

Binomial and Normal Probability Models

Grade 12 – AP Statistics math · Worksheet · Standards: AP Statistics Unit 2 (2026-27)

Name: _____ Date: _____ Class: _____

These twenty problems train the Unit 2 models of AP Statistics: identifying binomial settings, computing binomial probabilities, means and standard deviations, normal calculations in both directions, and the normal approximation to a binomial count. Later problems combine the models.

Standards: AP Statistics Unit 2 (2026-27) · **Level:** Grade 12 AP Statistics

Problem 1 Is It Binomial? (easy)

Decide whether each situation is binomial. If not, name the condition that fails.

- A basketball player takes 15 shots and X is the number made; each shot has the same probability 0.62 and shots are independent.
- Cards are dealt from a standard deck until a heart appears; X is the number of cards dealt.
- A teacher randomly picks 5 students from a class of 28 without replacement and X counts those who walk to school.

Problem 2 A Binomial Probability by Formula (easy)

A spinner lands on green with probability 0.4 on each spin. In 6 independent spins, find the probability of exactly 2 greens.

Problem 3 A Cumulative Binomial Probability (medium)

A quiz bowl player answers each question correctly with probability 0.25. In 8 independent questions, find the probability of at most 1 correct answer.

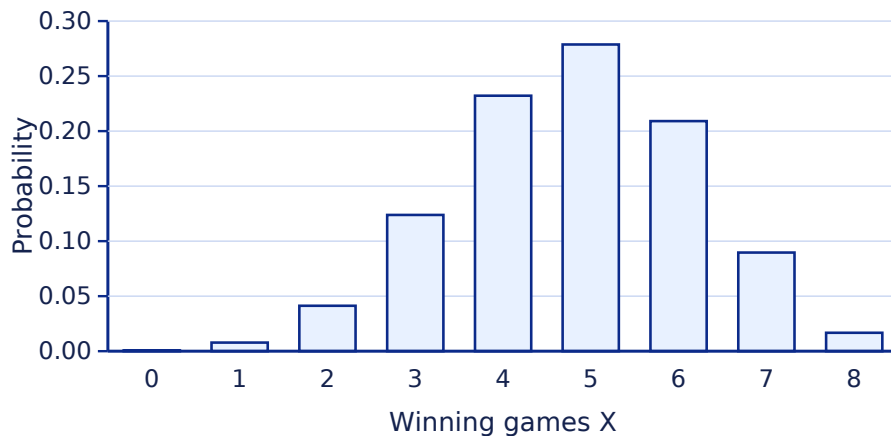
Problem 4 Mean and Standard Deviation of a Count (easy)

In a city, 35% of households own a hybrid car. In a random sample of 60 households, find the mean and standard deviation of the number that own a hybrid.

Problem 5 Reading a Binomial Histogram (medium)

A team wins each of 8 independent games with probability 0.6. The graph shows the distribution

of the number of wins X .



Binomial distribution with $n = 8$ and $p = 0.6$.

Find the most likely number of wins, $P(X \geq 7)$ and the mean.

Problem 6 At Least One Success (medium)

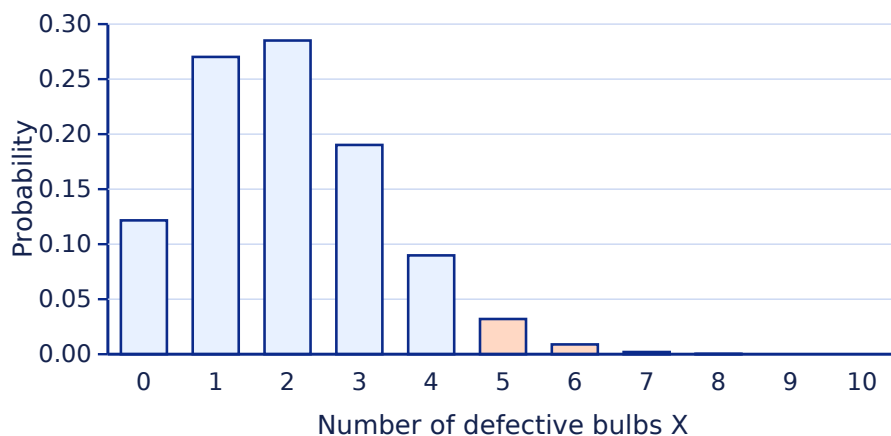
A seed company claims each seed sprouts with probability 0.85. Five seeds are planted independently. Find the probability that at least one seed does not sprout.

Problem 7 Binomial with a Calculator (medium)

A survey finds that 30% of teenagers use a library card. In a random sample of 15 teenagers, find the probability that at least 7 use a library card. Show the calculator command.

Problem 8 Is the Result Unusual? (hard)

A factory says 10% of its bulbs are defective. In a random sample of 20 bulbs, 5 are defective.



Binomial distribution with $n = 20$ and $p = 0.1$.

Find $P(X \geq 5)$. Is the result surprising if the factory's claim is true?

