# TUGAS KELOMPOK KALKULUS MINGGU 2

## KELOMPOK 2


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# NOMOR 1

① a. $\int_{3}^{\infty} \frac{x}{\sqrt{16+x^2}}\, dx$

Jawab:

Misal:

$u = 16 + x^2 \rightarrow \frac{du}{dx} = 2x \rightarrow dx = \frac{du}{2x}$

$\int_{25}^{\infty} \frac{1}{2\sqrt{u}}\, du = \lim_{b\to\infty} \int_{25}^{b} \frac{1}{2\sqrt{u}}\, du$

$= \lim_{b\to\infty} [\sqrt{u}]_{25}^{b}$

$= \lim_{b\to\infty} \sqrt{b} - \sqrt{25}$

$= \infty$ (divergen)

1b

$$\int_{-\infty}^{\infty} \frac{x}{\sqrt{9+x^2}}\, dx = \int_{-\infty}^{0} \frac{x}{\sqrt{9+x^2}}\, dx + \int_{0}^{\infty} \frac{x}{\sqrt{9+x^2}}\, dx$$

$$= \lim_{a\to -\infty} \int_{a}^{0} \frac{x}{\sqrt{9+x^2}} dx + \lim_{b\to\infty} \int_{0}^{b} \frac{x}{\sqrt{9+x^2}} dx$$

*Misalkan* $u = 9 + x^2$, *maka* $\frac{du}{dx} = 2x \rightarrow dx = \frac{du}{2x}$

*dengan batas atas dan bawah untuk sisi kiri menjadi* 9 *dan* $9 + a^2$

*untuk sisi kanan batas atas dan bawah menjadi* $b^2 + 9$ *dan* 9

$$= \lim_{a\to -\infty} \int_{a^2+9}^{9} \frac{1}{2\sqrt{u}} du + \lim_{b\to\infty} \int_{9}^{b^2+9} \frac{1}{2\sqrt{u}} du$$

$$= \lim_{a\to -\infty} [\sqrt{u}]_{a^2+9}^{9} + \lim_{b\to\infty} [\sqrt{u}]_{9}^{b^2+9}$$

$$= \lim_{a\to -\infty} \sqrt{9} - \sqrt{a^2+9} + \lim_{b\to\infty} \sqrt{b^2+9} - \sqrt{9}$$

$$= \lim_{a\to -\infty} \sqrt{9} - \sqrt{a^2+9} \rightarrow -\infty$$

$$= \lim_{b\to\infty} \sqrt{b^2+9} - \sqrt{9} \rightarrow \infty$$

$$= -\infty + \infty \rightarrow divergen$$

# NOMOR 2

② a. $\int_{2}^{\infty} \frac{\ln \sqrt{x}}{x} \, dx$

Jawab :

$\int_{2}^{\infty} \frac{\ln (x)^{\frac{1}{2}}}{x} dx = \frac{1}{2} \int_{2}^{\infty} \frac{\ln x}{x} dx$

misal:

$u = \ln x$

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

$dx = x\,du$

$\frac{1}{2} \int_{2}^{\infty} \frac{\ln x}{x} dx = \frac{1}{2} \int_{2} \frac{u}{x} \cdot x\,du$

$= \frac{1}{2} \int_{2}^{\infty} u\,du$

$= \frac{1}{2} \lim_{b \to \infty} \int_{2}^{b} u\,du$

$= \frac{1}{2} \left[\frac{u^2}{2}\right]_2^b$

$= \frac{1}{2} \left[\frac{(\ln x)^2}{2}\right]_2^b$

$= \frac{1}{4} \left[(\ln x)^2\right]_2^b$

$= \frac{1}{4} (\ln b^2 - \ln 4)$

$= \infty$ (divergen)

② b. $\int_{-\infty}^{\infty} \frac{x}{(x^2+4)} \, dx$

Jawab:

Misal:

$u = x^2 + 4 \rightarrow \frac{du}{dx} = 2x \rightarrow dx = \frac{du}{2x}$

$\int_{0}^{\infty} \frac{1}{u} du = \lim_{b \to \infty} \int_{0}^{b} \frac{1}{u} du$

$= \lim_{b \to \infty} [\ln u]_0^b$

$= \lim_{b \to \infty} \ln b - \ln 0$

$= \infty$ (divergen)

