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Math 31A Lecture Notes: The Fundamental Theorem of Calculus

Review: function on

* Partition:
* Sample points: where
* Riemann Sum:
* Nom:

if the limit exists whether all are integrable

Theorem: , is a constant

Theorem; Linearity of definite integrals:

If are integrable on and are constants, then:

Proof: Use and limit laws

Example 1: Compute using

Solution:

Definition: Reversing the limit of integration: For

Theorem; Additivity for adjacent intervals:

Let and assume that is integrable on

Example 2: Calculate

Solution:

Fundamental Theorem of Calculus (FTC)

for

↓ ↓ ↓

Indefinite anti

Integral derivative

Theorem; FTC: Assume that is continuous on if is an antiderivative of

Proof:

Idea: For every partition we find sample points , such that:

Given a partition

=

\* The other parts cancel out

=

By the mean value theorem, there are

=

=

=

Let , then

Remember:

Intuition:

FTC:

-------↓↓------ ↓↓ \* Multiplying the sum of each partition with each

Sum of all changes = total change partition will give the total sum within an interval

Notation:

Example 3: Calculate the are under the graph of over

Solution: is an antiderivative of .

Hence, by FTC,