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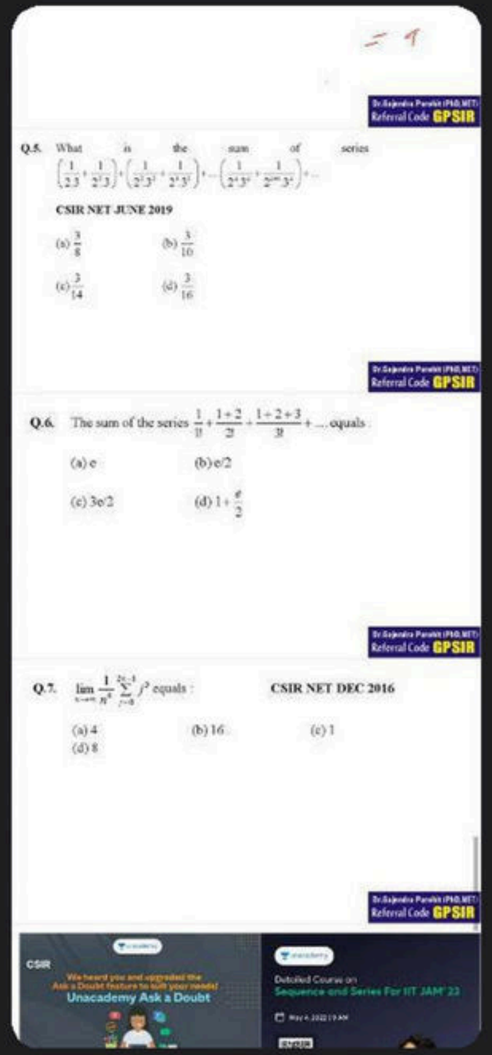

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Q.5. What is the sum of series $\left(\frac{1}{2.3}+\frac{1}{2^2.3}\right)+\left(\frac{1}{2^2.3^2}+\frac{1}{2^3.3^3}\right)+\cdots\left(\frac{1}{2^n.3^n}+\frac{1}{2^{n+1}.3^{n+1}}\right)+\cdots$

CSIR NET JUNE 2019

(a) $\frac{3}{8}$ (b) $\frac{3}{10}$

(c) $\frac{3}{14}$ (d) $\frac{3}{16}$

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Q.6. The sum of the series $\frac{1}{1!}+\frac{1+2}{2!}+\frac{1+2+3}{3!}+\ldots$ equals :

(a) e (b) e/2

(c) 3e/2 (d) $1+\frac{e}{2}$

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Q.7. $\lim_{n\to\infty}\frac{1}{n^3}\sum_{j=0}^{2n-1}j^2$ equals : CSIR NET DEC 2016

(a) 4 (b) 16 (c) 1

(d) 8

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Sum of the telescoping series : $\sum(t_n - t_{n+1})$ is telescoping series, then

$t_1 - t_2 + t_2 - t_3 + t_3 - t_4 + \ldots\ldots + t_n - t_{n+1} = t_1 - t_{n+1}$.

$\Rightarrow$ Sum of given series is $t_1 - \lim_{n\to\infty} t_{n+1}$.

Note : If telescoping series is convergent then this series is converge to sum of this series.

Q1. Let $a_1 = 1$ and $a_n = 2 - \frac{1}{n}$ for $n \geq 2$, then

$\sum_{n=1}^{\infty}\left(\frac{1}{a_n^{\,2}} - \frac{1}{a_{n+1}^{2}}\right)$ converges to

(a) 1

(b) $\frac{1}{2}$

(c) $\frac{1}{3}$

(d) $\frac{3}{4}$

Q2. Let $<a_n>$ be a sequence of real numbers such that $a_1 = 1$ and $\lim_{n\to\infty} a_n = 3$, then the value of $\sum_{n=1}^{\infty}\left(a_{n+1}^2 - a_n{}^2\right)$ is

