Kelompok 8

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1) a. $\int_3^{\infty} \frac{x}{\sqrt{16+x^2}}\,dx = \lim_{a\to\infty} \int_3^{a} \frac{x}{\sqrt{16+x^2}}\,dx$

$= \lim_{a\to\infty} \sqrt{16+x^2}\,\Big|_3^{a}$

$= \lim_{a\to\infty} \sqrt{16+a^2} - 5$

$= \infty$ (divergen)

2) a. $\int_2^{\infty} \frac{\ln\sqrt{x}}{x}\,dx = \lim_{a\to\infty} \int_2^{a} \frac{\ln\sqrt{x}}{x}\,dx$

misal:
$y = \ln x$
$dy = \frac{1}{x}\,dx$

$= \lim_{a\to\infty} \frac{1}{2} \int_2^{a} \frac{\ln x}{x}\,dx$

$= \lim_{a\to\infty} \frac{1}{2} \int_{\ln 2}^{\ln a} y \cdot dy$

$= \lim_{a\to\infty} \frac{1}{2}\, \frac{y^2}{2}\Big|_{\ln 2}^{\ln a}$

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

$= +\infty$ (divergen)

3) a. $\int_2^{\infty} \frac{1}{x\ln x}\,dx = \lim_{a\to\infty} \int_2^{a} \frac{1}{x\ln x}\,dx$

misal:
$t = \ln x$
$dt = \frac{1}{x}\,dx$

$= \lim_{a\to\infty} \int_{\ln 2}^{\ln a} \frac{1}{t}\cdot dt$

$= \lim_{a\to\infty} \ln t\,\Big|_{\ln 2}^{\ln a}$

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

$= +\infty$ (divergen)

9 a. $\int_2^\infty \frac{1}{x(\ln x)^2}\,dx = \lim_{a\to\infty} \int_2^a \frac{1}{x(\ln x)^2}\,dx$

misal :

$y = \ln x$

$dy = \frac{1}{x}\,dx$

$= \lim_{a\to\infty} \int_{\ln 2}^{\ln a} \frac{1}{y^2}\,dy$

$= \lim_{a\to\infty} -\frac{1}{y} \Big|_{\ln 2}^{\ln a}$

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

$= \lim_{a\to\infty} -\frac{1}{\ln a} + \frac{1}{\ln 2}$

$= 0 + \frac{1}{\ln 2}$

$= \frac{1}{\ln 2}$

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1\. b. $\int_{-\infty}^{\infty} \frac{x}{\sqrt{9+x^2}}\,dx = \lim_{a\to-\infty} \int_a^0 \frac{x}{\sqrt{9+x^2}}\,dx + \lim_{b\to\infty} \int_0^b \frac{x}{\sqrt{9+x^2}}\,dx$

Misal :

$U = \sqrt{9+x^2}$

$dx = \frac{du\,\sqrt{9+x^2}}{x}$

$= \lim_{a\to-\infty} \int_a^0 du + \lim_{b\to\infty} \int_0^b du$

$= \lim_{a\to-\infty} \sqrt{9+x^2}\,\Big|_a^0 + \lim_{b\to\infty} \sqrt{9+x^2}\,\Big|_0^b$

$= 3 - \sqrt{9+\infty^2} + \sqrt{9+\infty^2} - 3$

$= 3 - \infty + \infty - 3$

$= \infty$ (divergen)

2\. b $\int_{-\infty}^{\infty} \frac{x}{(x^2+4)}\,dx = \lim_{a\to-\infty} \int_a^0 \frac{1}{2u}\,du + \lim_{b\to\infty} \int_0^b \frac{1}{2u}\,du$

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

$= \lim_{a\to-\infty} \frac{1}{2} \cdot \ln(x^2+4)\Big|_a^0 + \lim_{b\to\infty} \frac{1}{2} \cdot \ln(x^2+4)\Big|_0^b$

$= \frac{1}{2}\left[\ln(2) - \frac{1}{2}\ln(\infty^2+4)\right] + \frac{1}{2}\left[\ln(\infty^2+4) - \ln(2)\right]$

$= -\infty + \infty$ (divergen)

3\. b. $\int_{-\infty}^{\infty} \frac{1}{x^2+4x+9}\,dx = \lim_{a\to-\infty} \int_a^0 \frac{1}{x^2+4x+9}\,dx + \lim_{b\to\infty} \int_0^b \frac{1}{x^2+4x+9}\,dx$

$= \lim_{a\to-\infty} \int_a^0 \frac{1}{(x+2)^2+5}\,dx + \lim_{b\to\infty} \int_0^b \frac{1}{(x+2)^2+5}\,dx$

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

$= \lim_{a\to-\infty} \frac{\sqrt{5}\tan^{-1}\left(\frac{x\sqrt{5}+2\sqrt{5}}{5}\right)}{5}\Bigg|_a^0 + \lim_{b\to-\infty} \frac{\sqrt{5}\tan^{-1}\left(\frac{x\sqrt{5}+2\sqrt{5}}{5}\right)}{5}\Bigg|_0^b$

$= \frac{\sqrt{5}\tan^{-1}\left(\frac{2\sqrt{5}}{5}\right) - \sqrt{5}\cdot\frac{-\pi}{2}}{5} + \frac{\sqrt{5}\cdot\frac{\pi}{2} - \sqrt{5}\tan^{-1}\left(\frac{2\sqrt{5}}{5}\right)}{5}$

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$$= \frac{2\pi\sqrt{5}}{10}$$

$$= \frac{\pi\sqrt{5}}{5}$$

9. b. $\int_{-\infty}^{\infty} \frac{x}{e^{|x|}}\,dx = \lim_{a\to-\infty} \int_{a}^{0} \frac{x}{e^{|x|}}\,dx + \lim_{b\to\infty} \int_{0}^{b} \frac{x}{e^{|x|}}\,dx$

$$= \lim_{a\to-\infty} x\cdot e^{x} - e^{x}\Big|_{a}^{0} + \lim_{b\to\infty} x(-e^{-x}) - e^{-x}\Big|_{0}^{b}$$

$$= (-1 + \infty e^{-\infty} + e^{-\infty}) + \left(-\frac{\infty + 1}{e^{\infty}} + 1\right)$$

$$= -1 + 0 + 0 + 0 + 1$$

$$= 0$$