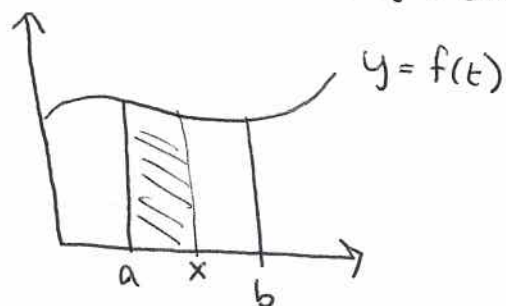**Please write an outline of the main contents of the lecture.**

- Continuous functions - over $[a, b]$

$y = f(t)$

- Definite Intergral

$$- \int_a^x f(t)\, dt = F(x)$$

  - gives area

- Fundemental Thm of calc

$$\frac{dF}{dx} = \frac{\partial}{\partial x} \int_a^x f(t)\,dt = f(x)$$

↳ Antiderivitive

  → Every cont. f has an antidrivative $F(x)$

- Example of fundamental

$$\frac{\partial}{\partial x} \int_\pi^x \frac{\cos^2 t}{\ln(t - \sqrt{t})}\, dt = \frac{\cos^2 x}{\ln(x - \sqrt{x}}$$

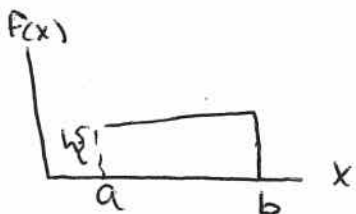 $\underbrace{\qquad}_{f(t)}$ $\underbrace{\qquad}_{f(x)}$

Please write an outline of the main contents of the lecture.

Uniform Distribution

· Definition

$$X \sim \text{Unif}(a, b)$$

○ Example $f(x)$

$$\text{area} = (b-a)h = 1$$
$$\Rightarrow h = \frac{1}{b-a}$$

· PDF

$$f_x(x) = \frac{1}{b-a} \quad a \leq x \leq b$$

· Derivation of CDF

$$F(x) = \begin{cases} 0 & x < a \\ \frac{x-a}{b-a} & a \leq x \leq b \\ 1 & x > b \end{cases}$$

$$E(x) = \frac{b+a}{2}, \quad \text{Var}(x) = \frac{(b-a)^2}{2}$$
$$\quad\quad\quad\quad\quad\quad\quad \hookrightarrow \text{Variance}$$

○ Moment Generating function
$$M_x(t) = \frac{e^{bt} - e^{at}}{(b-a)t}$$

CDF Definition
$$F_x(x) = P(x \leq X)$$
- When $x \in [a, b]$
$$F_x(x) = \frac{x-a}{b-a}$$
- When $x > b$
$$F_x(x) = 1$$

Prove Trig From Eulers

- Eulers

$$e^{ix} = \cos(x) + i\sin(x)$$

→ Prove $\sin^2(x) + \cos^2(x) = 1$

- Proof

$$e^{ix} = \cos x + i\sin x$$

$$e^{-ix} = e^{i(-x)} = \cos(-x) + i\sin(-x) = \cos x - i\sin x$$

multiplying

$$e^{ix} \cdot e^{-ix} = (\cos x + i\sin x)(\cos x - i\sin x)$$

$$1 = \cos^2 x - i\cos x \sin x + i\sin x \cos x - i^2 \sin^2 x$$

$$\implies 1 = \cos^2 x + \sin^2 x$$

- Angle Sum Formula

$$e^{ia} = \cos a + i\sin a$$

$$e^{ia} e^{ib} = (\cos a + i\sin a)(\cos b + i\sin b)$$

$$e^{i(a+b)} = \cos a \cos b - \sin a \sin b + i(\cos a \sin b + \sin a \cos b)$$

→