(a) 7 (b) 8

(c) 9 (d) 10

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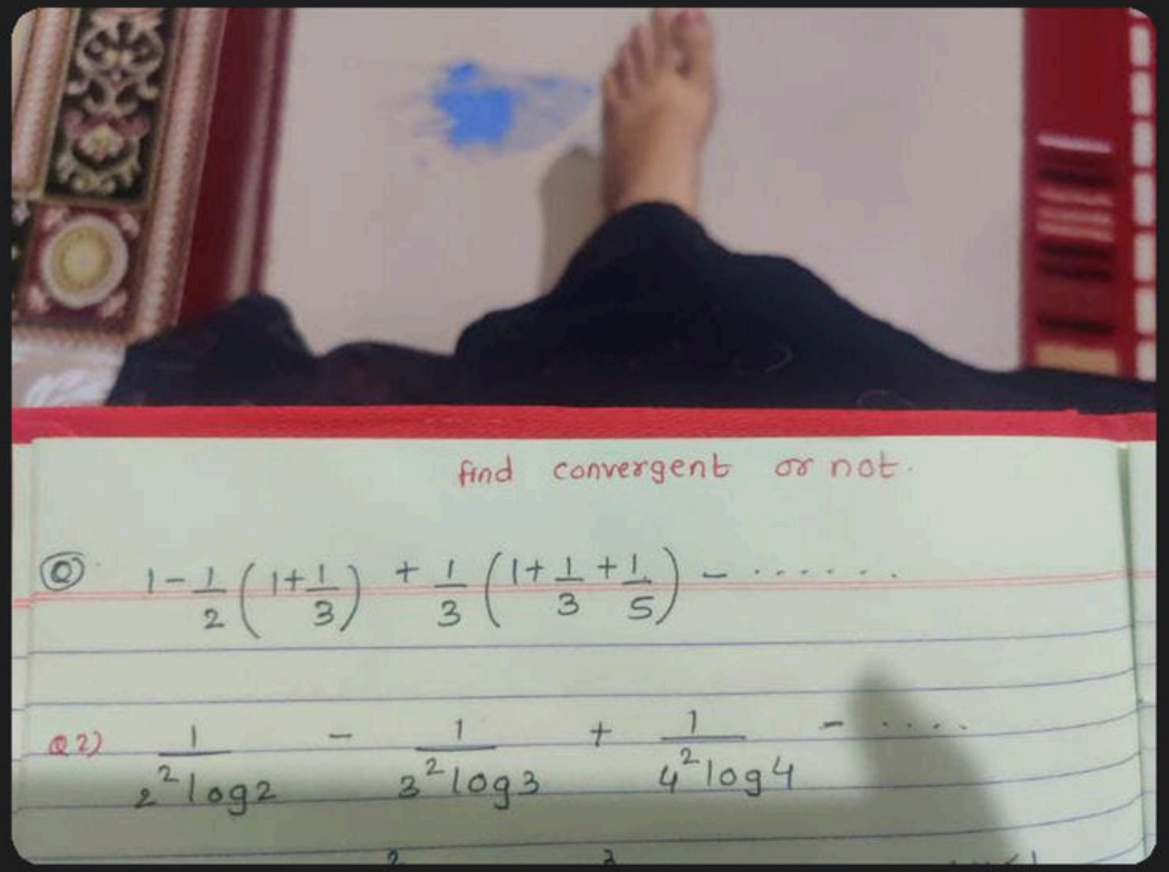

Result :

(1) Sum of series $\sum \frac{1}{n(n+1)}$ is $1 = \frac{1}{1}.\frac{1}{1!}$.

(2) Sum of series $\sum \frac{1}{n(n+1)(n+2)}$ is $\frac{1}{4} = \frac{1}{2}.\frac{1}{2!}$

(3) Sum of series $\sum \frac{1}{n(n+1)(n+2)(n+3)}$ is

$\frac{1}{3}.\frac{1}{3!} = \frac{1}{3\times 6} = \frac{1}{18}$.

(4) Sum of serries $\sum \frac{1}{n(n+1).....(n+m)}$ is $\frac{1}{m}.\frac{1}{m!}$.

Q3. The sum of the series $\sum \frac{1}{n(n+1)(n+2)}$.

