I encourage you to work with others in the class on this quiz. As with all writing you should work out
the details in a draft before writing a final solution. Be sure to follow the 5 basic guidelines listed in
the course information sheet unless explicitly directed to do otherwise in the problem statement. You do not
need to include every algebra or arithmetic step but you should include enough detail to allow a member
of your target audience to reconstruct any missing steps. Be sure to include in-line citations, with page
numbers if appropriate, every time you use the results of discussion, a text, notes, or technology. If you
include graphs, they should be done carefully on graph paper. Finally, there is to be no collaboration in
the writing of your solution even if you worked out the details with other people.

“Obvious” is the most dangerous word in mathematics.” – Eric Temple Bell

Problems

1. The first few terms of a certain sequence are given below. Find a formula for the $k$'th term of the
sequence. Your answer should have the form: $a(k) = \text{“Your formula here”}$, $k = 0, 1, 2, 3, \ldots$

   $5, 3, 9, 59, 213, 555, 1193, 2259, 3909, 6323, 9705, \ldots$

2. In class we defined the following sequences: $a_0(k) = k^0$, $a_1(k) = k^1$, $a_2(k) = k(k - 1)$, $a_3(k) = k(k - 1)(k - 2)$, $k = 0, 1, 2, 3, 4, 5, \ldots$ and noted

   \[
   \begin{align*}
   D_k(a_1) &= 1a_0 \\
   D_k(a_2) &= 2a_1 \\
   D_k(a_3) &= 3a_2.
   \end{align*}
   \]

   (a) Find a sequence $a_4(k)$, $k = 0, 1, 2, 3, \ldots$ that satisfies

   \[ D_k(a_4) = 4a_3. \]

   (b) State a formula for sequences $a_n(k)$ that works for each of the special cases $a_1, a_2, a_3, a_4$ and
   prove that your formula satisfies the property that the discrete derivative of $a_n(k)$ is the sequence
   $na_{n-1}(k)$. That is, using the letter $n$, show

   \[ D_k(a_n) = na_{n-1}. \]