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Tentukan apakah deret ini konvergen atau divergen. Jika divergen, cari nilainya

$\boxed{1}$. $\sum_{k=1}^{\infty} \left(\frac{1}{7}\right)^k$

Jwb : Deret tsb merupakan deret geometri dgn $a = \frac{1}{7}$, $r = \frac{1}{7}$.
Berdasarkan teorema kekonvergenan deret geometri, jika $|r| < 1$ maka deret geometri tsb konvergen. Dengan jumlah :

$$S = \frac{a}{1-r} = \frac{1/7}{1-1/7} = \frac{1}{6} \quad //$$

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

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

$$\lim_{n\to\infty} a_k = \lim_{n\to\infty} \frac{k^2-5}{k+2}$$

$$\overset{L'H}{=} \lim_{n\to\infty} \frac{2k}{1}$$

$$= \infty$$

Karena $\lim_{n\to\infty} \neq 0$ maka deret divergen

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

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

$\frac{1}{k}$ merupakan deret harmonik, sehingga

soal nomor 3 bernilai divergen

5) $\sum_{k=0}^{\infty} \frac{1}{k+3} = \int_0^{\infty} \frac{1}{k+3}\, dk$

$$\int_0^{\infty} \frac{1}{k+3}\, dk = \lim_{b \to \infty} \int_0^{b} \frac{1}{k+3}\, dk$$

$$= \lim_{b \to \infty} \int_0^{b} 1(k+3)^{-1}\, dk$$

$$= \lim_{b \to \infty} \int_0^{b} \frac{1 \cdot (k+3)^{-1+1}}{-1+1 \cdot 1} + C$$

$$= \lim_{b \to \infty} \int_0^{b} \frac{1}{0} + C$$

$$= \infty$$

$$= \text{divergen}$$

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

syarat uji integral: $f(k)$ kontinu $= \checkmark$

$F(x)$ positif $= \checkmark$

tak naik $= \checkmark$

$$\lim_{b \to \infty} \int_1^{b} \frac{2}{2x-3}\, dx$$ misal $u = 2x-3$, $du = 2\,dx$

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

$$\lim_{b \to \infty} \left(\ln |u| \Big|_{-1}^{2b-3} \right)$$

$$\lim_{b \to \infty} \ln|2b-3| - \ln|-1|$$

∞ (divergen)

7). $\sum_{k=0}^{\infty} \frac{k}{k^2+3} = \int_0^{\infty} \frac{k}{k^2+3} \, dk$

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

misal $u = k^2+3 \longrightarrow du = 2k \, dk$

$= \lim_{b \to \infty} \int_0^b \frac{k}{u} \cdot \frac{du}{2k}$

$= \lim_{b \to \infty} \int_0^b \frac{1}{2} \cdot \frac{1}{u} \, du$

$= \lim_{b \to \infty} \frac{1}{2} \int_0^b \frac{1}{u} \, du$

$= \lim_{b \to \infty} \frac{1}{2} \ln |u| \Big]_0^b$

$= \frac{1}{2} \lim_{b \to \infty} \ln |k^2+3| \Big]_0^b$

$= \frac{1}{2} \lim_{b \to \infty} \left[\ln |(b)^2+3| - \ln |(0)^2+3| \right]$

$= \frac{1}{2} \lim_{b \to \infty} \left[\ln |b^2+3| - \ln 3 \right]$

$= \infty$

= divergen

8) $\sum_{k=1}^{\infty} \frac{3}{2k^2+1} = \lim_{b \to \infty} \int_1^b \frac{3}{2k^2+1} \, dx$

$= \lim_{b \to \infty} \frac{3\sqrt{2} \tan^{-1} \sqrt{2}\, x}{2} \Big]_1^b$

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

konvergen