(a) 1 (b) $\frac{1}{2}$

(c) $\frac{1}{4}$ (d) $\frac{1}{8}$

Sum of Series of type $\sum_{k=1}^{n} f(n,k) = \frac{1}{n}\sum_{k=1}^{n} f\left(\frac{k}{n}\right)$

Step – 1 : Re – write the series in the form $\frac{1}{n}\sum_{k=1}^{n} f\left(\frac{k}{n}\right)$

Step – 2 : Put $\frac{1}{n} = dx$ & $\frac{k}{n} = x$ then Change summition into integration with limit 0 to 1

Step – 3 : Integrate and get final solution

Q4. The value of $\lim_{n\to\infty}\sum_{k=1}^{n}\frac{1}{\sqrt{n^2+kn}}$ is **[IIT-JAM 2011]**

(A) $2\left(\sqrt{2}-1\right)$

(B) $2\sqrt{2}-1$

(C) $2-\sqrt{2}$

(D) $\frac{1}{2}\left(\sqrt{2}-1\right)$

Sum of series by expansion :

We know that (i) $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots.$

(ii) $e^{-x} = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \ldots.$

(iii) $\log(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} \ldots$

(iv) $\log(1-x) = -x - \frac{x^2}{2} - \frac{x^3}{3} - \frac{x^4}{4} \ldots$

(v) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} \ldots\ldots$

(vi) $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} \ldots\ldots$

(vii) $\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \ldots\ldots$

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Q5. Let $a_n = n + \frac{1}{n}$, $n \in N$. Then the sum of the series

$\sum_{n=1}^{\infty} (-1)^n \frac{a_{n+1}}{\lfloor n}$ is **[IIT-JAM 2018]**

(A) $e^{-1} - 1$

(B) e^{-1}

(C) $1 - e^{-1}$

(D) $1 + e^{-1}$

Q6. The value of the series $\sum_{n=1}^{\infty} \frac{n}{2^n}$ is

(A) 1 (B) 3

(C) 2 (D) 4

Q7. The sum of the series $\sum_{n=2}^{\infty} \frac{(-1)^n}{n^2+n-2}$ is

[IIT-JAM 2016]

(A) $\frac{1}{3}\ln 2 - \frac{5}{18}$

(B) $\frac{1}{3}\ln 2 - \frac{5}{6}$

(C) $\frac{2}{3}\ln 2 - \frac{5}{18}$

(D) $\frac{2}{3}\ln 2 - \frac{5}{6}$

Q8. $\sum_{n=1}^{\infty} \tan^{-1} \frac{2}{n^2} = \text{is}$ **[IIT-JAM 2016]**

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{2}$

(C) $\frac{3\pi}{4}$

(D) π

Q9. The sum of the finite series $S = \frac{1}{2} - \frac{1}{3\times1!} + \frac{1}{4\times2!} - \frac{1}{5\times3!} + \ldots\ldots$ is equal to

[CSIR-NET Nov. 2020]

(A) $2 - \frac{1}{e}$ (B) $1 - \frac{2}{e}$

(C) $\frac{2}{e} - 1$ (D) $\frac{1}{e} - 2$

Q10. Let $S_1 = \frac{1}{3} - \frac{1}{2}\times\frac{1}{3^2} + \frac{1}{3}\times\frac{1}{3^3} - \frac{1}{4}\times\frac{1}{3^4} + \ldots\ldots$ and $S_2 = \frac{1}{4} + \frac{1}{2}\times\frac{1}{4^2} + \frac{1}{3}\times\frac{1}{4^3} + \frac{1}{4}\times\frac{1}{4^4} + \ldots\ldots$ Which of the following identities is true?

[CSIR-NET Feb. 2022]

(A) $3S_1 = 4S_2$ (B) $4S_1 = 3S_2$

(C) $S_1 + S_2 = 0$ (D) $S_1 = S_2$

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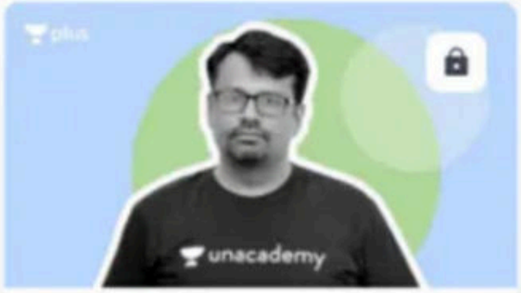

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