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:

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

$\lambda$ is the parameter which indicates the average number of events in the given time interval.
The mean of the Poisson distribution is the parameter, $\lambda^{x}$
The variance of the Poisson distribution is the parameter, $\lambda^{x}$

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

