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Nama : Pramas Ray Lapian
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1. $\sum_{n=1}^{\infty} \frac{n^2}{n^5+5}$

$a_n = \frac{n^2}{n^5+5}$, $b_n = \frac{n^2}{n^5}$

$a_n = \frac{n^2}{n^5+5}$, $b_n = \frac{1}{n^3} \to \sum_{n=1}^{\infty} \frac{1}{n^3}$ → uji banding p (p = 3), p > 1, maka konvergen

karena $\frac{n^2}{n^2+5} < \frac{1}{n^3}$, dan $\sum_{n=1}^{\infty} \frac{1}{n^3}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{n^2}{n^5+5}$ konvergen

2. $\sum_{n=6}^{\infty} \frac{1}{n-5}$

$a_n = \frac{1}{n-5} > b_n = \frac{1}{n} \to \sum_{n=6}^{\infty} \frac{1}{n}$ → uji banding p (p = 1), p ≤ 1, maka divergen

karena $\frac{1}{n-5} > \frac{1}{n}$ dan $\sum_{n=1}^{\infty} \frac{1}{n}$ divergen, maka $\sum_{n=6}^{\infty} \frac{1}{n-5}$ divergen

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

$a_n = \frac{1}{2^n+1} < b_n = \frac{1}{2^n}$

→ Uji b_n

$$\sum_{n=1}^{\infty} \frac{1}{2^n} = \lim_{b \to \infty} \int_1^b \frac{1}{2^x} dx = -\frac{1}{\ln(2).2^x} + C \Big]_1^b$$

$$= \lim_{b \to \infty} \left[-\frac{1}{\ln(2).2^{\infty}} + \frac{1}{\ln(2)2^1} \right] = \left[-\frac{1}{\infty} + \frac{1}{(0,6)2} \right.$$

$$= 0 + \frac{1}{(0,6)(2)} = \frac{1}{(0,6..)(2)}$$

karena $a_n = \frac{1}{2^n+1} < b_n \frac{1}{2^n}$ dan $\sum_{n=1}^{\infty} \frac{1}{2^n}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{1}{2^n+1}$ konvergen

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4. $\sum_{n=1}^{\infty} \frac{6+\cos n}{n^2}$

$a_n = \frac{6+\cos n}{n^2} < b_n = \frac{8}{n^2} = 0 \rightarrow 8 \sum_{n=1}^{\infty} \frac{1}{n^2} \rightarrow$ uji banding $P(p>1)$, maka b_n konvergen

karena $a_n = \frac{6+\cos n}{n^2} < b_n = \frac{8}{n^2}$ dan $\sum_{n=1}^{\infty} \frac{8}{n^2}$ konvergen, maka

$\sum_{n=1}^{\infty} \frac{6+\cos n}{n^2}$ konvergen

5. $\sum_{n=1}^{\infty} \frac{1}{\sqrt{2n-1}}$

$a_n = \frac{1}{\sqrt{2n-1}} > b_n > \frac{1}{\sqrt{2n}} \rightarrow \frac{1}{\sqrt{2}\sqrt{n}} \rightarrow \frac{1}{\sqrt{2}} \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} \rightarrow$ uji banding $P(p \leq 1)$, maka b_n divergen

karena $a_n = \frac{1}{\sqrt{2n-1}} > b_n = \frac{1}{\sqrt{2n}}$ dan $\sum_{n=1}^{\infty} \frac{1}{\sqrt{2n}}$ divergen, maka

$\sum_{n=1}^{\infty} \frac{1}{\sqrt{2n-1}}$ adalah divergen

6. $\sum_{n=1}^{\infty} \frac{\sqrt{n}}{n-1}$

$a_n = \frac{\sqrt{n}}{n-1} > \frac{\sqrt{n}}{n} \rightarrow \sum_{n=1}^{\infty} \frac{1}{\sqrt{n}} \rightarrow$ uji banding $P(p \leq 1)$, maka b_n divergen.

