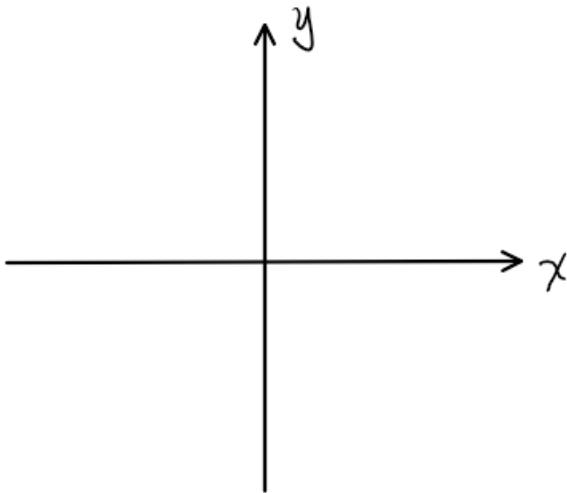**Introduction to Improper Integrals**
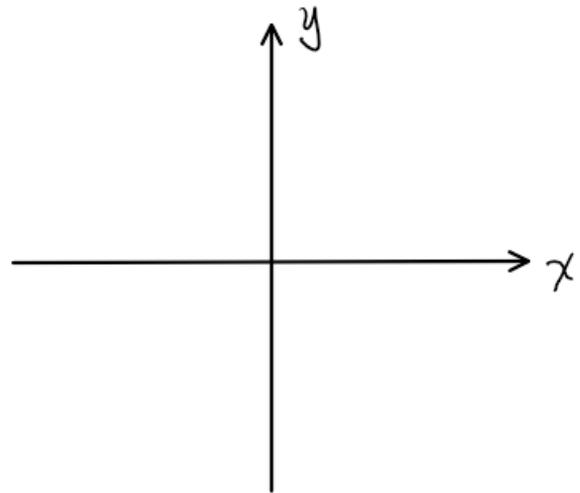
Integral is considered improper if:

- one (or both) bounds are +/- infinity

- integrand is discontinuous within interval (a,b)
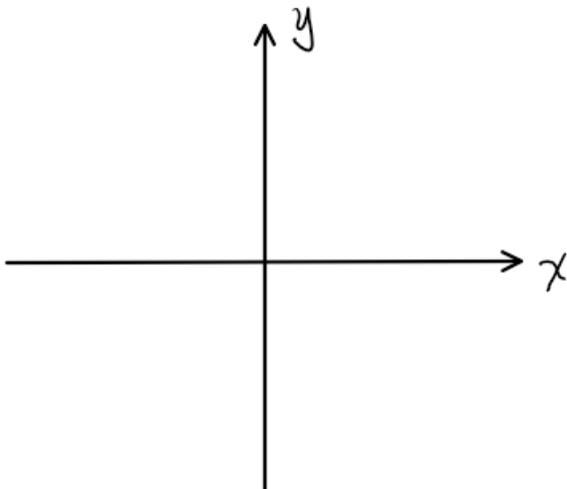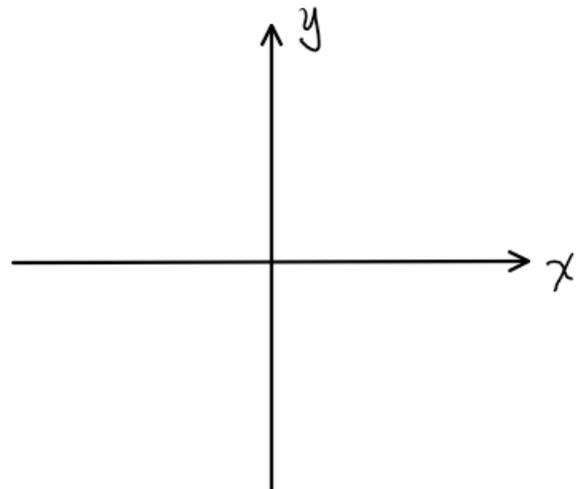
$$f(x) = \frac{1}{x}$$

$$f(x) = \frac{1}{x^2}$$

$$f(x) = e^x$$

$$f(x) = \ln x$$

Definition:

integral is **convergent** if corresponding limit **exists**

or it is **divergent** if corresponding limit **does NOT exist (DNE)**

Recall:

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

$\int_1^\infty \frac{1}{x} dx$ diverges

Question: for what values of p is _____ convergent?

already know that _____ converges and _____ diverges

ex. $\int_1^\infty \dfrac{1}{x^4}\, dx$

ex. $\int_1^\infty \dfrac{1}{\sqrt{x}}\, dx$

Integrals with Discontinuities

ex. $\int_1^4 \dfrac{dx}{1-x}$

ex. $\int_0^3 \dfrac{dx}{x-1}$

ex. $\int_0^1 \ln x \, dx$

When Both Bounds Contain an Infinity

ex. $\displaystyle\int_{-\infty}^{\infty} \frac{dx}{1+x^2}$