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Probability density of geometric Brownian motion at a fixed time

created by **Thijs van den Berg**

$$P(S_t) = \frac{1}{S_t\sigma\sqrt{2\pi t}} \exp \frac{-(\ln S_t/S_0 - [\mu - \frac{1}{2}\sigma^2]t)^2}{2\sigma^2 t}$$

This equation gives the probability density function of an underlying S at some future time t. The underlying behavior is geometric Brownian motion, has a present value S0, a yield (drift) of \mu, and volatility \sigma.

The probability density function is has a lognormal distribution with mean \mu.

Symbol list:

$P(x)$	Probability of x
S_t	The value of the geometric Brownian motion process at time t
σ	Volatility of the geometric Brownian motion
μ	Drift of the geometric Brownian motion