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In the given PyMC code example, pm.logp(mu, 0) represents the log-probability of the random variable mu taking the value 0. Mathematically, this can be expressed as:
log(p(mu = 0))

pm.logp(mu,0) → @x=0

where:

- mu is the random variable representing the mean of the Gaussian distribution.
- p(mu = 0) is the probability density function (PDF) of the Gaussian distribution evaluated at mu = 0.
- log() is the natural logarithm function.

The PDF of a Gaussian distribution with mean μ and standard deviation σ is given by:
p(x) = (1 / (σ * sqrt(2π))) * exp(-(x - μ)^2 / (2σ^2))

where:

- x is the value at which the PDF is evaluated.
- μ is the mean of the Gaussian distribution.
- σ is the standard deviation of the Gaussian distribution.
- exp() is the exponential function.
- sqrt() is the square root function.

$$\frac{1}{\sqrt{2\pi}\,\sigma} e^{-(x-\mu)^2/2\sigma^2} \quad @x=0, \mu = 0 \;\&\; \sigma=1 \quad \Big| \frac{1}{\sqrt{2\pi}} \times e^{(0-0)} \Big|_{\mu=0} = \frac{1}{\sqrt{2\pi}}$$

In the case of pm.logp(mu, 0), we are evaluating the log-probability of mu at x = 0. So, plugging in x = 0 and the specified values of μ = 0 and σ = 1 into the PDF equation, we get:
p(mu = 0) = (1 / (1 * sqrt(2π))) * exp(-(0 - 0)^2 / (2 * 1^2)) = (1 / sqrt(2π)) * exp(0) = (1 / sqrt(2π))

Taking the natural logarithm of both sides, we get:
log(p(mu = 0)) = log((1 / sqrt(2π))) = -0.5 * log(2π) ≈ -0.9189385332046727
Therefore, the mathematical equation for pm.logp(mu, 0) in this specific case is:
log(p(mu = 0)) = -0.5 * log(2π)

$$\Big| \log\left(\frac{1}{\sqrt{2\pi}}\right) = -0.5 \times \log 2\pi = -0.91$$