

$$\begin{aligned}
\sum_{n=0}^{\infty} \frac{1}{T_{mn+r}} &= \frac{2}{m} \sum_{0 < j < m/2} \left\{ \left[\cos \left(\frac{2\pi j(r+1)}{m} \right) - \cos \left(\frac{2\pi jr}{m} \right) \right] \right. \\
&\quad \cdot \ln \left[2 - \cos \left(\frac{2\pi j}{m} \right) \right] - \left[\sin \left(\frac{2\pi j(r+1)}{m} \right) - \sin \left(\frac{2\pi jr}{m} \right) \right] \\
&\quad \left. \cdot \frac{\pi(m-2j)}{m} \right\} + 2\delta_{mr} + \varepsilon_m \cdot (-1)^{r+1} 2 \ln(n)
\end{aligned}$$