

Welcome! M408L, Fall 2012. Integral Calculus.

Course web page: www.ma.utexas.edu/users/neitzke/teaching/408L

- contains link to first day handout, will contain lecture slides posted after each class

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TA: Javier Morales jmorales@math.utexas.edu

Lectures MWF 10-11a, ECJ 1.202 (10:00-10:50 ± 2min)

55460: TTh 8:30-9:30a, BUR 220

Discussion 55465: TTh 4:00-5:00p, BUR 112

55470: TTh 5:00-6:00p, RLM 7.114

Office hours Instructor: MF 11:00-12:00p RLM 9.134

TA: MW 12:30-2:00p RLM 13.152

Broadly the same format as M408K:

- Homework via QUEST at quest.cns.utexas.edu 10%

Due at 3am each Mon night/Tue morning — can submit as you go

One extra review assignment (HWO1), due 3am Fri Sep 7

Worst 3 (of 15) dropped from grade

Working together strongly recommended!

- 3 midterm exams (2hr, evening) 60%

Tue Oct 9, Tue Nov 6, Tue Dec 4

- Final exam 30%

Date unknown until late in the semester!

Could be anytime during the exam period.

Significantly harder than M408K ⇒ Have to work harder to get the same grade.

Many resources available:

Office hours

Textbook

Lecture slides

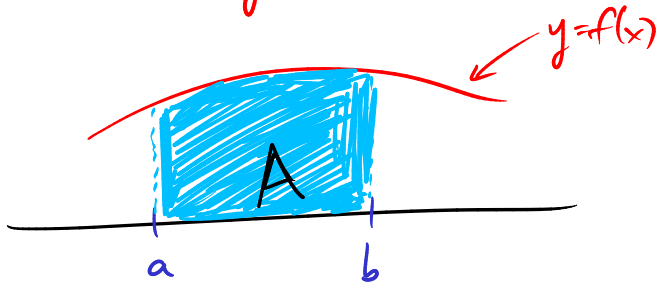
Sanger Learning+Career Center (Jester A115)

Your fellow students!

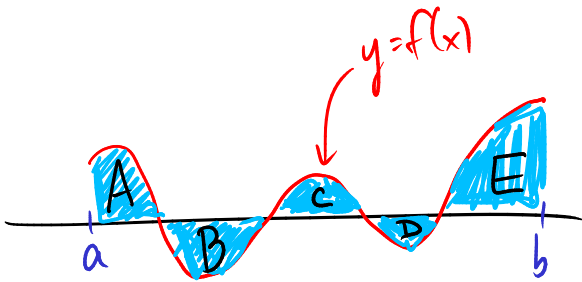
The Integral

Suppose we have a function $f(x)$.

If $b > a$, $\int_a^b f(x) dx$ means the signed area between the graph of $y = f(x)$ and the x -axis, between a and b :

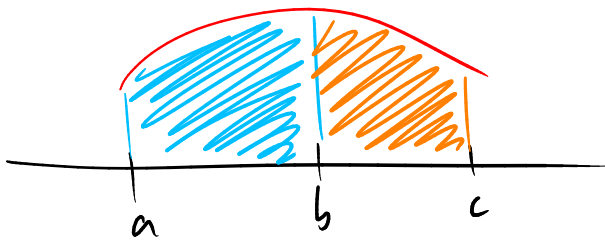


$$\int_a^b f(x) dx = A$$



$$\int_a^b f(x) dx = A - B + C - D + E$$

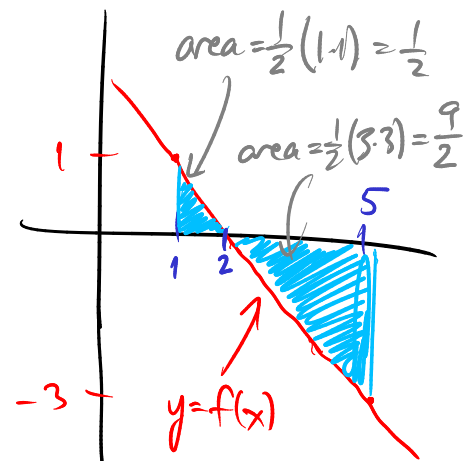
Formal properties of integral: e.g. $\int_a^b f(x) dx + \int_b^c f(x) dx = \int_a^c f(x) dx$



