38. Find the sum of the series $\Sigma_{n=1}^{\infty} 1/n^5$ correct to three decimal places.

Want $R_n < .0005$ to get that 3^{rd} decimal place.

$$\int_{n+1}^{\infty} \frac{dx}{x^5} \le R_n \le \int_n^{\infty} \frac{dy}{x^5}$$

So, make $\int_n^{\infty} \frac{dy}{x^5} \le .0005$ ∴

the error $= R_n = a_{n+1} + a_{n+2} + \cdots$

$= n$-tail for $S' = S' - S'_n$ will be $< .0005$!

$$\int_n^{\infty} \frac{dx}{x^5} \;\vdots\; \int_n^{t} \frac{dx}{x^5} = -\frac{1}{4} \cdot \frac{1}{x^4}\Big]_n^t = -\frac{1}{4x^4}\Big]_n^t$$

Not an = sign!

$$= -\frac{1}{4t^4} - \left(-\frac{1}{4n^4}\right) = -\frac{1}{4t^4} + \frac{1}{4n^4} \xrightarrow{t \to \infty} \frac{1}{4n^4}$$

$$= \frac{1}{4n^4} \overset{\text{want}}{\le} .0005 \longrightarrow$$

$$1 \le (4n^4)(.0005) = .002n^4$$

$$1 \le .002n^4$$

$$500 = \frac{1}{.002} \le n^4$$

$$5 \leftarrow 4.729 \approx \sqrt[4]{500} \le (n^4)^{\frac{1}{4}} = n$$

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~~.002^.25~~
    ~~.2114742527~~
500^.25
    4.728708045
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$\boxed{n = 5 \text{ should do it!}}$

Now to make sure of "$<$" vs "$\le$" in the above. ✓