

Section 6.2 Volumes

6.2₁

Learning outcomes

After completing this section, you will inshaAllah be able to

1. know what is meant by **cross-section** of a solid
2. know what is a **solid of revolution**
3. use **disk/washer method** to find volumes of solids of revolution
4. use **method of cross-sections** to find volumes of solids which are **NOT** solids of revolution

Introduction to method of cross-sections

Cross-section:

If a plane intersects a solid then the common region is called a **cross section or slice**

See class explanation

Can you intersect a right circular cylinder with a plane so that

- the slice is a circle
- the slice is a rectangle

Method of cross-section:

(Roughly) The method of cross-section is a way of computing volume of a solid

- by dividing it into (infinitely many) cross-sections
- calculating volume of each cross-section
- adding up to get volume of solid

Like rectangle method for area, we get a definite integral which gives the volume.

(See next page for the formula)

Method of volume by cross-sections

Cross-sections perpendicular to X-axis

Let S be a solid bounded by $x = a$, $x = b$ and the area of cross-section (perpendicular to X-axis) at x is $A(x)$ then

$$V = \int_a^b A(x) dx$$

Thinking that solid lies along X-axis

See figure and explanation of the formula in class

Cross-section perpendicular to Y-axis

Let S be a solid bounded by $y = c$, $y = d$ and the area of cross-section (perpendicular to Y-axis) at y is $A(y)$ then

$$V = \int_c^d A(y) dy$$

Thinking that solid lies along Y-axis

See figure and explanation of the formula in class

**Because of different calculation tricks,
we divide the study of this method into two parts**

1. Method of cross-section **for solids of revolution**

See part 1

Called
disk/washer method

2. Method of cross-section **for solids that are NOT solids of revolution**

See part 2