

AP Statistics · Binomial and Normal Distributions · Lesson

Common Core AP Statistics Unit 2 (2026-27) · mathovore.fr

This ap statistics binomial normal lesson explains binomial and normal distributions in one printable page, with definitions, a method and a worked example.

A binomial random variable counts the successes in a fixed number of independent trials that share the same success probability p . Its mean is np and its standard deviation is the square root of $np(1-p)$. Normal curves model continuous data through z-scores and areas, and also approximate large binomial counts.

AP StatisticsCommon Core: AP Statistics Unit 2 (2026-27)

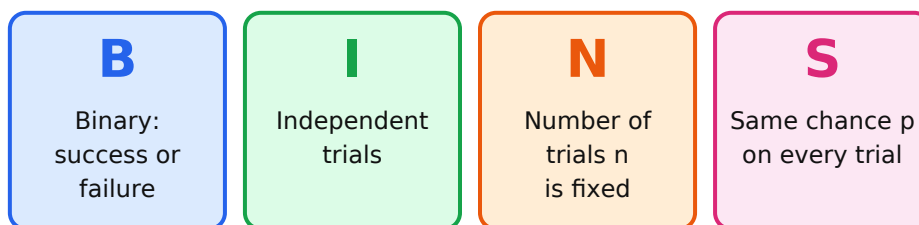
AP Statistics Binomial Normal Lesson: key facts

- Binomial setting: Binary outcomes, Independent trials, Number of trials fixed, Same probability of success (BINS).
- For a binomial count: $\mu = np$ and $\sigma = \sqrt{np(1-p)}$.
- Normal probabilities are areas: standardize with $z = \frac{x-\mu}{\sigma}$, then use Table A or normalcdf.
- Percentiles run backward: $x = \mu + z\sigma$, with z from the table or invNorm.
- Normal approximation to a binomial needs $np \geq 10$ and $n(1-p) \geq 10$.

What is a binomial setting?

A **binomial setting** counts successes in a fixed number of trials. The count X is a binomial random variable when all four BINS conditions hold. If any one fails, the binomial formulas do not apply.

The BINS checklist



Check all four BINS conditions before using a binomial model.

How do you find binomial probabilities, the mean and the standard deviation?

Binomial formulas for X with n trials and success probability p

$$P(X = k) = {}_n C_k p^k (1-p)^{n-k}$$

$$\mu_X = np \quad \sigma_X = \sqrt{np(1-p)}$$

${}_n C_k$ is the number of ways to choose k successes from n trials. It is the nCr key on a calculator.

Example. Maya makes 80% of her free throws and takes 10. Then

$P(X = 8) = {}_{10} C_8 (0.8)^8 (0.2)^2 = 45(0.8)^8 (0.2)^2 \approx 0.3020$. The mean is $\mu = 10(0.8) = 8$ and $\sigma = \sqrt{10(0.8)(0.2)} \approx 1.265$. For "at least" or "at most" questions, add the needed probabilities or use the complement.



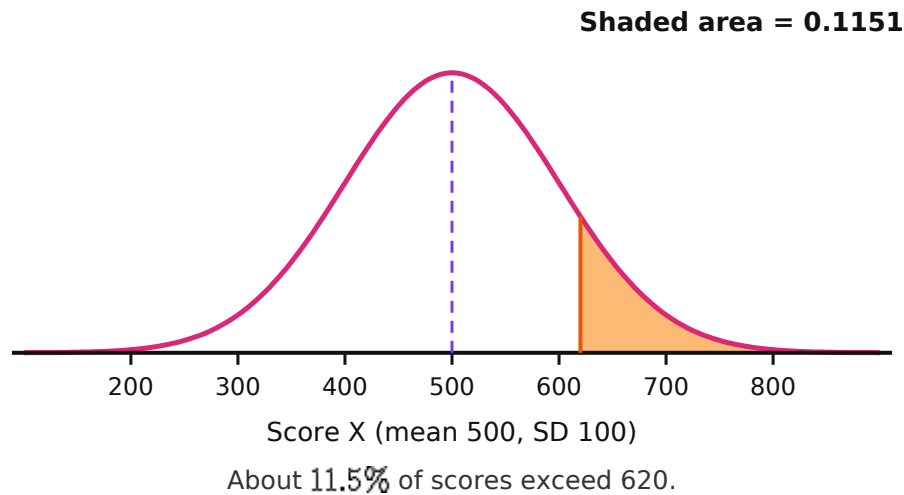
Maya's number of made free throws. The orange bar is $P(X = 8) \approx 0.3020$.

