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FISIKA STATISTIK

Fisika stabistik adalah gerakan suatu partikel yang sifatnya tidak bisa diatur oleh manusia.

Persamaan Sterling

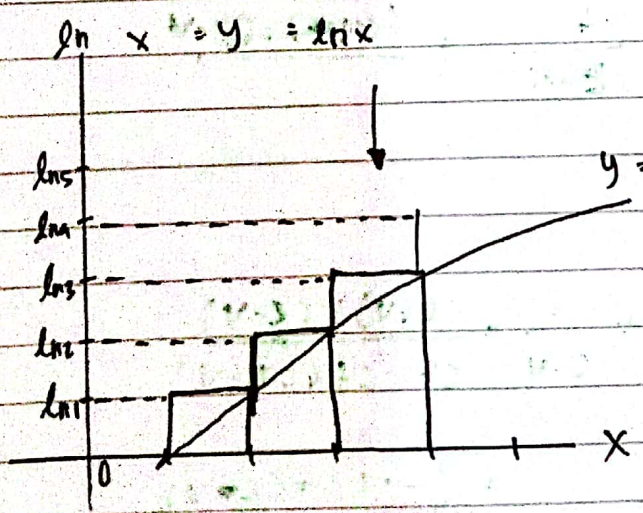
$\ln N! = ?$

$N! = 1, 2, 3, 4 \ldots N$

$\ln N! = \ln_1 + \ln_2 + \ln_3 + \ldots + \ln N$

$= \sum_{x=1}^{N} \ln x$

Grafik hubungan x dengan ln x



$\ln = 0$

$\ln 2 = 1$

$\ln 3 = 2$

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$$\ln N! = \sum_{x=1}^{N} \ln x$$

$$\approx \int_{1}^{N} \ln x \, dx \rightarrow \text{Gunakan integral Riemann}$$

Misal : $u = \ln x$ $\quad dv = dx$

$du = \frac{1}{x} dx$ $\quad v = x$

maka :

$$= x \ln x \Big|_1^N - \int_1^N x \frac{1}{x} dx \quad \left(\text{integrasi sisi parsial} \right)$$

$$= (N \ln N - 0) - (N - 1)$$

$$\ln N! = N \ln N - N + 1$$

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Misal

$u = \ln x$ $\qquad dv = dx$

$du = \frac{1}{x}\,dx$ $\qquad v = x$

Maka

$$\int_a^b u\,dv = uv\Big|_a^b - \int_a^b v\,du$$

$$= x \ln x \Big|_1^n - \int_1^N x \cdot \frac{1}{x}\,dx$$

$$= (N \ln N - 0) - (N - 1)$$ } kasus tak terbatas

$$\ln n! = N \ln N - N + 1$$

Contoh :

$$\frac{1}{c+v} + \frac{1}{c-v} = \frac{(c-v)+(c+v)}{c^2+cv-cv-v^2}$$

Contoh :

