Lesson 30 - Rectangular Regions I

Objectives

- Sketch a rectangular region.
- Evaluate an iterated integral over a rectangular region.
- Find the volume under a surface whose base is a rectangular region.
- Given an iterated integral, write an equivalent iterated integral with the order of integration reversed.
- Use an iterated integral to compute volume, population, center of mass, and other values that accumulate in more than one dimension.

READ

- Stewart, Chapter 15.2, page 959-964

THINK ABOUT

- How can you explain an iterated integral as two separate integrations?
- Does Fubini's theorem make sense intuitively?

MATHEMATICA COMMANDS AND TASKS YOU NEED TO KNOW

Mathematica can do most iterated integrals for you. There are a few ways in which you can accomplish this. First enter your function. Then click on the single definite integral button on the pallet. Then click the middle box and click on the single definite integral button again it should look like this:

$$\int_{\square}^{\square}\int_{\square}^{\square} \square \, d\square \, d\square$$

Now enter in your limits of integration, your function, and the correct order of integration. If you wanted to integrate first with respect to y then with respect to x with $0 \leq x \leq 5$ and $0 \leq y \leq 10$ it would look like:

$$\int_0^5 \int_0^{10} f[x, y] \, dy \, dx$$

Sometimes you may need to add the post command, `//N` to the end. This tells Mathematica you would like an approximation instead of a fraction.

You can also manually type in the same integral with the command:

```
Integrate[f[x, y], {x, 0, 5}, {y, 0, 10}] // N
```

Also, the `NIntegrate` command bypasses all efforts at exact computation which can be a time saver.

```
NIntegrate[f[x, y], {x, 0, 10}, {y, 0, 5} ]
```