The assignment is due at my office (Riley Hall, 205-J) by 3:30pm on Friday, November 9.

1. Find the sum of the series \( S = \sum_{k=1}^{\infty} \frac{6}{k^2 + 3k} \). Answer the parts below.

(a) Re-express the summand through a partial fraction decomposition.

(b) Find and expression for \( s_{10} \), the tenth partial sum of the series.

(c) Make a conjecture as to the form of \( s_n \).

(d) Find the sum of the series.
2. Consider the series \( S = \sum_{k=1}^{\infty} \frac{k}{10^k} \).

(a) Find \( s_3 \), the third partial sum of the series. Give the exact decimal value.

(b) Use an integral to find an upper bound on the difference \( S - s_3 \).
3. We return to filling a swimming pool with an infinite set of measuring cups, 1, 1/2, 1/3, \ldots.

(a) Use a comparison with an integral to show that

\[ \ln(n + 1) \leq \sum_{k=1}^{n} \frac{1}{k} \leq 1 + \ln(n). \]

(b) Compute the number of seconds since the beginning of the common era. Assume that we have completed the year 2018.

(c) Suppose that you started filling your swimming pool with the set of cups 1, 1/2, 1/3, \ldots at the beginning of the common era and you can fill and dump a measuring cup of water in a second. How much water would be in your swimming by the end of the year 2018?