DATE / / OM OT OW OT OF OS OS NOTES

Fisika Statistik

1. Apa itu fisika statistik ?

Fisika statistik adalah kajian mengenai gerak suatu partikel. yang sifatnya tidak bisa di atur oleh manusia.

2. Dalam belajar fisika statistik kita harus memahami dasar-dasar termodinamika, dan matematika trapapan untuk menggambarkan prangai suatu partikel.

DATE / / OM OT OW OT OF OS OS NOTES

Apoksimasi sterling

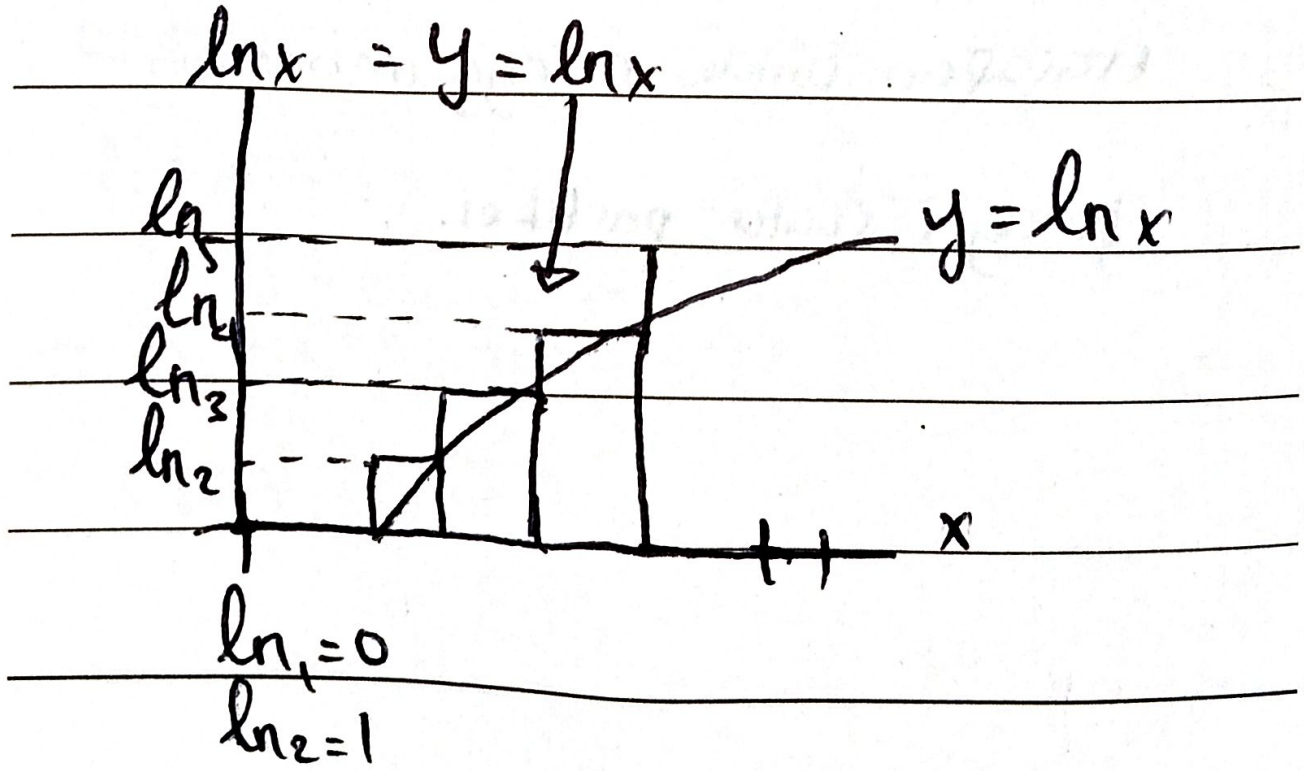
$\ln N! = ?$

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

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

$$= \sum_{x=1}^{N} \ln x \quad \text{(partikel terbatas)}$$

Grafik hubungan x dengan ln x



DATE / / OM OT OW OT OF OS OS NOTES

$$\ln(N!) = \int_0^N \ln(x)\,dx = x \ln x - x + 1$$

Partikel tak terbatas

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

$$= \ln x\,dx \rightarrow \text{gunakan integral parsial}$$

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

Misal

$u = \ln \quad dv = dx$

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

Maka: $\int_a^b u\,dv = uv\Big|_a^b - \int_a^b u\,dv$

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

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

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

DATE / / OM OT OW OT OF OS OS NOTES

Contoh

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

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

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

Hal yang harus di ingat!

