Directions: Please answer the following questions and make sure your answer is legible. You must show your work to receive credit for your answers. You may not use a calculator (or any other technology) on this quiz. Good Luck.

1. (4 points) Evaluate the following:
   
   (a) \( \ln \left( \frac{1}{\sqrt{e}} \right) \) \hspace{1cm} (6.1 \# 38)
   \[
   \ln \left( \frac{1}{\sqrt{e}} \right) = \ln (e^{-\frac{1}{2}}) = -\frac{1}{2}
   \]

   (b) \( \log_2 (3^{-\log_3(2)}) \) \hspace{1cm} (6.1 \# 41)
   \[
   \log_2 (3^{-\log_3(2)}) = \log_2 \left( \frac{1}{3^{\log_3(2)}} \right) \\
   = \log_2 \left( \frac{1}{3} \right) = \log_2 (2^{-1}) = -1
   \]

2. (5 points) Find the domain of the function \( f(x) = \log \left( \frac{x+2}{x^2-1} \right) \) \hspace{1cm} (6.1 \# 47)
   
   \[
   f(x) = \log \left( \frac{x+2}{x^2-1} \right) \\
   \text{Domain: } x \neq -1, 1 \\
   \text{solve correctly}
   \]

3. (6 points) Find the domain of the function \( f(x) = \log_9(\sqrt{x-4} - 3) \) \hspace{1cm} (6.1 \# 54)
   
   \[
   f(x) = \log_9(\sqrt{x-4} - 3) \\
   \text{Domain: } x \geq 4 \\
   \text{solve correctly}
   \]
   
   \[
   \text{Domain: } (13, \infty)
   \]
4. (7 points) (6.1 # 60)
(a) Sketch the graph of the function \( g(x) = 3^{-x} + 2 \) by starting with the graph of \( f(x) = 3^x \) using transformations. Track (and label) at least 3 points and any asymptotes.

(b) State the domain and range of \( g(x) \).

5. (3 points) Expand the given logarithm \( \log_3 \left( \frac{x^2}{81y^4} \right) \) and simplify.

Assume when necessary that all quantities represent positive real numbers. (6.2 # 10)

\[
\begin{align*}
\log_3 \left( \frac{x^2}{81y^4} \right) &= \log_3 (x^2) - \log_3 (81y^4) \\
&= 2 \log_3 (x) - \log_3 (81) - 4 \log_3 (y^4) \\
&= 2 \log_3 (x) - 4 - 4 \log_3 (y) 
\end{align*}
\]