8/30/2021 near Mather house

Lecture 8

9/24/2021

Improper Integration 1

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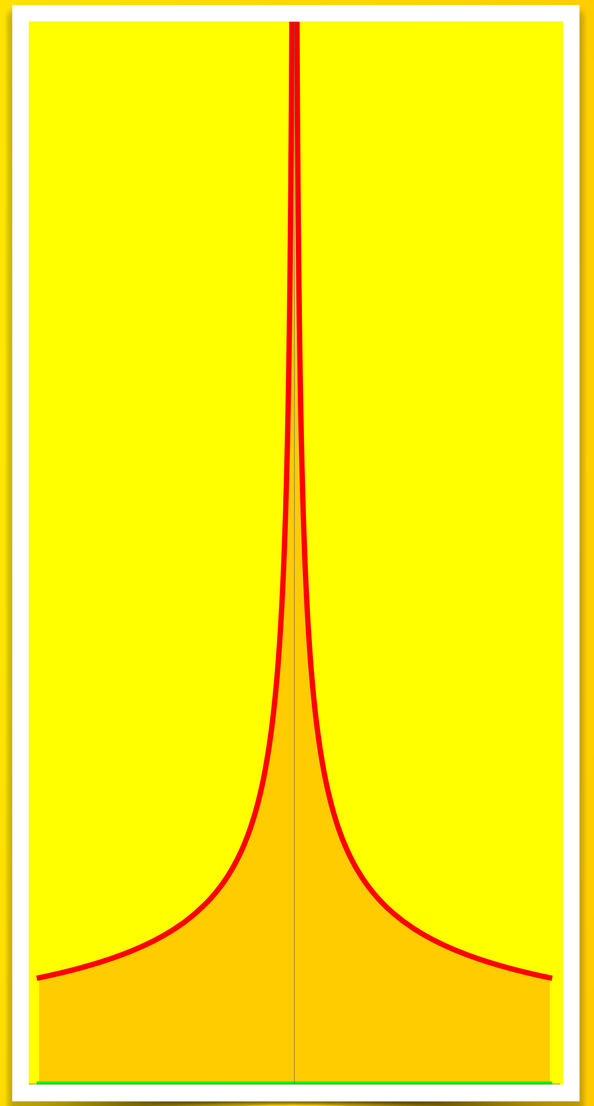
Improper Integrals

