1. (7 pts) Let \( q(x) = \frac{1}{1 + e^{-x}} \)

a) (4 pts) Calculate the derivative \( q'(x) \). No need to simplify.

\[
q'(x) = \frac{(1 + e^{-x})'}{(1 + e^{-x})^2} \quad \text{(power law)}
\]

\[
= \frac{-e^{-x}}{(1 + e^{-x})^2} \quad \text{(exponential, chain rule)}
\]

\[= \frac{e^{-x}}{(1 + e^{-x})^2} \]

b) (3 pts) Imagine inserting your answer from part a) into the integral below. What does the fundamental theorem of calculus tell you about the integral? You need not calculate a value.

\[
\int_{-1000}^{1000} (\text{answer from part a)}) \, dx = \int_{-1000}^{1000} q'(x) \, dx
\]

\[
= q(1000) - q(-1000)
\]

\[
= \left( \frac{1}{1 + e^{-1000}} \right) - \left( \frac{1}{1 + e^{1000}} \right)
\]

2. (5 pts) \( \int_{3}^{9} (5 - 2f(x)) \, dx = 22 \). Find \( \int_{3}^{9} f(x) \, dx \).

\[
22 = \int_{3}^{9} (5 - 2f(x)) \, dx = \int_{3}^{9} 5 \, dx - 2 \int_{3}^{9} f(x) \, dx
\]

\[
= 30 - 2 \int_{3}^{9} f(x) \, dx
\]

Solving \( 2 \int_{3}^{9} f(x) \, dx = 30 - 22 = 8 \),

\[
\int_{3}^{9} f'(x) \, dx = 4
\]