**The Power of Algebra Is a Curious Thing**

**Using Formulas to Determine Terms of a Sequence**

1. Greta must volunteer 225 hours for a community service project. She plans to volunteer for 6 hours each week. The sequence shown represents the number of volunteer hours she has left after three weeks have passed.

   \[225, 219, 213, 207, \ldots\]

   a. Describe this sequence.

   The sequence is arithmetic because a constant is added to each term to produce the next term. The common difference is \(-6\).

   b. Use a formula to determine how many volunteer hours Greta has left to fulfill her requirement after 33 weeks have passed. Show your work.

   \[a_n = 225 + (-6)(n-1)\]

   To determine the number of volunteer hours Greta has left to fulfill her requirement after 33 weeks have passed, I must use 34 as the value of \(n\) in the explicit formula.

   \[a_{34} = 225 + (-6)(34-1)\]

   \[a_{34} = 225 + (-198)\]

   \[a_{34} = 27\]

   Greta will have 27 hours of volunteer work left to fulfill her requirement after 33 weeks have passed.

   c. Which formula should you use to determine how many volunteer hours Greta has left to fulfill her requirement after 40 weeks have passed? Explain your reasoning.

   I should use the explicit formula, because I do not know how many volunteer hours Greta has left after 39 weeks have passed to fulfill her requirement.
d. Calculate the number of volunteer hours Greta has left to fulfill her requirement after 40 weeks have passed. Show your work. Explain what your answer means in terms of the problem situation. To determine the number of volunteer hours Greta has left to fulfill her requirement after 40 weeks, I will use 41 as the value of \( n \) in the explicit formula.

\[
\begin{align*}
a_n &= 225 + (-6)(n-1) \\
a_{41} &= 225 + (-6)(41-1) \\
a_{41} &= 225 + (-240) \\
-15 &= a_{41}
\end{align*}
\]

My answer of \(-15\) hours means that Greta will complete her community service before 40 weeks.

2. The half-life of a substance is defined as the period of time it takes for the amount of the substance to decay by half. The sequence below shows the amount of a substance that will be left after a certain number of half-lives have elapsed.

\[
\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots
\]

a. Describe this sequence.

The sequence is geometric because each term is multiplied by a constant to produce the next term. The common ratio is \( \frac{1}{2} \).

b. Calculate how much of the substance will be left after 21 half-lives have elapsed.

Show your work. Does your answer make sense in this problem context? Why or why not?

To find the amount of the substance left after 21 half-lives have elapsed, I must use 22 as the value of \( n \) in the explicit formula.

\[
\begin{align*}
g_n &= 1 \cdot \left( \frac{1}{2} \right)^{n-1} \\
g_{22} &= 1 \cdot \left( \frac{1}{2} \right)^{22} \\
g_{22} &= \frac{1}{2,097,152}
\end{align*}
\]

The amount of the substance left after 21 half-lives have elapsed is \( \frac{1}{2,097,152} \).

My answer makes sense in this context because the substance will continue to get smaller and smaller as it decays. However, the amount of substance will become more and more difficult to measure.