Exponential distribution is interval between consecutive Poisson events

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Let's denote the interval between consecutive Poisson events with random variable Y, during the interval that extends from a to a + y, the number of Poisson events k has the probability $P(k) = e^{-\lambda}\frac{\lambda^k}{k!}$, $k = 0$ means there is no event during the $(a, a + y)$ time period.