

# Exponential Distribution

$$f(x) = ae^{-ax} \quad x, a > 0$$

Transformation	General PDF	Example: Exponential(2)										Support	Comment
PDF	CDF	HF	IDF	$\mu$	$\sigma^2$	MF	MGF	HF Shape					
$x^2$	✓	✓	✓	✓	✓	✓	$\partial$	DFR				$0, \infty$	piecewise CDF
$\sqrt{x}$	✓	✓	✓	✓	✓	✓	✓	IFR				$0, \infty$	
$x^{-1}$	✓	✓	✓	✓	$\infty$	✓	✓	UBT				$0, \infty$	
$\arctan(x)$	✓	✓	✓		$\partial$	$\partial$	$\partial$	IFR				$0, \pi/2$	
$e^x$	✓	✓	✓	✓	✓	$\infty$	$\partial$	DFR				$1, \infty$	
$\ln(x)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$-\infty, \infty$	
$e^{-x}$	✓	✓	✓	✓	✓	✓	✓	IFR				$0, 1$	
$-\ln(x)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$					$-\infty, \infty$	
$\ln(x+1)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, \infty$	
$1/\ln(x+2)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, 1/\ln(2)$	
$\tanh(x)$	✓	✓	✓	✓	✓	✓	✓	IFR				$0, 1$	
$\sinh(x)$	✓	✓	✓	✓	✓	✓	$\partial$	DFR				$0, \infty$	
$\operatorname{arcsinh}(x)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, \infty$	
$\operatorname{csch}(x+1)$	✓	✓	$\partial$	$\partial$	$\partial$	$\partial$	$\partial$	IFR				$0, 2/(-e + e^{-1})$	
$\operatorname{arccsch}(x+1)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, \ln(1 + \sqrt{2})$	
$1/\tanh(x+1)$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$1, (e + e^{-1})/(e - e^{-1})$	
$1/\sinh(x+1)$	✓	✓	$\partial$	$\partial$	$\partial$	$\partial$	$\partial$	IFR				$2, 2/(e - e^{-1})$	
$1/\operatorname{arcsinh}(x+1)$	✓	✓	✓	✓				IFR				$0, 1/\ln(1 + \sqrt{2})$	
$1/\operatorname{csch}(x) + 1$	✓	✓	✓	✓	✓	$\infty$	$\partial$	DFR				$1, \infty$	
$\tanh(x^{-1})$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, 1$	
$\operatorname{csch}(x^{-1})$	✓	✓	$\partial$	$\partial$	$\partial$	$\partial$	$\partial$					$1, \infty$	
$\operatorname{arccsch}(x^{-1})$	✓	✓	✓	✓	$\partial$	$\partial$	$\partial$	IFR				$0, \infty$	

## Legend

Symbol	Meaning
✓	Exists, Closed Form
$\partial$	Exists, Not Closed Form
$\emptyset$	Not Possible
	Not Calculated