The function $f(x) = \frac{5}{x^6}$ is continuous, positive, and decreasing on $[1, \infty)$, so the Integral Test applies.

$$\int_1^{\infty} \frac{5}{x^6}\, dx = \lim_{t\to\infty} \int_1^t 5x^{-6}\, dx = \lim_{t\to\infty} 5\left[\frac{x^{-5}}{-5}\right]_1^t = \lim_{t\to\infty} 5\left(-\frac{1}{5t^5} + \frac{1}{5}\right) = 1.$$

Since this improper integral is convergent, the series $\sum\limits_{n=1}^{\infty} \frac{5}{n^6}$ is also convergent by the Integral Test.