Kelompok 2

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$$\sum_{k=1}^{\infty} \left(\frac{1}{7}\right)^k \quad \text{akan menjadi} \quad \sum_{k=1}^{\infty} \frac{1}{7^k}$$

$$S_n = \frac{1}{7} + \frac{1}{7^2} + \frac{1}{7^3} + \frac{1}{7^4} + \frac{1}{7^n}$$

$$\frac{1}{7} S_n = \frac{1}{7^2} + \frac{1}{7^3} + \frac{1}{7^4} + \frac{1}{7^{n+1}}$$

$$\frac{6}{7} S_n = \frac{1}{7} - \frac{1}{7^{n+1}}$$

$$S_n = \frac{1}{7} - \frac{1}{7^{n+1}} \cdot \frac{7}{6}$$

$$S_n = \frac{1}{6}\left(1 - \frac{1}{7^n}\right)$$

Kekonvergenan :

$$\lim_{n \to \infty} \frac{1}{6}\left(1 - \frac{1}{7^n}\right) = \frac{1}{6} \quad \text{atau} \quad S_n = \frac{a}{1-r} = \frac{\frac{1}{7}}{\frac{6}{7}} = \frac{1}{6}$$

karna ada nilainya maka dia konvergen

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Penentuan apakah deret ini konvergen atau divergen

2. $\sum_{k=1}^{\infty} \frac{k^2-5}{k+2}$

- Uji limit barisannya

$a_k = \frac{k^2-5}{k+2}$

$\lim_{k \to \infty} a_k = \lim_{k \to \infty} \frac{k^2-5}{k+2} = \left(\text{bentuk } \frac{\infty}{\infty}\right)$

$\lim_{k \to \infty} a_k \overset{LH}{=} \lim_{k \to \infty} \frac{\frac{d}{dk}(k^2-5)}{\frac{d}{dk}(k+2)}$

$= \lim_{k \to \infty} \frac{2k}{1} = +\infty$

karena $\lim_{k \to \infty} a_k \neq 0$, maka deret tersebut __Divergen__

③ $\sum_{k=1}^{\infty} \frac{2}{3k}$

$$S_n = \sum_{k=1}^{\infty} \frac{2}{3k}$$

$$S_n = \frac{2}{3} \sum_{k=1}^{\infty} \frac{1}{k}$$

$$= \frac{2}{3}\left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n}\right)$$

$$= \infty \text{ (divergen)}$$

(4) $\sum_{k=2}^{\infty} \left(\underbrace{\frac{1}{k} - \frac{1}{k-1}}_{} \right)$

cari S_n

$$S_n = \left(\frac{1}{2} - \frac{1}{1}\right) + \left(\frac{1}{3} - \frac{1}{2}\right) + \left(\frac{1}{4} - \frac{1}{3}\right)$$

$$= -1 + \frac{1}{k}$$

$$\lim_{n \to \infty} S_n = \lim_{n \to \infty} \frac{1}{k} - 1$$

$$= -1$$ konvergen ke -1

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5. $\sum_{k=0}^{\infty} \frac{1}{k+3}$

$F = \frac{1}{k+3}$ kontinu ✓, Positif ✓, tak naik ✓] maka bisa menggunakan uji Integral

$\frac{1}{k+3} - \frac{1}{k+4}$

$\frac{k+4-k-3}{(k+4)(k+3)} \Rightarrow \frac{1}{(k+4)(k+3)} > 0$

$\int_1^{\infty} \frac{1}{k+3}\, dk \rightarrow$ misal $u = k+3$, $du = dk$ — batas atas $= \infty$, batas bawah $= 4$

$\lim_{b\to\infty} \int_4^b \frac{1}{u}\, du \Rightarrow \lim_{b\to\infty} [\ln u]_4^b$

$\lim_{b\to\infty} \ln b - \ln 4 \Rightarrow \infty$ (divergen)

maka

$\sum_{k=0}^{\infty} \frac{1}{k+3}$ (divergen)

DATE :

Menentukan Kekonvergenan

6. $\sum_{k=1}^{\infty} \frac{3}{2k-3}$

$\hookrightarrow \sum_{k=1}^{\infty} \frac{3}{2k-3} = -3 + \underbrace{\sum_{k=2}^{\infty} \frac{3}{2k-3}}_{\text{misal } a_n}$ → $a_n > 0$ ketika $k \in [2, \infty)$

$a_{n+1} - a_n = \frac{3}{2k-1} - \frac{3}{2k-3} < 0$ (barisan tak naik)

a_n kontinu pada selang $[2, \infty)$

Maka bisa menggunakan Uji Integral untuk memeriksa kekonvergena a_n

Uji Integral

$\hookrightarrow \int_2^{\infty} \frac{3}{2k-3}\, dk = \lim_{a\to\infty} \int_2^a \frac{3}{2k-3}\, dk$

$= \lim_{a\to\infty} \left[\frac{3}{2} \ln(2k-3) \right]_2^a$

$= \lim_{a\to\infty} \frac{3}{2} \ln(2a-3) - 0$

$= \infty$ (divergen)

maka $\sum_{k=1}^{\infty} \frac{3}{2k-3} = -3 + \sum_{k=2}^{\infty} \frac{3}{2k-3}$ merupakan deret yang diverge

$-3 + \sum_{k=2}^{\infty} \frac{3}{2k-3} \rightarrow$ konvergen + divergen = diverge

7. $$\sum_{k=0}^{\infty} \frac{k}{k^2+3}$$

$$= \lim_{b\to\infty} \int_0^b \frac{x}{x^2+3}\,dx$$

$u = x^2+3$
$du = 2x\,dx$
$\frac{1}{2}du = x\,dx$

$$= \lim_{b\to\infty} \frac{1}{2} \int_{3}^{b^2+3} \frac{1}{u}\,du$$

$$= \lim_{b\to\infty} \frac{1}{2} \left(\ln u \Big|_3^{b^2+3} \right.$$

$$= \lim_{b\to\infty} \frac{1}{2} \left(\ln (b^2+3) - \ln(3) \right)$$

$= \infty$ (diverge)

8. $$\sum_{k=1}^{\infty} \frac{3}{2k^2+1}$$

$$\int_1^{\infty} \frac{3}{2x^2+1} = \lim_{b\to\infty} \int_1^b \frac{3}{2x^2+1}$$

$$= \lim_{b\to\infty} \left[\frac{3\sqrt{2} \tan^{-1} \sqrt{2}x}{2} \right|_1^b$$

$$= \lim_{b\to\infty} \frac{3\sqrt{2} \tan^{-1} \sqrt{2}(b)}{2} - \frac{3\sqrt{2} \tan^{-1} \sqrt{2}(1)}{2}$$

$$= \frac{3\sqrt{2}\pi - 6\sqrt{2} \tan^{-1} \sqrt{2}}{4}$$ (konvergen)