Problem. Find the general term of the sequence
\[ \{a_n\} = \{4, \frac{1}{9}, \frac{1}{4}, \frac{4}{25}, \ldots\} \quad a_n = \ ? \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.
\[ \{a_n\} = \left\{ \frac{(-1)^n}{n^2} \right\} \]

\[ \lim_{n \to \infty} \frac{1}{n^2} = 0 \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.
\[ \{a_n\} = \left\{ \frac{-1(n-3)!}{(n+3)!} \right\} \]

\[ \lim_{n \to \infty} \frac{(n-3)!}{(n+3) \cdot (n+1) \cdot n \cdot (n-1) \cdot (n-2) \cdot (n-3)!} = 0 \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.
\[ \{a_n\} = \{n^2\} \]

\[ \lim_{n \to \infty} n^2 = \infty \quad \therefore \text{Diverges} \]
Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{a_n\} = \left\{ \frac{9}{4} \cos(2\pi n) \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{a_n\} = \left\{ -\frac{3 \cos(n)^3}{3^n} \right\} \]

2.

Find the sum.

\[ \sum_{n=2}^{\infty} \frac{-1 + (-3)^n}{4^n} \]

We need the formula \( \sum_{n=2}^{\infty} r^n = \frac{a_1}{1-r} \) for the first term and \( \frac{1}{1-\text{common ratio}} \). \( \sum_{n=2}^{\infty} \frac{1}{4^n} = \frac{1}{\frac{1}{16}} = \frac{1}{1-\frac{1}{4}} \) and

\[ \sum_{n=2}^{\infty} \left( \frac{-3}{4} \right)^n = \frac{\left( \frac{-3}{4} \right)^2}{1-\left( \frac{-3}{4} \right)} \]
Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ -5 \left( \frac{3}{n} + 1 \right)^n \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ \frac{(-1)^n - n}{n^2 + 6} \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ \frac{(-1)^n}{n^{1/2}} \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ 5 \sin \left( \frac{2}{n} \right) \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ \frac{3(n^2 + 1)}{7n^3} \right\} \]

Problem. Determine whether the sequence converges or diverges. If it converges, find its limit.

\[ \{ a_n \} = \left\{ \frac{(-5)^n}{(-4)^n/5} \right\} \]
8. Which sequence converges, find the limit.

- P. \( \left\{ \left( -1 \right)^n + 2 \right\} \)
- Q. \( \left\{ \left( -1 \right)^n \right\} \)
- R. \( \left\{ \left( -1 \right)^{n+1} + n^2 \right\} \)
- S. \( \left\{ \left( -1 \right)^n n^n \right\} \)

- P: converges to \( e^2 \)
- Q: converges to \( e^{\lambda(2)} \)
- R: converges to \( e^{\lambda(2)} \), both R and S converges to 1
- S: converges to \( e^{\lambda(2)} \), both R and S converges to 1

\[ \lim_{n \to \infty} \frac{n}{n + 5} = 1 \text{, so } \lim_{n \to \infty} \left( -1 \right)^n \frac{n}{n + 5} \text{ could be } -1 \text{ or } 1 = DNE \]

\[ \lim_{n \to \infty} \frac{n^2}{n^2 + 5} = 1 \text{ so } \lim_{n \to \infty} \left( -1 \right)^{n+1} \frac{n^2}{n^2 + 5} \text{ could be } -1 \text{ or } 1 = DNE \]

**Problem.** The sequence \( \left\{ \sqrt{3}, 1, \sqrt[3]{3}, 1, \sqrt[3]{3}, \ldots \right\} \) is monotonically increasing and bounded above. Find the limit.

**Problem.** Suppose a sequence \( \{a_n\} \) is alternating, and the absolute value of the sequence, \( \{|a_n|\} \), is strictly decreasing. Must the sequence converge?

- Yes
- No

**Problem.** Consider the sequence \( a_n = \{2n^3 - 8\} \).
1) Does the sequence \( \{a_n\} \) converge?

- No
- Yes

2) Does the sequence \( \{a_n\} \) converge?

- No
- Yes

3) Does the sequence \( \{a_n\} \) converge?

- Yes
- No

4) Does the sequence \( \{a_n\} \) converge?

- Yes
- No
Determine whether the sequences converge or diverge. If converges, find the limit:

P. \( a_n = \frac{(5n - 2)!}{(5n - 3)!} \)
Q. \( a_n = \frac{(-7)^n}{n!} \)
R. \( a_n = \frac{(-1)^n n^3}{n^3 + 1} \)
S. \( a_n = \left( 1 - \frac{6}{n} \right)^n \)

5. Determine the limits of the following sequences, or 'div' if it diverges:

P. \( a_n = \ln(5n^2 + 7) - \ln(2n^2 + 10) \)
Q. \( a_n = \frac{(\ln n)^3}{100\sqrt{n}} \)
R. \( a_n = e^{1/n} \)

Determine if the sequence converges, if so, find the limit.

3. \( a_n = \frac{3n^3 + 11n - 9}{9n^3 - 2n^2 + 11n - 9} \)

Question 4 *

\( a_n = n \tan \left( \frac{1}{n} \right) \)
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5. Which sequence is/are convergent, find the limit it converges to.

- P. \( \{a^{1/n}\} \)
- Q. \( \{(\ln n)^{1/n}\} \)
- R. \( \{a^{1/n}, \ a > 0, \ a \text{ is a real number}\} \)
- S. \( \{(3n^2 + 2n + 5)^{1/n}\} \)
- T. \( \{(1 + \frac{p}{n})^n, \ \text{where is a real number}\} \)

- Only P; Converges to 1
- Only P and Q; both converges to 1
- Only P, Q, S all converge to 1, and T converges to \(e^p\)
- All P, Q, R, S converge to 1, and T converges to \(e^p\)

6. Which of the sequence converges, find the limit.

- P. \( \{\cos \left(\frac{1}{n}\right)\} \)
- Q. \( \{\sin \left(\frac{1}{n}\right)\} \)
- R. \( \{\arctan n\} \)
- S. \( \{\tan \left(\frac{1}{n}\right)\} \)