Problem 1: The Riddler has rigged a pendulum in the clock tower with enough explosives to level the nearby elementary school. Batman has figured out that he must snip the green wire when the pendulum has swung for exactly 2.5 seconds in order to deactivate the bomb. If the velocity of the pendulum (cm/s) \( t \) seconds after it begins to swing is given by \( v(t) = -10 \sin(\pi t) \), how far from its starting point (and in which direction!) will the pendulum be after 2.5 sec? Help Batman save the children!

Problem 2: The velocity (cm/s) of a point on a vibrating guitar string \( t \) seconds after being plucked is given approximately by

\[
v(t) = \cos(\pi t + \pi/2), \quad 0 \leq t \leq 4
\]

Find the total distance traveled by the point on the string from \( t = 0 \) to \( t = 2 \) sec. Include units. (Hint: It isn’t zero.) Provide a good, scaled sketch of the function and explain how your answer can be seen in the picture.

Problem 3: Find all local extrema of \( S(x) = \int_0^x \sin(t^2) \, dt \) on the interval \((0, \pi)\). Combine your knowledge of differential calculus with the FTC, pt 1!

Problem 4: Find the area of the region enclosed by the curves \( f(x) = x + 2, g(x) = x^2 - 2x + 2 \). (Hint: Find where they intersect and then sketch their graphs on the same grid.)