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) $\displaystyle\int_{1}^{\infty} \frac{3 + \sin(4x)}{\sqrt[3]{x}}\,dx.$

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

    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.