# NOMOR 3

3a. $\int_2^{\infty} \frac{1}{x\, lnx} dx =$

Misalkan :

u = x du = dx

v = lnx dv = $\frac{1}{x}\ dx$

$$\int_2^{\infty} \frac{1}{x\, lnx} dx = \lim_{a\to\infty} \int_2^{\infty} \frac{1}{x\, lnx} dx$$

$$= \lim_{a\to\infty} (\ln(|\ln a|)) - (\ln(\ln 2))$$

$$= \infty$$

3b. $\int_{-\infty}^{\infty} \frac{1}{x^2+4x+9} dx$

$$\int_{-\infty}^{\infty} \frac{1}{x^2+4x+9} dx = \int_{-\infty}^{\infty} \frac{1}{(x^2+4x+4)+5} dx$$

$$= \int_{-\infty}^{\infty} \frac{1}{(x+2)^2+5} dx$$

$Misalkan\ u = x+2, maka \frac{du}{dx} = 1 \to dx = du$

$dengan\ batas\ atas\ dan\ bawah\ menjadi\ \infty\ dan - \infty$

$$\int_{-\infty}^{\infty} \frac{1}{u^2+5} du = \int_{-\infty}^{0} \frac{1}{u^2+5} du + \int_{0}^{\infty} \frac{1}{u^2+5} du$$

$$= \lim_{a\to-\infty} \int_a^0 \frac{1}{u^2+5} du + \lim_{b\to\infty} \int_0^b \frac{1}{u^2+5} du$$

$$= \lim_{a\to-\infty} [\frac{\tan^{-1}\frac{x}{\sqrt{5}}}{\sqrt{5}}]_a^0 + \lim_{b\to\infty} [\frac{\tan^{-1}\frac{x}{\sqrt{5}}}{\sqrt{5}}]_0^b$$

$$= \lim_{a\to-\infty} \frac{\tan^{-1}\frac{0}{\sqrt{5}}}{\sqrt{5}} - \frac{\tan^{-1}\frac{a}{\sqrt{5}}}{\sqrt{5}} + \lim_{b\to\infty} \frac{\tan^{-1}\frac{b}{\sqrt{5}}}{\sqrt{5}} - \frac{\tan^{-1}\frac{0}{\sqrt{5}}}{\sqrt{5}}$$

$$= 0 - \frac{\left(-\frac{\pi}{2}\right)}{\sqrt{5}} + \frac{\left(\frac{\pi}{2}\right)}{\sqrt{5}} - 0 \to \frac{\pi}{\sqrt{5}}$$

$$\int_{-\infty}^{\infty} \frac{1}{x^2+4x+9} dx = \frac{\pi}{\sqrt{5}}\ (konvergen)$$

# NOMOR 4

4 a.) $\int_{2}^{\infty} \frac{1}{x|\ln(x)|^2}\,dx$

misal $u = \ln x$

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

$du = \frac{1}{x} \cdot dx$

$dx = x \cdot du$

$\lim_{a \to \infty} \int_{2}^{a} \frac{1}{x(\ln(x))^2}\,dx$

$= \lim_{a \to \infty} \int_{\ln(2)}^{\ln(a)} \frac{1}{(u)^2}\,du$

$= \lim_{a \to \infty} -\frac{1}{u} \Big|_{\ln(2)}^{\ln(a)} du$

$= \lim_{a \to \infty} -\frac{1}{\ln(a)} - \left(-\frac{1}{\ln(2)}\right)$

$= \frac{1}{\ln(2)} \approx 1{,}4927$



4. B $\int_{-\infty}^{\infty} \frac{x}{e^{||x||}}\,dx = \int_{-\infty}^{0} \frac{x}{e^{||x||}}\,dx + \int_{0}^{\infty} \frac{x}{e^{||x||}}\,dx$

$= \int_{-\infty}^{0} x e^{x}\,dx + \int_{0}^{\infty} x e^{-x}\,dx$

$= \lim_{a \to -\infty} [e^{x}x - e^{x}]$ (dari a ke 0) $+ \lim_{b \to \infty} [-e^{-x}x - e^{-x}]$ (dari 0 ke b)

$= \lim_{a \to -\infty} [-1 - (\frac{a}{e^{-a}} - e^{a})] + \lim_{b \to \infty} [-\frac{b}{e^{b}} - e^{-b} - (-1)]$

$= \lim_{a \to -\infty} [-\frac{a}{e^{-a}}] - 1 - 0 + \lim_{b \to \infty} [-\frac{b}{e^{b}}] - 0 - (-1)$

$= \lim_{a \to -\infty} [-\frac{1}{-e^{-a}}] - 1 - 0 + \lim_{b \to \infty} [-\frac{1}{e^{b}}] - 0 - (-1)$ (LHOPITAL)

$= (0 - 1 - 0) + (0 - 0 + 1)$

$= 0$