Problem 1: (4 points) Show that there is a zero of the equation \( x^3 - 2x + 3 = 0 \) between -2 and -1. (What is the name of the Theorem you used here?)

Problem 2: (4 points) Find the rate of change at which the surface area \( S \) of the sphere is changing with respect to the radius \( r \) when the radius \( r = 1 \). (Note \( S = 4\pi r^2 \))

Problem 3: (4 points) Where is the function \( y = \frac{x + \ln x}{\sqrt{5-x}} \) continuous?

Problem 4: (4 points) Find all horizontal asymptotes of the function \( y = \frac{1 - 2\sin x}{1 + x^2} \)

Problem 5: (8 points) If it exists, find the limit. Use the symbols \( \infty \) or \( -\infty \) as appropriate.

\[
\begin{align*}
a) \quad & \lim_{x \to -\infty} \frac{x \sqrt{x^2 + 3}}{1 + x^2} \\
b) \quad & \lim_{x \to -1} \left[ \ln(x - 1) - \ln(\sqrt{x} - 1) \right]
\end{align*}
\]

Problem 6: (6 points) Consider the function \( f(x) = 2 + \sqrt{x+1} \)

a. Use the definition to find \( f'(0) \)

b. Find the equation of the tangent line to the curve at \((0,3)\).