**Poisson Distribution**

A Poisson distribution is the probability distribution that results from a Poisson experiment.

Attributes of a Poisson Experiment

A **Poisson experiment** is a [statistical experiment](https://stattrek.com/statistics/dictionary.aspx?definition=Statistical_experiment) that has the following properties:

* The experiment results in outcomes that can be classified as successes or failures.
* The average number of successes (μ) that occurs in a specified region is known.
* The probability that a success will occur is proportional to the size of the region.
* The probability that a success will occur in an extremely small region is virtually zero.

Notation

The following notation is helpful, when we talk about the Poisson distribution.

* *e*: A constant equal to approximately 2.71828. (Actually, *e* is the base of the natural logarithm system.)
* μ: The mean number of successes that occur in a specified region.
* *x*: The actual number of successes that occur in a specified region.
* P(*x*; μ): The **Poisson probability** that exactly *x* successes occur in a Poisson experiment, when the mean number of successes is μ.

**Poisson Distribution**

A **Poisson random variable** is the number of successes that result from a Poisson experiment. The [probability distribution](https://stattrek.com/statistics/dictionary.aspx?definition=Probability_distribution) of a Poisson random variable is called a **Poisson distribution**.

Given the mean number of successes (μ) that occur in a specified region, we can compute the Poisson probability based on the following formula:

**Poisson Formula**. Suppose we conduct a Poisson experiment, in which the average number of successes within a given region is μ. Then, the Poisson probability is:

P(*x*; μ) = (e-μ) (μx) / x!

where *x* is the actual number of successes that result from the experiment, and *e* is approximately equal to 2.71828.

The Poisson distribution has the following properties:

* The mean of the distribution is equal to μ .
* The [variance](https://stattrek.com/statistics/dictionary.aspx?definition=Variance) is also equal to μ .

**Poisson Distribution Example**

The average number of homes sold by the Acme Realty company is 2 homes per day. What is the probability that exactly 3 homes will be sold tomorrow?

*Solution:* This is a Poisson experiment in which we know the following:

* μ = 2; since 2 homes are sold per day, on average.
* x = 3; since we want to find the likelihood that 3 homes will be sold tomorrow.
* e = 2.71828; since *e* is a constant equal to approximately 2.71828.

We plug these values into the Poisson formula as follows:

P(*x*; μ) = (e-μ) (μx) / x!

P(3; 2) = (2.71828-2) (23) / 3!

P(3; 2) = (0.13534) (8) / 6

P(3; 2) = 0.180

Thus, the probability of selling 3 homes tomorrow is 0.180 .