$f(x) = \dfrac{x^5}{x^6 + 3}$ is continuous and positive on $[2, \infty)$, and also decreasing since $f'(x) = \dfrac{x^4(15 - x^6)}{(x^6 + 3)^2} < 0$ for $x \geq 2$, so we can use the Integral Test [note that f is *not* decreasing on $[1, \infty)$].

$\int_2^\infty \dfrac{x^5}{x^6 + 3}\, dx = \lim_{t \to \infty} \left[\frac{1}{6} \ln(x^6 + 3)\right]_2^t = \frac{1}{6} \lim_{t \to \infty} [\ln(t^6 + 3) - \ln 67] = \infty$,

so the series $\sum_{n=2}^{\infty} \dfrac{n^5}{n^6 + 3}$ diverges, and so does the given series, $\sum_{n=1}^{\infty} \dfrac{n^5}{n^6 + 3}$.