$$\frac{1}{c+v} + \frac{1}{c-v} = \frac{(c-v)+(c+v)}{c^2-cv+cv-v^2}$$

$$= \frac{(c-v)+(c+v)}{c^2-v^2}$$

$$= \frac{2c}{c^2-v^2}$$

$$\frac{l_A}{\sqrt{e^2+v^2}} + \frac{l_A}{\sqrt{c^2+v^2}} =$$

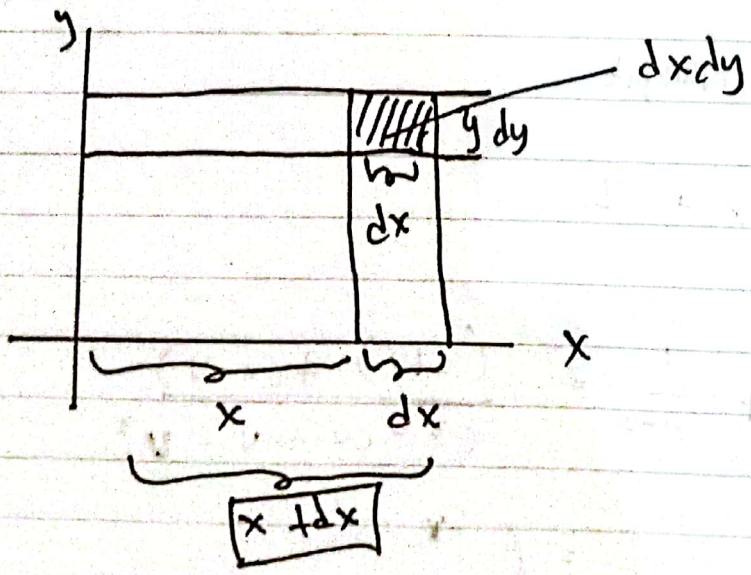
$$= \int_{\infty}^{\infty} e^{-ax^2} dx = ?$$

$$= \int_{-\infty}^{\infty} e^{-ax^2} dx = I$$

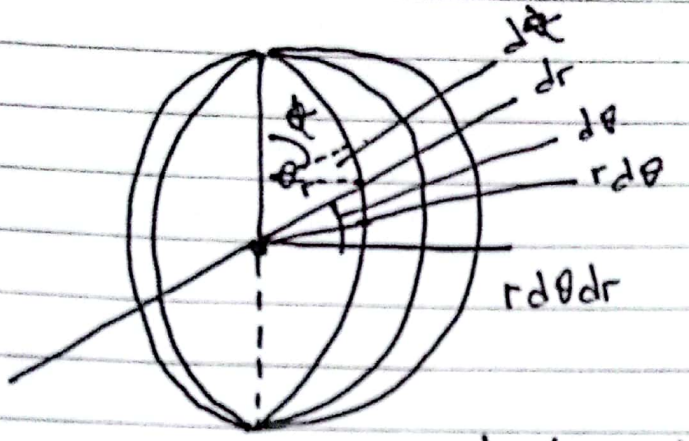
$$= \int_{-\infty}^{\infty} e^{-ax^2} dy = I$$

$$= \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} a^{(x^2+y^2)} dx\,dy = I^2$$

Transformasi koordinat



Transformasi koordinat bola x dan y



$dy\,dy = r\,d\theta\,dr$

$r^2 = x^2 + y^2$

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$$

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-ar^2} r\,dr\,d\theta$$

$r = 0 \quad \theta = 0$

$$2\pi \int_0^{\infty} e^{-(ar^2)} r\,dr$$

→ harus dicumakan

$$= \frac{2\pi}{2a}\int_0^{\infty} e^{-ar^2} d(ar^2)$$

$$= \frac{2\pi}{2\pi}\left[-e^{-ar^2}\Big|_0^{\infty}\right]$$

$$= \frac{-2\pi}{2\pi}(0-1) = \frac{\pi}{2}$$

$$I^2 = \frac{\pi}{a}$$

$$I = \sqrt{\frac{\pi}{a}}$$

$$\frac{d}{da}\int_{-\infty}^{\infty} e^{-ax}\,dx = \frac{dx}{da}\left[\sqrt{\frac{\pi}{a}}\right]$$

$$\int_{-\infty}^{\infty} \frac{d}{da}\left(e^{-ax^2}\right)dx = \frac{d}{da}\sqrt{\frac{\pi}{a}}$$

$$-\int_{-\infty}^{\infty} x^2 e^{-ax^2}\,dx = \frac{d}{da}\sqrt{\frac{\pi}{a}}$$

$$= \sqrt{\pi}\frac{d}{da}\left(a^{-\frac{1}{2}}\right)$$

Sehingga :

$$-\int_{-\infty}^{\infty} x^2 e^{-ax^2}\,dx = \sqrt{\pi}\left(-\frac{1}{2}a^{-3/2}\right)$$

$$-\int_{-\infty}^{\infty} x^2 e^{-ax^2}\,dx = \frac{1}{2}\sqrt{\frac{\pi}{a^3}}$$