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1. $\sum_{n=1}^{\infty} \frac{n}{n^2+2n+3}$ $\quad B_n = \frac{n}{n^2}$

$\lim_{n\to\infty} \frac{\frac{n}{n^2+2n+3}}{\frac{1}{n}} = \lim_{n\to\infty} \frac{n^2}{n^2+2n+3} = P \frac{n^2}{n^2\left(1+\frac{2}{n}+\frac{3}{n^2}\right)}$

$\frac{1}{\left(1+\frac{2}{\infty}+\frac{3}{\infty}\right)} = \frac{1}{(1+0+0)} = 1$

karena $\sum_{n=1}^{\infty} \frac{1}{n}$ adalah divergen, maka $\sum_{n=1} \frac{n}{n^2+2n+3}$ divergen

2. $\sum_{n=1}^{\infty} \frac{1}{n\sqrt{n+1}} = \sum_{n=1}^{\infty} \frac{1}{\sqrt{n^3+n^2}}$ $\quad B_n = \frac{1}{\sqrt{n^3}}$

$\lim \frac{\frac{1}{n\sqrt{n+1}}}{\frac{1}{\sqrt{n^3}}} = \lim_{n\to\infty} \frac{\sqrt{n}}{\sqrt{n+1}} = \lim_{n\to\infty} \sqrt{\frac{n}{n\left(1+\frac{1}{n}\right)}} = \sqrt{\frac{1}{1+0}} = 1$

karena $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^3}}$ adalah konvergen, maka $\sum_{n=1}^{\infty} \frac{1}{n\sqrt{n+1}}$ konvergen

3. $\sum_{n=1}^{\infty} \frac{\sqrt{2n+3}}{n^2}$ $\quad b_n = \frac{\sqrt{2n}}{n^2}$

$\lim_{n\to\infty} \frac{\frac{\sqrt{2n+3}}{n^2}}{\frac{\sqrt{2n}}{n^2}} \to \frac{\sqrt{2n+3}}{n^2} \cdot \frac{n^2}{\sqrt{2n}} = \sqrt{\frac{2n\left(1+\frac{3}{2n}\right)}{2n}} = \sqrt{1+\frac{3}{\infty}} = 1$

karena $\sum_{n=1}^{\infty} \frac{\sqrt{2n}}{n^2}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{\sqrt{2n+3}}{n^2}$ konvergen

4. $\sum_{n=1}^{\infty} \frac{3n+1}{n^3-4}$ $\quad B_n = \frac{3n}{n^3} = \frac{3}{n^2}$

$\lim_{n\to\infty} \frac{\frac{3n+1}{n^3-4}}{\frac{3}{n^2}} \to \frac{3n+1}{n^3-4} \cdot \frac{n^2}{3} = \frac{3n^3+n^2}{3n^3-12} = \frac{3n^3\left(1+\frac{n^2}{3n^3}\right)}{3n^3\left(1-\frac{12}{3n^3}\right)}$

$= \frac{\left(1+\frac{1}{3n}\right)}{\left(1-\frac{12}{3n^3}\right)} = \frac{(1+0)}{1-0} = 1$

karena $\sum_{n=1}^{\infty} \frac{3}{n^2}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{3n+1}{n^3-4}$ konvergen

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5. $\sum_{n=1}^{\infty} \frac{\ln n}{n^2}$ $\quad b_n = \frac{1}{n^{3/2}}$

$\lim_{n \to \infty} \frac{\frac{\ln n}{n^2}}{\frac{1}{n^{3/2}}} = \frac{\ln n}{\sqrt{n}} = 0$

karena $\sum_{n=1}^{\infty} \frac{\ln}{(n)^{3/2}}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{\ln n}{n^2}$ konvergen

6. $\sum_{n=1}^{\infty} \frac{1}{2^n - 1}$ $\quad b_n = \frac{1}{2^n}$

$\lim_{n \to \infty} \frac{\frac{1}{2^n-1}}{\frac{1}{2^n}} = \lim_{n \to \infty} \frac{2^n}{2^n - 1} = \frac{2^n}{2^n(1 - \frac{1}{2^n})} = \frac{1}{1 - 0} = 1$

karena $\sum_{n=1}^{\infty} \frac{1}{2^n}$ konvergen, maka $\sum_{n=1}^{\infty} \frac{1}{2^n - 1}$ konvergen

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1. $\sum_{n=1}^{\infty} \frac{n^2}{n!}$

$a_n = \frac{n^2}{n!}$ $\quad a_{n+1} : \frac{(n+1)^2}{(n+1)!}$

$P = \lim_{n \to \infty} \frac{\frac{(n+1)^2}{(n+1)!}}{\frac{n^2}{n!}} = \lim_{n \to \infty} \frac{(n+1)^2}{(n+1)!} \cdot \frac{n!}{n^2} = \frac{(n+1)^2}{(n+1)(n^2)} = \frac{(n+1)}{n^2}$