Problem 9 Normal Area to the Left (easy)

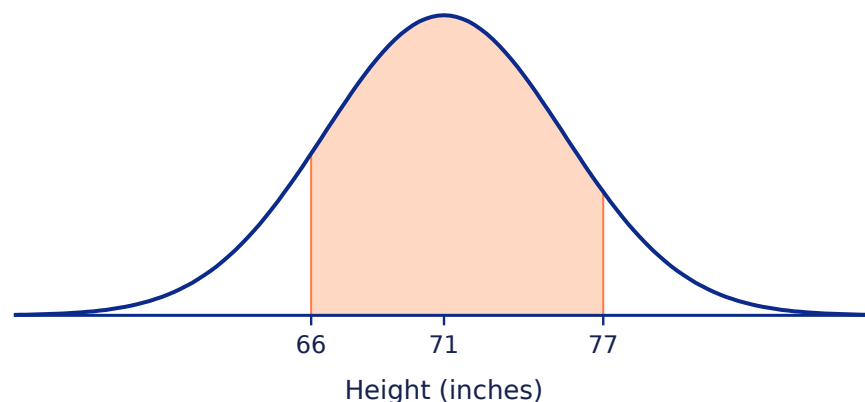
The lengths of adult rainbow trout in a hatchery are approximately normal with mean 14.5 inches and standard deviation 2.1 inches. Find the proportion of trout shorter than 12 inches.

Problem 10 Normal Area to the Right (easy)

Using the same trout distribution (mean 14.5 inches, standard deviation 2.1 inches), find the proportion longer than 18 inches.

Problem 11 Normal Area Between Two Values (medium)

Heights of players in a basketball league are approximately normal with mean 71 inches and standard deviation 4.5 inches.



Heights of adult men in a league; shaded between 66 and 77 inches.

Find the proportion of players between 66 and 77 inches tall.

Problem 12 Finding a Cutoff (medium)

Scores on a driving test are approximately normal with mean 78 and standard deviation 8. The top 10% of scores earn a bonus. What is the minimum score for the bonus?

Problem 13 Quartiles of a Normal Model (medium)

Weekly spending on snacks is approximately normal with mean \$24 and standard deviation \$6.50. Find the first and third quartiles.

Problem 14 Comparing Two Normal Models (medium)

Maya scored 672 on a reading test (mean 640, standard deviation 24) and 58 on a math test (mean 52, standard deviation 5). Both distributions are approximately normal. On which test is her percentile higher?

Problem 15 Binomial Probability in Context (hard)

A plant packs 12 batteries in a box. Each battery is defective independently with probability 0.04. Find the probability that a box has at most 2 defective batteries, and the expected number of defective batteries per box.

Problem 16 Surprising Counts (hard)

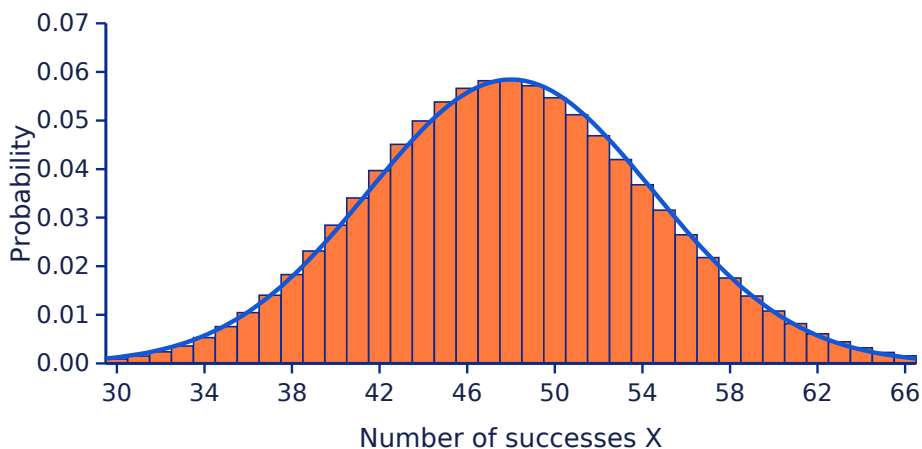
A bakery claims 30% of its customers order a muffin. In a random sample of 50 customers, 25 order a muffin. Find the mean and standard deviation of the count, how many standard deviations 25 is above the mean, and the exact probability $P(X \geq 25)$.

Problem 17 Normal Approximation Setup (hard)

In a city, 40% of residents support a new transit tax. A random sample of 150 residents is selected. Verify that a normal approximation is appropriate, then approximate the probability that at least 70 residents in the sample support the tax.

Problem 18 Approximating a Lower Tail (hard)

Of 400 randomly selected packages shipped by a store, each is returned with probability 0.12. The graph shows the distribution of the number returned.



Distribution of X for $n = 400$ and $p = 0.12$.

Show that the normal approximation applies and approximate $P(X \leq 40)$.

Problem 19 Normal Model Then Binomial (hard)

A machine fills juice cups with an amount that is approximately normal with mean 12.1 ounces and standard deviation 0.2 ounce. A cup is underfilled if it contains less than 12 ounces. (a) Find the probability that a cup is underfilled. (b) Eight cups are filled independently; find the probability that at least one is underfilled.

Problem 20 Finding μ and σ from Two Percentiles (hard)

Waiting times at a service desk are approximately normal. Exactly 10% of customers wait less than 40 minutes and exactly 5% wait more than 70 minutes. Find the mean and standard deviation.