Improper Integrals

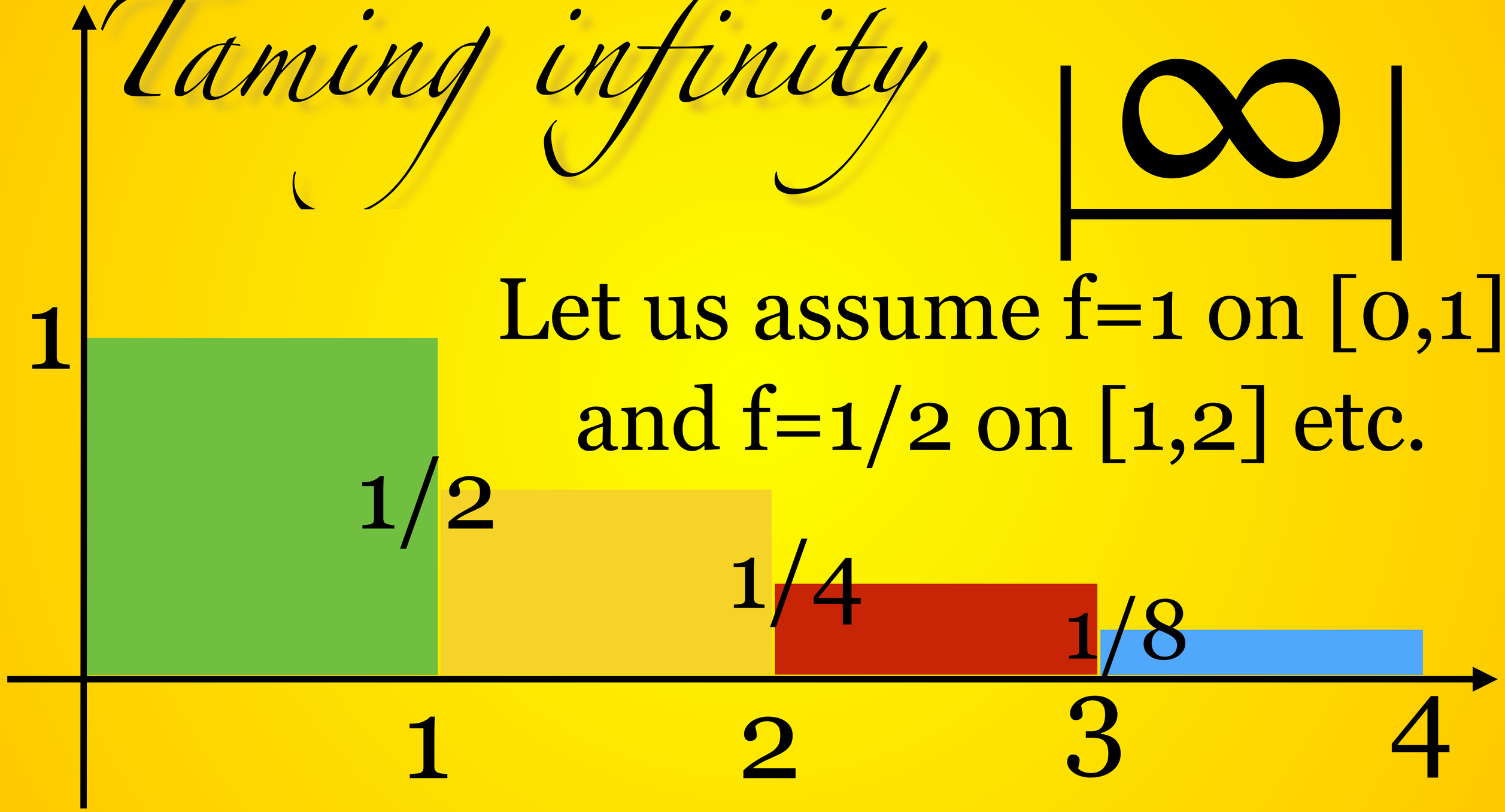


$$\int_a^{\infty} f(x)dx$$

$$\int_{-1}^{1} \frac{1}{\sqrt{|x|}}dx$$

Taming infinity

Let us assume f=1 on [0,1]
and f=1/2 on [1,2] etc.



Improper integral

$$\int_a^{\infty} \sin(x)dx$$

Example

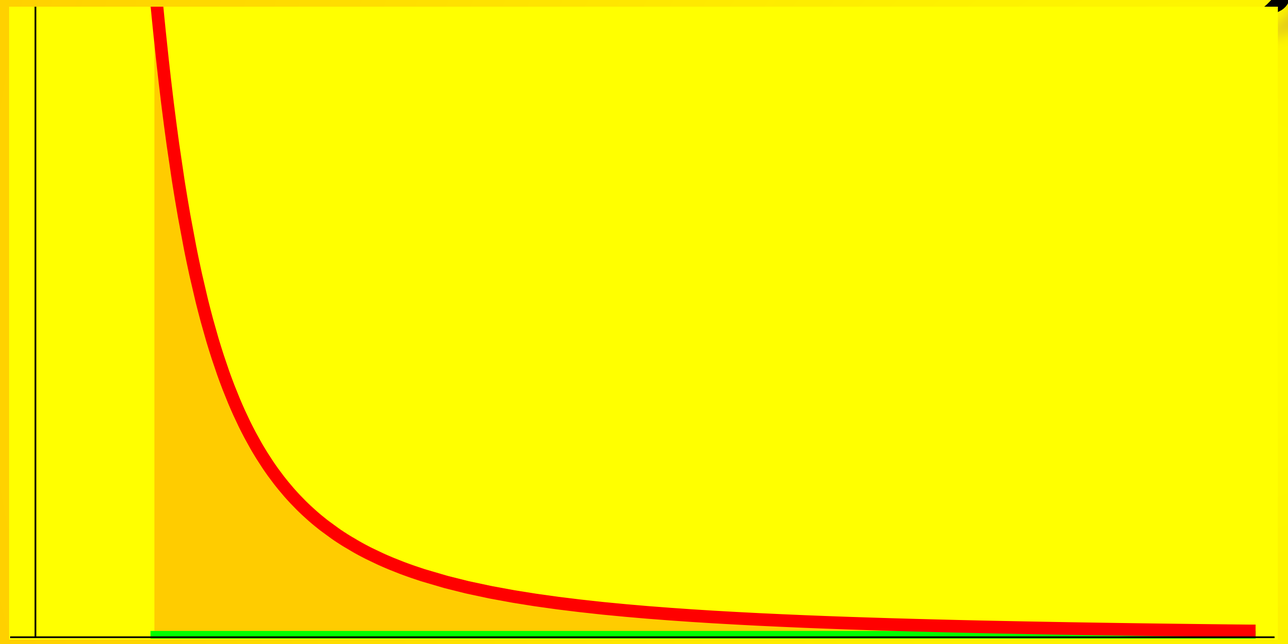
Why?

