Consider the sequence $\left\{\dfrac{5k^2-42}{3k^2+5}\right\}_{k=1}^{\infty}$. We want to know whether or not this sequence converges, and if so, what to.

Just to try to get a feel for what's going on with this sequence, let's look at the first several terms of this sequence.

k	$a_k = \frac{5k^2-42}{3k^2+5}$
1	$\frac{5\cdot 1^2-42}{3\cdot 1^2+5} = -\frac{37}{8}$
2	$\frac{5\cdot 2^2-42}{3\cdot 2^2+5} = -\frac{22}{17}$
3	$\frac{5\cdot 3^2-42}{3\cdot 3^2+5} = \frac{3}{32}$
4	$\frac{38}{53}$
5	$\frac{83}{80}$
6	$\frac{138}{113}$

Thus the sequence begins like

$$\{-\frac{37}{8}, -\frac{22}{17}, \frac{3}{32}, \frac{38}{53}, \frac{83}{80}, \frac{138}{113}, \ldots\}$$

Do the following sequences converge or diverge?
If the sequence converges, find the limit.

1. $\left\{ \dfrac{j^2 + 32j}{e^j} \right\}_{j=3}^{\infty}$

2. $\left\{ \dfrac{\sin(k)}{k^2} \right\}_{k=1}^{\infty}$

Example: $\sum_{k=0}^{\infty}\left(\frac{1}{2}\right)^k$ is a geometric series, with $r = \frac{1}{2}$.

The associated **sequence of terms** $\{a_k\}$ is

$$\left\{\left(\frac{1}{2}\right)^k\right\}_{k=0}^{\infty} = \{1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots\}$$

The associated **sequence of partial sums** S_n is

$$\begin{aligned}\{1, 1+\frac{1}{2}, 1+\frac{1}{2}+\frac{1}{4}, 1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8},\\ 1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}, \ldots\} \quad = \quad \{1, \frac{3}{2}, \frac{7}{4}, \frac{15}{8}, \frac{31}{16}, \ldots\}\end{aligned}$$