Fisika Statistik

↳ Fisika Statistik (kajian mengenai gerak suatu partikel yang sifatnya tak bisa diatur manusia)

Aproksimasi Sterling

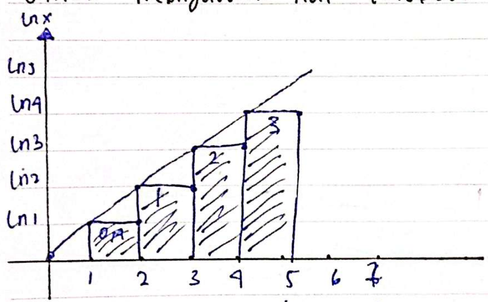
$\ln N! = ?$

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

$$\ln N! = \ln 1 + \ln 2 + \ln 3 + \ldots + \ln N$$

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

Untuk menjawab hal tersebut diatas, Sterling membuat grafik



$\ln 1 = 0$
$\ln 2 = 0,6$
$\ln 3 = 1$
$\ln 4 = 2$
$\ln 5 = 3$
$\ln 5! = 3+2+1+0,6 = 6,6$

→ untuk partikel tidak terbatas

$$= \int_1^N \ln x \, dx \rightarrow \text{gunakan integral parcial}$$

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

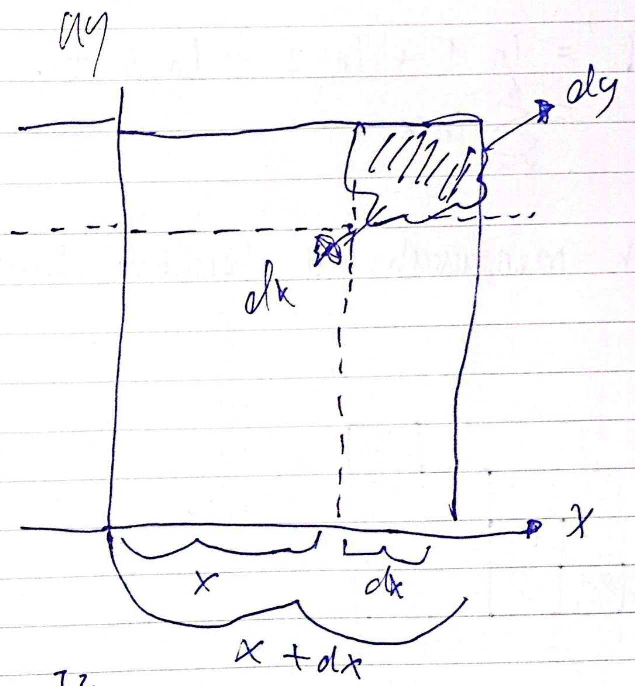
Perlu diingat

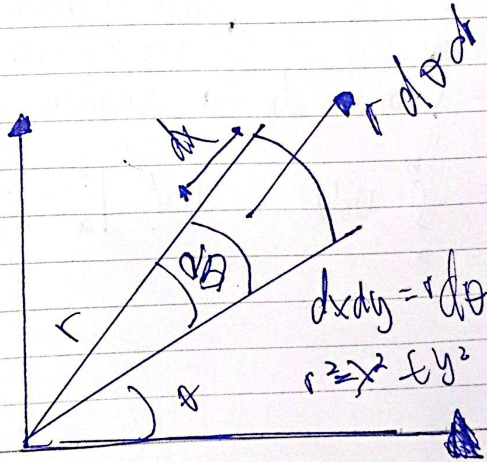
Persamaan Sterling

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

$$\left[\begin{array}{l} \int_{-\infty}^{\infty} e^{-ax^2}\, dx = 1 \\ \int_{-\infty}^{\infty} e^{-ax^2}\, dy = 1 \end{array}\right.$$

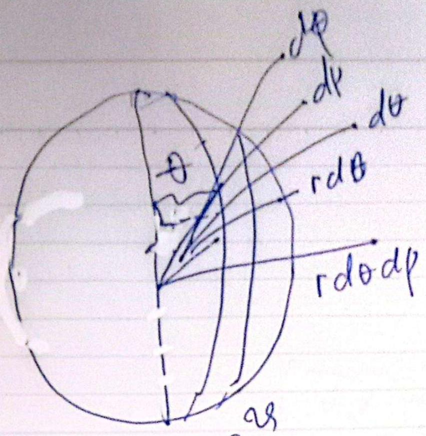
$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} a\,(x^2 + dy^2)\, dx\,dy = I^2$$





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

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



$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} a^{-(x^2+y^2)}\, dx\, dy = \int_0^{2\pi} d\theta$$

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{-\infty^2}\, \rho\, dy\, d\theta = \theta\int_0^{2\pi}$$

$$= 2\pi \int_0^{\infty} e^{-a\rho^2}\, \rho\, d\rho$$

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

$$\int_0^{\infty} e^{-x}\, dx = \frac{1}{e^x}$$