

Section 7

TA: Dante
Buhl

Agenda

Review

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UCSC Math-19B

February 28, 2024

Plan for Today

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Review

Topics to Cover

- Improper Integrals
- Arc Length
- Surface Area

Section Activity 7

- 1 question

Upcoming Assignments

- Homework 7 (Due Mon, Mar. 4th)
- Project 2 (Will be released by the end of the week)

Learning Outcomes

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- Accomodating improper integrals with the use of limits.
- Integral forms for Arc Length and Surface Area

Improper Integrals

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Improper Integrals are integral cases where we find infinity arrive in some form in our work, often in the limits of integration.

$$\int_0^{\infty} f(x)dx = F(\infty) - F(0)$$

What is to be done here is to take the limit of the terms that involve infinity and see if they converge to a value or not. Take for example, $f(x) = -e^{-x}$

$$\int_0^{\infty} e^{-x} dx = -e^{-x} \Big|_0^{\infty} = \left(\lim_{x \rightarrow \infty} -e^{-x} \right) + 1 = 1$$

Arc Length and Surface Area

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We now introduce two new integral forms. These are integrals for 1D functions which have geometrical interpretations.

Arc Length (of $f(x)$ over the interval $[a, b]$)

$$\int_a^b \sqrt{1 + (f'(x))^2} dx$$

Surface Area (by rotating $f(x)$ about the x-axis on $[a, b]$)

$$2\pi \int_a^b f(x) \sqrt{1 + (f'(x))^2} dx$$