1. (10 points) Evaluate the following integral.

\[ \int \frac{dx}{x^2 \sqrt{x^2 + 4}} \]

2. (10 points) Evaluate the following integral.

\[ \int \frac{dx}{x^2 - 6x + 8} \]
3. (10 points) Evaluate the following integral.

\[ \int \frac{dx}{x^2 - 6x + 10} \]

4. (10 points) Evaluate the following integral.

\[ \int \frac{2x - 5}{x - 3} \, dx \]
5. (10 points) Evaluate the following integral.

\[ \int \frac{2x^2}{(x - 1)(x^2 + 1)} \, dx \]

6. (10 points) Evaluate the following integral. Use proper notation for each step in your work.

\[ \int_3^\infty \frac{6}{x^2} \, dx \]
7. (10 points) Evaluate the following integral. Use proper notation for each step in your work.

\[ \int_{1}^{3} \frac{dx}{x - 1} \]

8. (10 points) Write out the first five terms of the sequence, determine if the sequence converges, and if so find its limit.

\[ \left\{ \frac{\ln k}{k} \right\}_{k=2}^{+\infty} \]
9. (10 points) Show that the given sequence is eventually strictly increasing or eventually strictly decreasing. Which one? You must fully justify your claim and include the value that \( n \) needs to exceed for this to occur.

\[ \{ 15n - n^2 \}_{n=1}^{+\infty} \]

10. (5 points) Show how to define the sequence below more concisely using curly braces and a general term as in the problem above.

\[
\begin{array}{cccccccc}
1 & -1 & 1 & -1 & 1 & -1 & 1 \\
4 & 9 & 16 & 25 & 36 & 49 & 64 & \cdots
\end{array}
\]
11. (5 points) Consider the sequence \( \{a_n\}_{n=1}^{+\infty} \) where

\[
a_1 = \sqrt{2} \\
a_2 = \sqrt{2 + \sqrt{2}} \\
a_3 = \sqrt{2 + \sqrt{2 + \sqrt{2}}} \\
a_4 = \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2}}}} \\
a_5 = \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2}}}}} \\
\vdots
\]

(a) Find a recursion formula for \( a_{n+1} \).

(b) Assuming the sequence converges, find its limit.