9. (8 points) Cosmologists, through a technique best described as hocus pocus, measure a quantity $T(t)$, the temperature of the universe in degrees Kelvin (K), where t is in gigayears (Gyr) after the Big Bang. Suppose that, currently, $t = 13.6$, $T(13.6) = 2.4$, and $T'(13.6) = -12$.

[Note: A gigayear is 1 billion years, and the Kelvin temperature scale is an absolute temperature scale where the lowest possible temperature is defined as being zero Kelvin.]

(a) For each of the following statements, state whether you agree or disagree with the conclusion and justify your reasoning.

    (i) In the next billion years, the temperature of the universe will drop by approximately 12 degrees Kelvin.

    (ii) In the next year, the temperature of the universe will drop by approximately $\frac{12}{1,000,000,000}$ degrees Kelvin.

(b) Assume $T(t)$ is decreasing and does not change concavity on the domain $[13.6, \infty)$. Do you expect $T(t)$ to be concave up or concave down on the domain $[13.6, \infty)$? Justify your answer using physical reasoning.