## Medication Regimen

A person takes 5 mg of Lexapro ${ }^{\circledR}$ once per day for depression. Every 24 hours, the patient retains $98 \%$ of the drug, eliminating $2 \%$ through the liver and kidneys. If $D_{n}$ is the amount of medication in the person's body immediately after the $n$th dose, where every dose is 24 hours apart, then we can write $D_{1}=5$.

| MORMAL FLOAT RUTO REAL RADIAN MP | $\square$ |
| :--- | :--- |
| 5 |  |
| 98 ABns +5 - |  |

(a) Complete the boxes to find the following. Report each to 0.1 mg .
i) the number of mg of drug, $D_{2}$, in the patient's body immediately after the second dose of 5 mg (assuming it is taken 24 hours after the first dose).
ii) the number of mg of drug, $D_{3}$, in the patient's body immediately after the third dose of 5 mg (assuming it is taken 24 hours after the second dose).
iii) the number of mg of drug, $D_{4}$, in the patient's body immediately after the fourth dose of 5 mg (assuming it is taken 24 hours after the second dose).

| (Number of doses, each taken every 24 hours apart) | $D_{n}(\mathrm{mg})$ | Expanded form |
| :---: | :---: | :---: |
| 1 | $D_{1}=\mathbf{5} \mathrm{mg}$ | $D_{1}=\mathbf{5}$ |
| 2 | $D_{2}=\square \mathrm{mg}$ | $D_{2}=0.98 D_{1}+\boldsymbol{5}=(0.98 \square+$ © $)$ |
| 3 | $D_{3}=\square \mathrm{mg}$ | $\begin{aligned} D_{3}=0.98 D_{2}+\text { (5) } & =0.98(0.98 \square+\text { (5) })+\text { (5) } \\ & =0.98^{2} \cdot \square+0.98 \cdot(3)+\text { (5) } \end{aligned}$ |
| 4 | $D_{4}=\square \mathrm{mg}$ | $D_{4}=$ |

(b) Suppose the person takes 5 mg of the drug for 4 weeks, i.e., 28 days, where every dose is 24 hours apart.
i) What is the amount of medication $D_{28}$, in the person's body immediately after the 28th dose? $\qquad$ mg (Report to the nearest whole number of mg.)
ii) Write a series to represent the amount of medication, $D_{28}$, in the person's body immediately after the 28th dose.

$$
\begin{aligned}
& \quad D_{28}=5+5 \cdot(0.98)^{1}+5 \cdot(0.98)^{2}+\cdots+5 \cdot(0.98)= \\
& \text { iii) Find a direct formula for the } n \text {th term. } \\
& D_{n}=\square \\
& \text { Enter your formula into a grapher. } \\
& \text { Check your table matches part a. } \\
& \text { Produce a graph of your function. } \\
& \text { Sketch a plot of }\left(n, D_{n}\right) \text { to the right. }
\end{aligned}
$$

(c) You can solve for the stabilization point for the person's medication regimen by setting $D_{n}=0.98 D_{n-1}+5$. When stabilization occurs, we have $D_{n}=D_{n-1}$. If stabilization occurs at $w \mathrm{mg}$, then $w=0.98 w+5$. Solve for $w$.
(d) In the equation $w=0.98 w+5$, replace 0.98 by the variable $r$ and 5 by the letter $a$. Then report $w$ for the general case. What are we assuming about the value of $r$ in this situation?

