## Unit 12: Integrals over the whole real line and probability densities

## Vocabulary and notation

Improper integral	DNE	undefined integral	$\int_{-\infty}^{\infty}$
probability density	probability	random variable	mean
exponential density	normal density	standard normal	uniform density
standard deviation	median	average value	normalizing constant
$\Phi$	half life	convolution	

## Skills

- Know the definition of an improper integral via limits
- Know for which k, p and q these integrals converge:

$$-\int_1^\infty e^{kx} dx$$
  
$$-\int_1^\infty x^p dx$$
  
$$-\int_1^\infty (\ln x)^q x^{-1} dx$$

- Know the relation between convergence of  $\int_b^\infty f(x) \, dx$  and convergence of  $\int_b^\infty g(x) \, dx$  when  $f \ll g$  or  $f \sim g$  as  $x \to \infty$ .
- Know how to find p so that  $f(x) \sim cx^p$  as  $x \to \infty$  when f is a more complicated function.
- Know the relation between convergence of series and convergence of integrals
- Know the exponential, uniform and normal densities
- Be able to compute the mean and median of the exponential
- Have an idea of when to use these distributions in modeling
- Know how to standardize a normal random variable (last sentence of the Unit)
- Know how to compute a convolution of two probability densities and what this means probabilistically