Problem statement  a) For $x$ near 0, $\sin x$ is well-approximated by its tangent line at $x = 0$. What is this tangent line?

b) Approximation over an interval is preferred over approximation near a point for many purposes. One criterion for assessing the accuracy of such an approximation is mean-square error. The mean-square error between a straight line $y = Ax$ going through the origin and the function $\sin x$ over the interval $[0, 1]$ is given by the definite integral $\int_0^1 (\sin x - Ax)^2 \, dx$. Find the $A$ which minimizes this integral.

**Hint** Expand the integrand, compute the integral, and find the $A$ minimizing the result.

c) Sketch $\sin x$ and the straight lines found in a) and b) on the unit interval $[0, 1]$. 