2. [7 points] The amount, in milligrams (mg), of a certain drug in a patient's bloodstream t minutes after it is administered is given by:

$$V(t) = 120e^{-0.006t}$$

a. [2 points] By what percentage does the amount of the drug in the patient's bloodstream decrease each minute? *Show all work. Give your answer in exact form, or rounded to at least* ***three*** *decimal places.*

$100(1 - e^{-0.006}) = 0.598$ %

b. [3 points] How long does it take for the amount of the drug in the patient's bloodstream to decrease to 10 mg? *Show all work. Give your answer rounded to the* ***nearest minute***.

Solution: We need to solve for the time t at which

$$120e^{-0.006t} = 10$$

Once we are past that time, the drug will be less than 10mg.

$$\begin{aligned} 120e^{-0.006t} &= 10 \\ e^{-0.006t} &= \frac{1}{12} \\ -0.006t &= \ln(\tfrac{1}{12}) \\ t &= \ln(\tfrac{1}{12})/-0.006 \approx 414 \end{aligned}$$

$\ln(\frac{1}{12})/-0.006 \approx 414$ minutes

c. [2 points] The amount, in mg, of a *different* drug in a patient's bloodstream t minutes after it is administered is given by $G(t)$. Some values of $G(t)$ are given below. Could $G(t)$ be exponential? *Show all work.*

t, in minutes	20	30	50
$G(t)$, in mg	95	76	48.64

Solution: There are several ways that we could check if this is exponential. One way is to imagine a theoretical output for $t = 40$ minutes. If this function were exponential, then the multiplicative increase from $G(20)$ to $G(30)$ should be the same as the multiplicative increase from $G(30)$ to $G(40)$ and from $G(40)$ to $G(50)$. We can compute that the multiplicative increase from $G(20)$ to $G(30)$ is $76/95$. If we apply that multiplicative increase to $G(30) = 76$ we get $76^2/95$ as a hypothetical value for $G(40)$. If we apply it one more time we get $76^3/95^2 = 48.64$ That is, this is the value we'd expect for $G(50)$ if our function were exponential. Since that is exactly the value for $G(50)$ we see in our table, we can conclude that our function could, in fact, be exponential.

(Circle One) $\boxed{\text{COULD BE EXPONENTIAL}}$ NOT EXPONENTIAL