Sample questions on microbial growth

The following questions are designed to allow you to practice with several of the equations that are commonly used to model populations, including that of microbes. For our purposes assume that the microbial populations in question are in the exponential portion of the growth curve (the rate of growth is constant).

1. A population of diatoms are taking over a water supply in Sullivan County. Published recommendations for water treatment facilities suggest that populations of this species of microbe not exceed 1 X 10^6 algal cells/ml. On February 1st (to make it easier and unless told otherwise, assume that sampling always occurs at midnight), the population was barely visible on the surface of some of the lagoons. On February 12th, the populations were very visible and were consequently assessed. The water treatment technicians determined that, on February 12th, the population contained 1.5 X 10^4 algal cells/ml. If the theoretically known mean doubling time for this algal species is 10.5 hours/generation . . .

a. What would be the estimated concentration of alga on Valentine s day (Feb. 14th; in cells/ml)?

b. Would you expect to have surpassed the recommended limit (1 X 10^6 algal cells/ml) for this species in your water supply on Valentine s day?

c. Assuming a constant growth rate, how many alga cells/ml would be have in the lagoons if you had sampled after 12 hours before Valentine s day (noon on 13th February)?

d. How much time (in hours) would be required for this species to reach the critical value, 1 X 10^6 algal cells/ml, from the concentration found on February 12th (1.5 X 10^4 algal cells/ml)?

e. [Challenge] Can you estimate the population of alga/ml ON February 1st? Why/why not?