

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

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

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

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

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

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