Determine whether the sequence $\left\{\left(\dfrac{n^2-2}{n^2+3}\right)^n\right\}$ ☐ converges or diverges, and if it converges find its limit.

Determine whether the sequence $\left\{\left(\dfrac{n+1}{n}\right)^{5n}\right\}$ converges or diverges, and if it converges find its limit.

Find the sum of the series

$$\sum_{n=1}^{\infty} \frac{4}{7^{n-1}} + \sum_{n=4}^{\infty} \frac{12}{(2n-6)(2n-4)}.$$

Find the sum of the series:

$$\sum_{n=1}^{\infty} \left[\frac{5^n}{3^{2n}} + \frac{1}{(n+2)(n+3)}\right].$$

Find the sum of the series:

$$\sum_{n=1}^{\infty} \left[\cos \left(\frac{1}{n} \right) - \cos \left(\frac{1}{n+3} \right) \right].$$