Definite integrals $\int_a^b f(x)\,dx$ are required to have

- Finite domain of integration $[a, b]$
- Finite integrand $f(x) < \pm\infty$

In constrast, **improper integrals** are characterized by one of the following two conditions

- Infinite limits of integration
- Integrals with vertical asymptotes, i.e., discontinuities.

An improper integral is said to be

- **convergent** if the limit is finite and that limit is the value of the integral
- **divergent** if the limit does not exist.

For each of the following, determine if the integral is proper or improper. If it is improper, explain why. Do not evaluate any of the integrals.

1. $\int_0^2 \frac{x}{x^2 - 5x + 6}\,dx$

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

3. $\int_1^2 \ln|x - 1|\,dx$

4. $\int_{-\infty}^{\infty} \frac{\sin x}{1 + x^2}\,dx$

5. $\int_0^{\pi/2} \sec x \, dx$

Determine if the integral converges or diverges

1. $\int_{-\infty}^{0} \frac{1}{2x-1} \, dx$

2. $\int_0^2 \frac{x-3}{2x-3} \, dx$

3. $\int_0^{\infty} \sin\theta \, d\theta$