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 $p > 1$