How do you do normal calculations?

A **normal distribution** is a symmetric bell-shaped model for a continuous variable, described by its mean μ and standard deviation σ . Because a continuous variable takes any single value with probability 0, probabilities are areas under the curve.

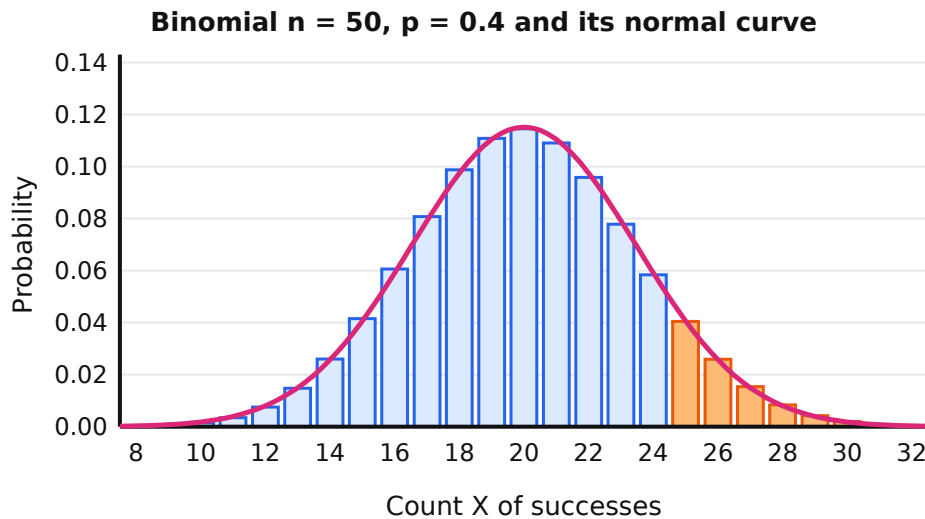
1. Sketch the curve and shade the region.
2. Standardize: $z = \frac{x - \mu}{\sigma}$.
3. Find the area to the left of z with Table A or *normalcdf*; use $1 -$ that area for a right tail.
4. State the result in context.

Scores with $\mu=500$ and $\sigma=100$: $z = \frac{620-500}{100} = 1.20$, so $P(X > 620) = 1 - 0.8849 = 0.1151$. To go the other way, find the z for a percentile, then use $x = \mu + z\sigma$.



When can a normal curve approximate a binomial count?

When both $np \geq 10$ and $n(1-p) \geq 10$, the binomial distribution is close to normal with the same mean and standard deviation. For $n=50$ and $p=0.4$: $np=20$ and $n(1-p)=30$, so the condition holds. With $\mu=20$ and $\sigma \approx 3.464$, $P(X \geq 25) \approx P(z \geq 1.44) = 0.0749$, while the exact value is 0.1034. Approximations are rougher near the tails and for small n .



The normal curve with $\mu=20$ and $\sigma \approx 3.464$ follows the tops of the bars.

Binomial and Normal Distributions: frequently asked questions

How do I know if a situation is binomial?

Check BINS: two outcomes per trial, independent trials, a fixed number of trials, and the same

success probability each time. Sampling without replacement from a small population breaks independence unless the sample is under 10% of the population.

What is the difference between binompdf and binomcdf?

$\text{binompdf}(n, p, k)$ gives $P(X = k)$ for one value. $\text{binomcdf}(n, p, k)$ gives $P(X \leq k)$, the sum of all probabilities up to and including k . For $P(X \geq k)$, use 1 minus $\text{binomcdf}(n, p, k - 1)$.

Why is the probability of one exact value zero for a normal variable?

A normal variable is continuous, so its probability is the area under a curve. A single point has no width and therefore no area. That is why $P(X < a)$ and $P(X \leq a)$ are the same for a normal model.

How do I find a value from a percentile in a normal distribution?

Find the z -score with that area to its left, using Table A backward or invNorm . Then compute $x = \mu + z\sigma$. The 90th percentile has $z \approx 1.28$.

When should I use the normal approximation instead of the exact binomial?

Use it only when np and $n(1 - p)$ are both at least 10 and the problem asks for an approximation. When a calculator can give the exact binomial probability and the conditions fail, use the exact value.

How to use this ap statistics binomial normal lesson

Use this ap statistics binomial normal lesson before the worksheet, then check what you learned with the quiz.

