

Learning outcomes

After completing this section, you will inshaAllah be able to

1. find **volumes** of solids of revolutions by using
 - a. **cylindrical shells** perpendicular to X-axis
 - b. **cylindrical shells** perpendicular to Y-axis

Another method to find volumes of solids of revolution

What is a cylindrical shell?

A solid between two concentric cylinders

Volume of a cylindrical shell

$$V = 2\pi r h \Delta r$$

- r : average radius
- h : height
- Δr : width

See figure and explanation given in class

**Volume (by cylindrical shells) of solid obtained by
revolving area under $y = f(x)$ about Y-axis**

See class
explanation

If $y = f(x)$ is revolved about Y-axis
from $x = a$ to $x = b$ then volume of
the solid is

$$V = \int_a^b 2\pi x f(x) dx$$

Here

- x corresponds to radius
- $f(x)$ corresponds to height
- dx corresponds to width
of shell at point x

See example 1 done in class

**Volume (by cylindrical shells) of solid obtained by
revolving area under $x = f(y)$ about X-axis**

See class
explanation

If $x = f(y)$ is revolved about X-axis
from $y = c$ to $y = d$ then volume of
the solid is

$$V = \int_c^d 2\pi y f(y) dy$$

Here

- y corresponds to radius
- $f(y)$ corresponds to height
- dy corresponds to width
of shell at point y

See example 2 done in class

Volume (by cylindrical shells) of solid obtained by revolution about a line

- Same idea as above
- we learn through examples

See examples 3, 4, 5 done in class

End of Section 6.3