Read each problem very carefully before starting to solve it. Each problem is worth 10 points. It is necessary to show all your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. The fox population in a certain park was 400 in 2010 and increasing by $7 \%$ annually.
(a) Write a model for the fox population as a function of time, explaining the meaning of your variables clearly.
(b) Forecast the year in which the fox population in the park is predicted to surpass 1,000 .
2. Find by hand an equation for the exponential function passing through the points $\left(-3, \frac{5}{8}\right)$ and $(4,80)$. Please, show all your steps.
3. (a) Sketch the graph of $y=\log _{2}(x)$ using a small table of values. Please, be neat and label all important points.
(b) Describe all transformations that must be performed to obtain from the graph you sketched in Part (a) the graph of $f(x)=-3 \log _{2}(x-1)+5$. (You do not have to sketch the graph of $y=f(x)$.)

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y=\log _{2}(x) \longrightarrow
$$


$\longrightarrow \quad y=-3 \log _{2}(x-1)+5$
(c) Find the domain and the vertical asymptote of the graph of $y=f(x)$ starting from the domain of $y=\log _{2}(x)$ and tracing carefully the changes induced by the transformations you described in Part (b).
4. Use properties of logarithms to expand or condense as appropriate the following expressions. Please, go as far as possible.
(a) $\ln \left(\frac{x^{3} y}{\sqrt{z}}\right)=$
(b) $7 \log (a)-\frac{1}{3} \log (b)+5 \log (c)=$
5. Solve the following equations:
(a) $10 e^{8 x+3}+2=8$.
(b) $\log (x)+\log (7-x)=1$

