1. Suppose the population of bears in a national park grows according to the logistic differential equation $\frac{dP}{dt} = 5P - 0.002P^2$, where P is the number of bears at time t in years. Given that P(0) = 100, find the following.

A.) Find $\lim_{t\to\infty} P(t)$.

B.) What is the range of the solution curve?

C.) For what values of P is the solution curve increasing? Decreasing? Justify your answer.

D.) Find $\frac{d^2P}{dt^2}$ and use it to find the values of P for which the solution curve is concave up and concave down. Justify your answer.

E.) Does the solution curve have an inflection point? Justify your answer.

F.) Use the information you found to sketch the graph of P(t).

2. Suppose the population of bears in a national park grows according to the logistic differential equation $\frac{dP}{dt} = 5P - 0.002P^2$, where P is the number of bears at time t in years. Given that P(0) = 3000, find the following.

A.) Find $\lim_{t\to\infty} P(t)$

B.) What is the range of the solution curve?

C.) For what values of P is the solution curve increasing? Decreasing? Justify your answer.

D.) Find $\frac{d^2P}{dt^2}$ and use it to find the values of P for which the solution curve is concave up and concave down. Justify your answer.

E.) Does the solution curve have an inflection point? Justify your answer.

F.) Use the information you found to sketch the graph of P(t).

3. The table gives the number of yeast cells in a new laboratory culture.

Time (hours)	Yeast cells	Time (hours)	Yeast cells
0	18	10	509
2	39	12	597
4	80	14	640
6	171	16	664
8	336	18	672

A.) Plot the data and use the plot to estimate the carrying capacity for the yeast population.

B.) Use the data to estimate the initial relative growth rate.

C.) Find both an exponential model and a logistic model for these data.

D.) Compare the predicted values with the observed values, both in a table and with graphs. Comment on how well your models fit the data.

E.) Use your logistic model to estimate the number of yeast cells after 7 hours.