( y \)) are **perpendicular** to the line about which you are rotating.

You integrate with respect to \( x \) if your cuts are perpendicular to the \( x \)-axis (that is, if your cuts are vertical).

You integrate with respect to \( y \) if your cuts are perpendicular to the \( y \)-axis (that is, if your cuts are horizontal).