In Stats, many distributions are defined on unbounded domains or are unbounded

$$\frac{e^{-x^2/2}}{\sqrt{2\pi}}$$

$$\frac{1}{\sqrt{1-x^2}}\frac{1}{\pi}$$

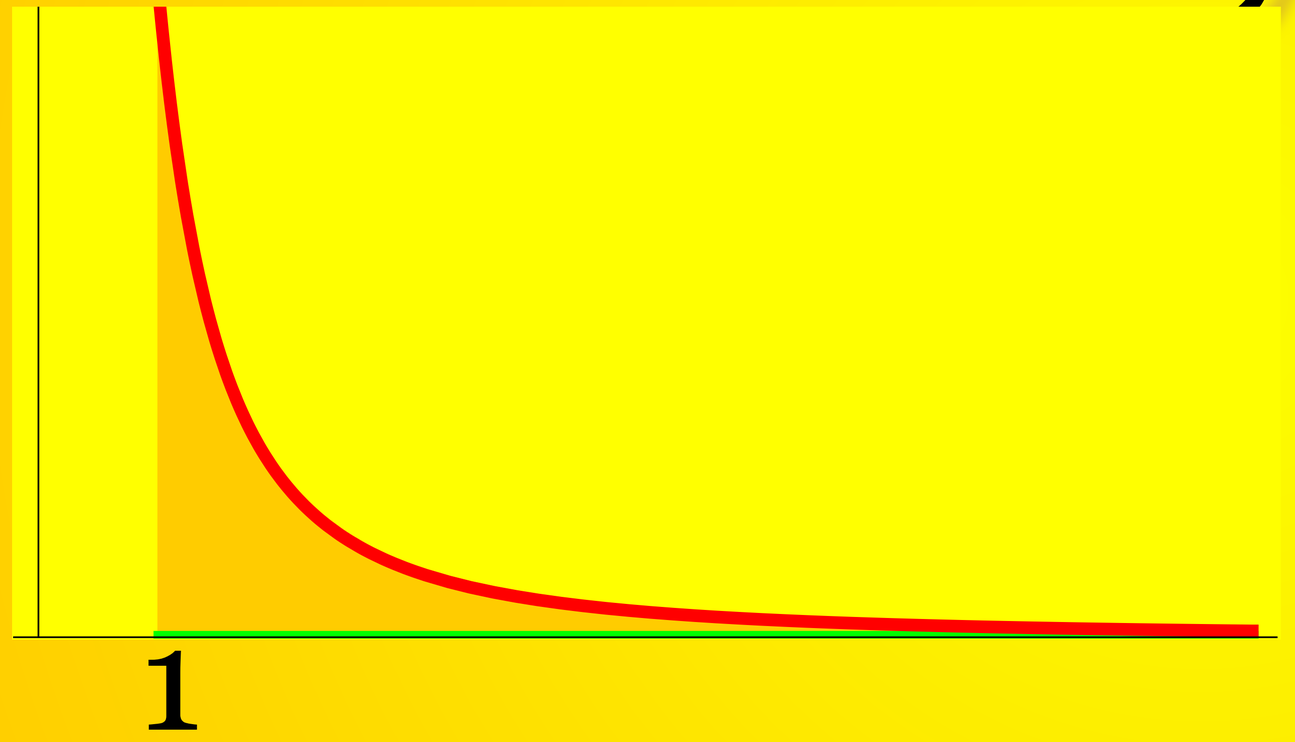
Example 1



$$\int_1^{\infty} \frac{1}{x^3} dx$$

Region is unbounded

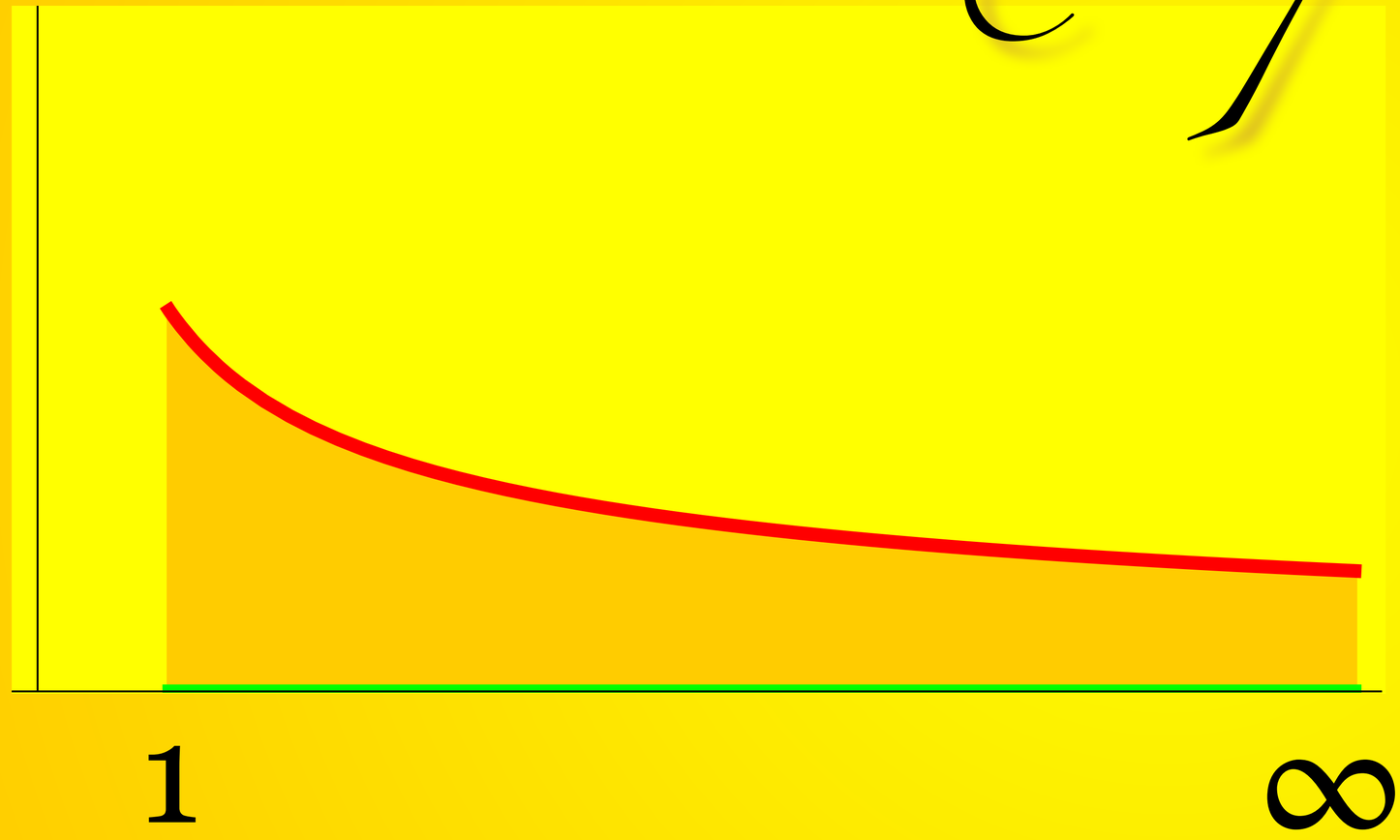
Example 2



$$\int_1^{\infty} \frac{1}{e^x} dx$$

Does this integral converge?

Example 3



$$\int_1^{\infty} \frac{1}{x^{1/3}}\,dx$$

Does this integral converge?

The Trumpet

Surface Area $\geq \int_1^b \frac{2\pi}{x}\,dx$

Volume: $\int_1^b \frac{\pi}{x^2}\,dx$

b

1

The Trumpet

Punch line!

Quiz

converge or diverge?

$$\int_1^\infty \frac{1}{x^2}dx$$

$$\int_1^\infty \frac{\sin^2(x)}{x^3}dx$$

$$\int_1^\infty \frac{1}{\sqrt{x}}dx$$

$$\int_1^\infty \frac{\sin^2(x)}{x^{1/4}}dx$$

$$\int_1^\infty \frac{1}{x}dx$$

$$\int_1^\infty \frac{\sin^2(x)}{x+1}dx$$

The End