To deal with improper integrals $\int_a^{\infty} f(x)\,dx$, $\int_{-\infty}^{b} f(x)\,dx$, or $\int_a^b f(x)\,dx$ where f is not defined somewhere on $[a, b]$:

- **When $f(x)$ can be antidifferentiated:**

  Problem: We'd like to use the connection between the integral and the antiderivative, but The Fundamental Theorem of Calculus does not apply to improper integrals.

  Solution: If we rewrite our improper integral as the limit of one or more proper definite integrals, we can apply the FTC by antidifferentiating, plugging in the limits of integration, and taking the limit.

- **When $f(x)$ can not be antidifferentiated:**

  Problem: When we were dealing with plain-old definite integrals, we approximated the antiderivative by subdividing the interval of integration into n subintervals and using rectangles (or trapezoids) to approximate the area under the curve. Can we do that here?

  This is really 2 problems:

  1. Approximation is not a short process, and I would just as soon not try to approximate something that turns out to be infinite. So is there a way to tell before beginning the approximation process whether the improper integral converges or diverges?
  2. Suppose I know my improper integral converges. My usual approximation technique involved subdividing the interval. What do I do if my interval is infinite?

1. **Solution to Subproblem #1:** Sometimes we can determine whether an unknown improper integral converges or diverges by comparing it (in a clever and useful way) to a known convergent or divergent improper integral.

2. **Solution to Subproblem #2:** ?

   (This is what we're doing today!)