#1 (Ch. 8: #8.) For \( n = 0, 1, 2, \ldots \), and \( x \) real, prove that

\[
|\sin(nx)| \leq n|\sin x|.
\]

#2 (Ch. 8: #12(d)). Prove that

\[
\int_{0}^{\infty} \left( \frac{\sin x}{x} \right)^2 dx = \frac{\pi}{2}.
\]

#3 (Ch. 8: #18). Find out, for each of two functions

\[
f(x) := x^3 - \sin^2 x \cdot \tan x,
g(x) := 2x^2 - \sin^2 x - x \tan x,
\]

whether it is positive or negative for all \( x \in (0, \pi/2) \), or whether it changes sign.

#4. Evaluate the sum

\[
\sum_{n=1}^{\infty} \frac{1}{n(2n-1)}.
\]