Lecture - 4

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Integration

If

$$g(x) = \frac{df(x)}{dx}$$

Then

$$f(x) = \int g(x)dx + constant$$

Sometimes, an integral is called “anti-derivative”

Memorize This

$$\int x^n dx = \frac{1}{n+1} x^{n+1}; n \neq 1$$

$$\int (a+bx)^n = \frac{1}{(n+1)b}(a+bx)^{n+1}; n \neq 1$$

$$\int \frac{1}{x} dx = Ln\,|\,x\,|$$

$$\int \frac{dx}{a+bx} = \frac{1}{b} Ln(a+bx)$$

$$\int \frac{dx}{a^2+b^2x^2} = \frac{1}{ab} \arctan\left(\frac{bx}{a}\right)$$

$$\int \frac{dx}{a^2-b^2x^2} = \frac{1}{2ab} Ln\left|\frac{a+bx}{a-bx}\right|$$

$$\int \sin(x)dx = -\cos(x)$$

$$\int \cos(x)dx = \sin(x)$$

Integration by Parts

$$\int u(x)v(x)dx = u(x)\int v(x)dx - \int \frac{du}{dx}\left\{\int v(x)dx\right\}dx$$

Example

$$\int Ln(x)dx = xLn(x) - x$$

$$u(x) = Ln(x)$$

$$v(x) = 1$$

Example

$$\int x^2 e^x dx = x^2 e^x - 2xe^x + 2e^x$$

$$u(x) = x^2$$

$$v(x) = e^x$$

Example

$$\int \cos(x)e^{x}dx$$

$$\int x\sin(x)dx$$

$$\int x^{2}Ln(x)dx$$

$$\int x\sqrt{x+1}dx$$