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

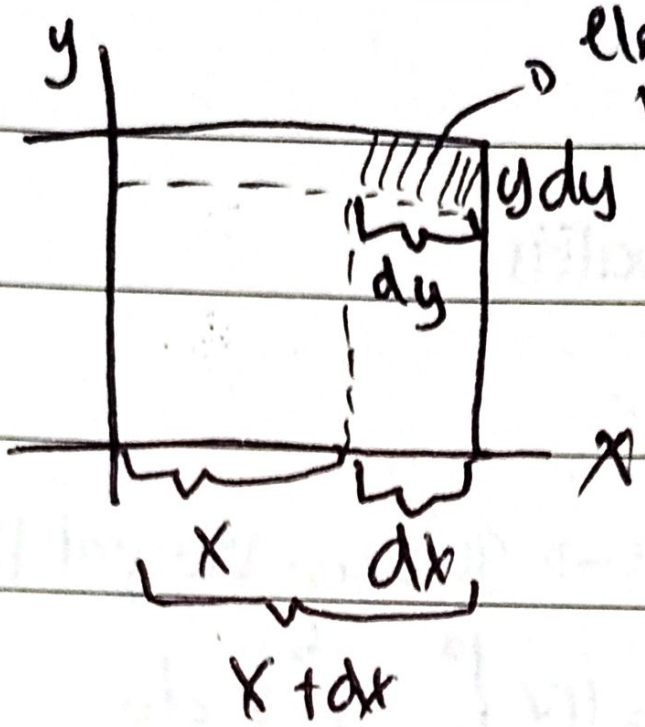
$$\int_{-\infty}^{\infty} e^{-ax^2} dx = I$$

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

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

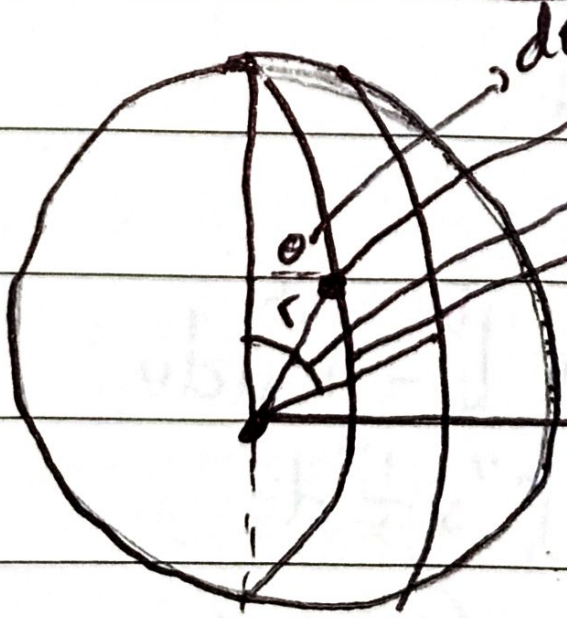
DATE / / OM OT OW OT OF OS OS NOTES

Tansformasi koordinat-



elemen / bagian luas permukaan

Tansformasi koordinat bola x dany



$r\,d\theta\,dr$

$dydy = r\,d\theta\,rr$

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

DATE / / OM OT OW OT OF OS OS NOTES

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

$$\int_{\rho=0}^{\infty}\int_{\theta=0}^{2\pi} e^{-ar^2}\, r\, dr\, d\theta$$

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

(ar² → harus disamakan)

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

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

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

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

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

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

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

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

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

Sehingga:

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

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