6. [11 points]
   a. [8 points] Use the **comparison method** to determine the convergence or divergence of the following improper integrals. Justify your answers. Make sure to properly cite any results of convergence or divergence of integrals that you use.

   i) \( \int_{1}^{\infty} \frac{3 + \sin(4x)}{\sqrt{x}} \, dx \).

   ii) \( \int_{4}^{\infty} \frac{1}{\sqrt{x} + x^2} \, dx \).

   b. [3 points] For which values of \( p \) does the following integral converges?

   \[ \int_{2}^{\infty} \frac{x^2 - 1}{x^p + 4x^2 + 2} \, dx. \]

   No justification is required.