The geometric series
\[ \sum_{i=1}^{\infty} ar^{i-1} = a + ar + ar^2 + \cdots \]
is convergent if \(|r| < 1\) and its sum is
\[ \sum_{i=1}^{\infty} ar^{i-1} = \frac{a}{1 - r}, \quad |r| < 1. \]

If \(|r| \geq 1\), the geometric series is divergent.

1. Determine whether the geometric series is convergent or divergent. If it is convergent, find its sum.

   (a) \[ 5 - \frac{10}{3} + \frac{20}{9} - \frac{49}{27} + \cdots \]

   (b) \[ \sum_{n=1}^{\infty} 2^{2n} \cdot 3^{1-n} \]
2. The $n$th partial sum is $s_n = a + ar + ar^2 + \cdots + ar^{n-1}$.

(a) Compute $s_n - rs_n$. Note that all but two terms should cancel out.

(b) Assuming $r \neq 1$, use this equation to solve for $s_n$.

(c) Show that $\lim_{n \to \infty} s_n = \frac{a}{1-r}$ if $|r| < 1$. 