how to calculate the Probability of “At Least Three” Successes

Authored by

stats writer

November 30, 2025

The probability of at least three successes can be calculated by subtracting the probability of zero, one, and two successes from 1. That is, P(at least three) = 1 - (P(zero) + P(one) + P(two)). This is also known as the complement rule.

We can use the following general formula to find the **probability of at least three successes** in a series of trials:

P(at least 3) = 1 - P(0 successes) - P(1 success) - P(2 successes)

In the formula above, we can calculate each probability by using the following formula for the :

P(X=k) = nCk * pk * (1-p)n-k

where:

n: number of trials
k: number of successes
p: probability of success on a given trial
nCk: the number of ways to obtain *k* successes in *n* trials

The following examples show how to use this formula to find the probability of "at least three" successes in different scenarios.

Example 1: Free-Throw Attempts

Ty makes 25% of his free-throw attempts. If he attempts 5 free-throws, find the probability that he makes at least three.

First, let's calculate the probability that he makes exactly zero, exactly one, or exactly two free-throws:

P(X=0) = 5C0 * .250 * (1-.25)5-0 = 1 * 1 * .755 = **0.2373**

P(X=1) = 5C1 * .251 * (1-.25)5-1 = 5 * .25 * .754 = **0.3955**

P(X=2) = 5C2 * .252 * (1-.25)5-2 = 10 * .0625 * .753 = **0.2636**

Next, let's plug these values into the following formula to find the probability that Ty makes at least three free-throws:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)
P(X≥3) = 1 - .2373 - .3955 - .2636

P(X≥3) = **0.1036**

The probability that Ty makes at least three free-throws in five attempts is **0.1036**.

Example 2: Widgets

First, let's calculate the probability that exactly zero, exactly one, or exactly two are defective:

P(X=0) = 10C0 * .020 * (1-.02)10-0 = 1 * 1 * .9810 = **0.8171**

P(X=1) = 10C1 * .021 * (1-.02)10-1 = 10 * .02 * .989 = **0.1667**

P(X=2) = 10C2 * .022 * (1-.02)10-2 = 45 * .0004 * .988 = **0.0153**

Next, let's plug these values into the following formula to find the probability that at least three widgets are defective:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)
P(X≥3) = 1 - 0.8171 - 0.1667 - 0.0153
P(X≥3) = **0.0009**

The probability that at least three widgets are defective in this random sample of 10 is **0.0009**.

Example 3: Trivia Questions

Bob answers 60% of trivia questions correctly. If we ask him 5 trivia questions, find the probability that he answers at least three correctly.

First, let's calculate the probability that he answers exactly zero, exactly one, or exactly two correctly:

P(X=0) = 5C0 * .600 * (1-.60)5-0 = 1 * 1 * .405 = **0.01024**

P(X=1) = 5C1 * .601 * (1-.60)5-1 = 5 * .60 * .404 = **0.0768**

P(X=2) = 5C2 * .602 * (1-.60)5-2 = 10 * .36 * .403 = **0.2304**

Next, let's plug these values into the following formula to find the probability that he answers at least three questions correctly:

P(X≥3) = 1 - P(X=0) - P(X=1) - P(X=2)
P(X≥3) = 1 - 0.01024 - 0.0768 - 0.2304
P(X≥3) = **0.6826**

The probability that he answers at least three questions correctly out of five is **0.6826**.

Bonus: Probability of "At Least Three" Calculator

Use to automatically find the probability of "at least three" successes, based on the probability of success in a given trial and the total number of trials.