Tornadoes for January in Kansas average 3.2 per month. What is the probability that, next January, Kansas will experience exactly two tornadoes?

A. 0.2087

B. 0.1304

C. 0.4076

D. 0.2226

Solution:

In many practical situations we are interested in measuring how many times a certain event occurs in a specific time interval or in a specific length or area. The Poisson distribution plays a key role in modeling such problems. The major difference between Poisson and Binomial distributions is that the Poisson does not have a fixed number of trials. Instead, it uses the fixed interval of time or space in which the number of successes is recorded. A good way to identify when you need to use the Poisson distribution is when the problem requires you to use a rate. In our task we apply Poisson Distribution Formula:

$$P(X = x) = e^{-\lambda} \frac{\lambda^x}{x!}, x = 0, 1, \dots, \infty$$

 λ is the parameter which indicates the average number of events in the given time interval.

The mean of the Poisson distribution is the parameter, λ^{χ}

The variance of the Poisson distribution is the parameter, λ^{x}

Let X be the number of tornadoes. X has the Poisson distribution with parameter $\lambda^x = 3.2$

In this problem we have

$$\lambda = 3.2$$

x = 1 time unit(s)

This results in our random variable $X \sim Poisson(3.2)$

$$P(X = x) = 2,718281828459045^{-3.2} \frac{3.2^2}{2!} = 0.040762203978 \cdot \frac{10.24}{2} \approx 0.20870248437$$

Answer: A. 0.2087