5. [10 points] While ski jumping, David broke his leg and was taken to the hospital. The hospital doctor administered a painkiller to David at noon. At 3 pm, the concentration of the painkiller in David’s blood was 10 mg per liter and at 5 pm, it fell to 6 mg per liter. Let \( C(t) \) be the concentration (in mg per liter) of the painkiller in David’s blood \( t \) hours after noon. Suppose that the function \( C \) is decreasing exponentially.

a. [6 points] Find a formula for \( C(t) \). Show all your work. Your answer must be exact.

\[
\text{Solution: Since } C \text{ is an exponential function, } C(t) = ab^t. \text{ Plug in } (3, 10) \text{ and } (5, 6) \text{ to obtain } \begin{align*}
10 &= ab^3 \quad \text{and} \quad 6 &= ab^5. \\
\text{By taking the ratio, we get } b^2 &= \frac{3}{5}, \text{ so } b &= \sqrt{0.6}. \text{ Thus, } a &= \frac{10}{\sqrt{0.6}}, \text{ and so } C(t) = \frac{10}{\sqrt{0.6}} (\sqrt{0.6})^t.
\end{align*}
\]

b. [4 points] What is the hourly percentage growth rate of \( C(t) \) and the initial concentration of painkiller in David’s blood? Include units when appropriate. Your answer must be exact or accurate up to one decimal place.

\[
\text{Solution: Hourly percentage growth rate}= -22.5\%. \text{ Initial concentration}= 21.5 \text{ mg/liter.}
\]

6. [5 points] For each of the following functions, write down its growth factor if the function is exponential or NONE if the function is not exponential.

(i) \( f(t) = 2t^3 \) \hspace{1cm} Answer=____________________

\[
\text{Solution: NONE}
\]

(ii) \( g(t) = 2e^{3t} \) \hspace{1cm} Answer=____________________

\[
\text{Solution: 6}
\]

(iii) \( h(t) = (3^{-t})^2 \) \hspace{1cm} Answer=____________________

\[
\text{Solution: } \frac{1}{9}
\]