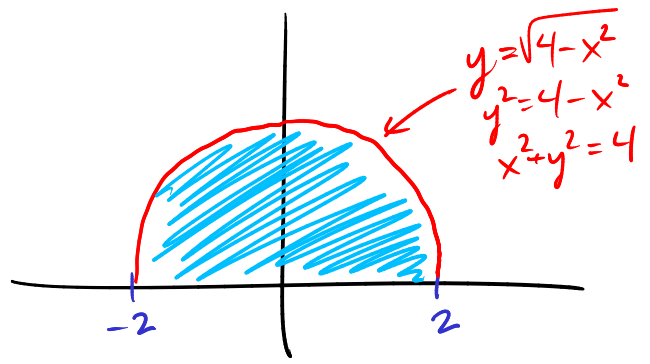
Ex

Say $f(x) = 2 - x$

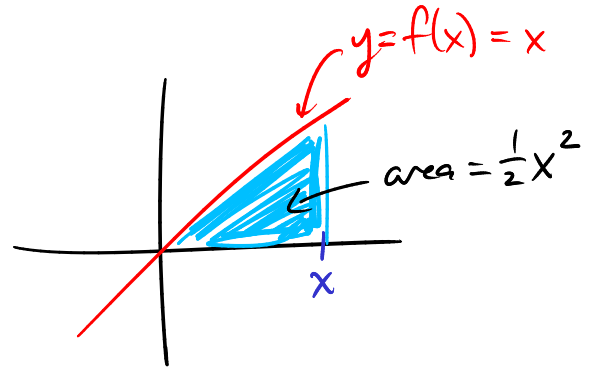
$$\text{Then } \int_1^5 f(x) dx = \frac{1}{2} - \frac{9}{2} = \underline{\underline{-4}}$$



Ex Say $f(x) = \sqrt{4-x^2}$
 Then $\int_{-2}^2 f(x) dx = \frac{1}{2}(\pi \cdot 2^2)$
 $= \underline{\underline{2\pi}}$



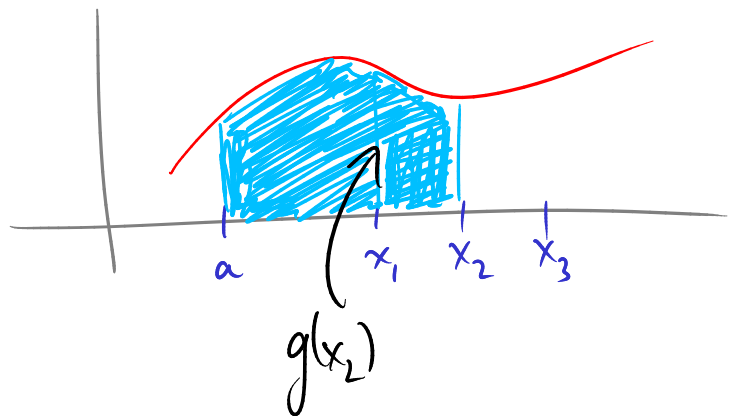
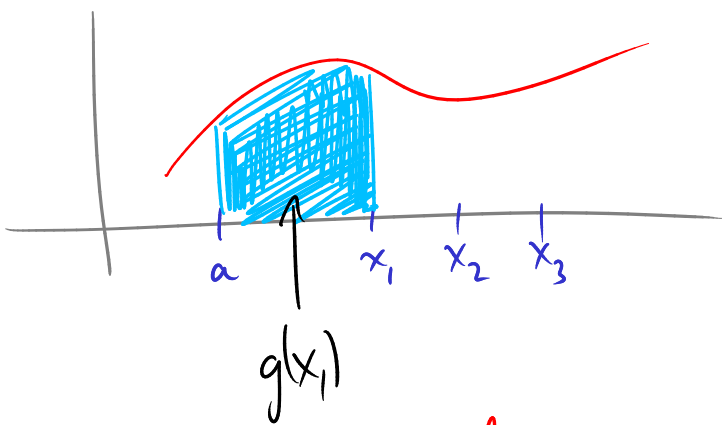
Ex Say $f(x) = x$
 $\int_0^x f(t) dt = \frac{1}{2}x^2$



Fundamental Theorem of Calculus

Given any function $f(x)$, and any number a ,
 define a new function

$$g(x) = \int_a^x f(t) dt$$



FTC I: $\frac{d}{dx} g(x) = f(x) !!$

Ex We just saw above that if $f(x) = x$ then $\int_0^x f(t) dt = \frac{1}{2}x^2$

i.e. $g(x) = \frac{1}{2}x^2$

So indeed, $\frac{d}{dx}g(x) = \frac{d}{dx}\left(\frac{1}{2}x^2\right) = x = f(x)$

Just as FTC 1 predicted!

Ex What is $\frac{d}{dx} \int_7^x \underbrace{\sin(t^2)}_{f(t)} dt$?

It is $\sin(x^2)$.

[Because $\frac{d}{dx}g(x) = f(x)$ by FTC 1]