$= \frac{n^2\left(\frac{1}{n} + \frac{1}{n^2}\right)}{n^2} = 0$

karena $P = 0$, $P < 1$, maka $\sum_{n=1}^{\infty} \frac{n^2}{n!}$ konvergen

2. $\sum_{n=1}^{\infty} \frac{n!}{4^n}$

$a_n : \frac{n!}{4n}$ $\quad a_{n+1} = \frac{(n+1)!}{4^{n+1}}$

$P = \lim_{n \to \infty} \frac{(n+1)!}{4^{n+1}} \frac{4^n}{n!} = \frac{(n+1)(4^n)}{(4^n)(4)} = \infty$

karena $P = \infty$, $P > 1$, maka $\sum_{n=1}^{\infty} \frac{n!}{4^n}$ Divergen

3. $\sum_{n=1}^{\infty} \frac{n!}{n^n}$

$a_n = \frac{n!}{n^n}$ $\quad a_{n+1} \frac{(n+1)!}{(n+1)^{n+1}}$

$\lim_{n \to \infty} \frac{(n+1)!}{(n+1)^{n+1}} \frac{n^n}{n!} = \frac{(n+1)(n^n)}{(n+1)(n+1)^n} = \left(\frac{n}{n+1}\right)^n = \frac{1}{\left(\frac{n+1}{n}\right)^n} = \frac{1}{\left(\frac{n\left(1+\frac{1}{n}\right)}{n}\right)^n}$

$= \frac{1}{\left(1+\frac{1}{n}\right)^n} = \frac{1}{e} < 1$

karena $P = \frac{1}{e}$, $P < 1$, maka $\sum_{n=1}^{\infty} \frac{n!}{n^n}$ konvergen

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4. $\sum_{n=1}^{\infty} \frac{4^n+n}{n!}$

$a_n = \frac{4^n+n}{n!}$ $\quad a_{n+1} = \frac{4^{n+1}+(n+1)}{(n+1)!}$

$\lim_{n\to\infty} \frac{4^{n+1}+(n+1)}{(n+1)!} \cdot \frac{n!}{4^n+n} = \frac{(4^{n+1})+(n+1)}{(n+1)(4^n+n)} = \frac{(4^{n+1})}{(n+1)(4^n+n)} + \frac{n+1}{(n+1)(4^n+n)}$

$4 \lim_{n\to\infty} \frac{4n}{4^n\left(\frac{n}{4^n}+\frac{1}{4^n}\right)\left(1+\frac{n}{4^n}\right)} = 4(0+0) = 0$

[redacted] $\sum_{n=1}^{\infty} \frac{4^n+n}{n!}$ konvergen, karena [redacted] $P = 0$, $P < 1$

6. $\sum_{n=1}^{\infty} \frac{n^3}{(2n)!}$

$a_n = \frac{n^3}{(2n)!}$ $\quad a_{n+1} = \frac{(n+1)^3}{(2n+2)!}$

$\lim_{n\to\infty} \frac{(n+1)^3}{(2n+2)!} \cdot \frac{(2n)!}{n^3} = \frac{(n+1)^3}{(2n+2)(n^3)} = \frac{(n+1)(n+1)^2}{2(n+1)(n^3)}$

$\frac{1}{2} \lim_{n\to\infty} \frac{(n+1)^2}{(n^3)} = \frac{n^3\left(\frac{1}{n^2}+\frac{1}{n^3}\right)}{n^3} = \left(\frac{1}{2}\right)\left(0+0\right) = 0$

[redacted] $\sum_{n=1}^{\infty} \frac{n^3}{(2n)!}$ konvergen, karena $P=0$, $P < 1$

5. $\sum_{n=1}^{\infty} \frac{5+n}{n!}$

$a_n = \frac{5+n}{n!}$ $\quad a_{n+1} = \frac{5+(n+1)}{(n+1)!}$

$\lim_{n\to\infty} \frac{5+(n+1)}{(n+1)!} \cdot \frac{n!}{5+n} = \frac{5+(n+1)}{(n+1)(5+n)} = \frac{\frac{5}{n+1}+\left(\frac{n+1}{n+1}\right)}{\left(\frac{n+1}{n+1}\right)\left(\frac{5+n}{n+1}\right)} = \frac{0+1}{\infty} = 0$

$\sum_{n=1}^{\infty} \frac{5+n}{n!}$ konvergen, karena $P=0$, $P < 1$