Poisson Distribution Probabilities

Probability of exactly k, at most k and at least k events in an interval for a Poisson process with a mean count λ, with the mean and standard deviation.

Method: Poisson distribution

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean number of events in the interval	3.2000	
Number of events	5.0000	

Calculated results

Parameter	Value	Unit
Probability of exactly k	0.11398	
Probability of at most k	0.89459	
Probability of at least k	0.21939	
Standard deviation √λ	1.7889	

Notes for this case

• For events occurring independently at a constant average rate, the count in an interval follows P(X = k) = e^{−λ}λ^k/k!, with mean and variance both λ. Typical uses: failures per year, defects per batch, arrivals per hour, radioactive counts. P(X ≥ k) = 1 − P(X ≤ k − 1). Computed in logarithms to avoid overflow.

Formula and method

$$P(X = k) = \frac{e^{-\lambda}\lambda^{k}}{k!}, \quad \sigma = \sqrt{\lambda}$$

Variables

λ	Mean number of events in the interval	-
k	Number of events	-
$P(X = k)$	Probability of exactly k	-
$P(X \leq k)$	Probability of at most k	-
$P(X \geq k)$	Probability of at least k	-
σ	Standard deviation √λ	-

Method and standards

Poisson.

Assumptions and limits

- Independent events; constant rate.

References

Poisson distribution

Report details

Report reference	FCC-GE3A-E2HZ (the same inputs always give the same reference)
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Calculator	Poisson Distribution Probabilities
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/general/geometry/poisson-probability

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.