1. Find the following limits.
(1) \( \lim_{x \to 2} \ln(\cos(\pi x)) e^{x^2 + 2} \)
(2) \( \lim_{x \to -\infty} \frac{\sqrt{x^2 + 1}}{x + 1} \)
(3) \( \lim_{w \to \infty} (w - \sqrt{w^2 + 9}) \)
2. Suppose \( f(x) = \sqrt{|\cos x|} - \cos x \).

(1) Find the domain and range of \( f(x) \).

(2) Show that \( f(x) = x^3 - 1 \) has at least one solution in \([0, 2]\).
3. Suppose $g(x) = x^\alpha \sin\left(\frac{x}{2}\right)$, $x > 0$ and $\alpha$ is a constant. Give the range of $\alpha$ such that $g(x)$ has a horizontal asymptote.