12 Days of ChrisMATH — Day 10

Each of the following sequences has a simple rule based on the previous number.

Level 1:

Each term is obtained from the previous term as follows:

- If the previous term is even, the next term is 1 less than the previous term.
- If the previous term is odd, the next term is 3 more than the previous term.

If the first term in the sequence is 10, what is the 20th term?

Level 2:

Each term is obtained from the previous term as follows:

- If the previous term is even, the next term is one half of the previous term.
- If the previous term is odd, the next term is one more than five times the previous term.

If the first term in the sequence is 10, what is the 2022nd term?

Level 3:

Each term is obtained from the previous term as follows:

- If the previous term is a multiple of 3, the next term is one third of the previous term.
- If the previous term is one more than a multiple of 3, the next term is one more than double the previous term.
- If the previous term is two more than a multiple of 3, the next term is seven less than quadruple the previous term.

If the first term in the sequence is 2022, what is the term in position number $n = 2022^{2022^{\cdot^{\cdot^{\cdot^{2022}}}}}$, where there are 2022 copies of 2022 in this power tower? Note: power towers are evaluated from the top down, so that $3^{3^3} = 3^{(3^3)} = 3^27 = 7625597484987$, and *not* $(3^3)^3 = 729$.