1. Let

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

(a) Find all horizontal and vertical asymptotes
(b) Find the first derivative and all critical points
(c) Use that to find all maximum and minimum points and intervals of increase/decrease
(d) Find the second derivative and all its critical points
(e) Use that to find all inflection points and all intervals of concavity up/down
(f) Use the information gathered to give a rough sketch of the function

2. Find the number \( c \) such that the area between the functions \( f(x) = x^2 \) and \( g(x) = c^2 - x^2 \) is equal to \( c \).

3. Find the following definite integral

\[ \int_0^{\pi/2} (\sin(h)\cos(h))^3 \, dh \]

4. Let \( f(x) \) be an integrable function such that:

\[ \int_0^6 f(t) \, dt = 10 \]
\[ \int_4^{10} 2f(t) \, dt = 4 \]
\[ \int_4^6 (f(t) + 3) \, dt = 12 \]

Find

\[ \int_0^{10} f(t) \, dt \]

Explain your answer.