For each integral, explain why it is improper, and determine whether the integral converges or diverges.

1. $\displaystyle \int_1^\infty \frac{1}{x^3} \, dx$

2. $\displaystyle \int_1^\infty \frac{1}{x} \, dx$

3. $\displaystyle \int_0^1 \frac{1}{x^3} \, dx$

4. $\displaystyle \int_1^\infty \frac{1}{x^p} \, dx$ where $p > 1$

5. $\displaystyle \int_0^1 \frac{1}{x^p} \, dx$ where $p > 1$