

# Binomial and Normal Probability Models

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

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

This 45-minute test has eight AP-style questions worth 20 points. Define each variable, show the setup and standardizing steps, and state conclusions in the context of the problem.

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

Time: 45 minutes · 8 questions · Total: 20 points · Calculator: as allowed by your teacher

### Question 1 Binomial Setting (2 points)

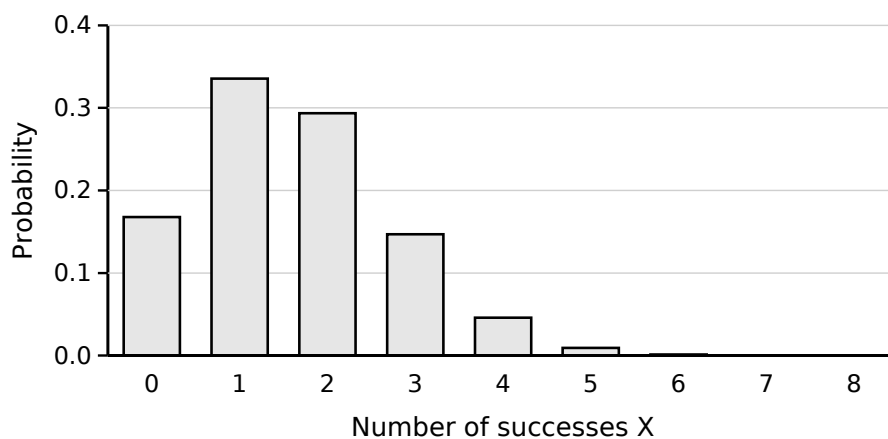
A coach records whether each of the 12 players on her team passes a fitness test (each passes independently with probability 0.8). Let  $X$  be the number that pass. Check each condition for a binomial setting and state the distribution of  $X$ .

### Question 2 Binomial Calculations (3 points)

Let  $X$  be binomial with  $n = 10$  and  $p = 0.3$ . (a) Find  $P(X = 4)$ . (b) Find  $P(X \geq 1)$ . (c) Find the mean and standard deviation of  $X$ .

### Question 3 Shape and Tail Probability (2 points)

The graph shows the distribution of a binomial variable  $X$  with  $n = 8$  and  $p = 0.2$ .



*Distribution of  $X$ .*

a. Describe the shape. (1 point)

b. Find  $P(X \geq 3)$ . (1 point)

#### Question 4 Normal Probability (2 points)

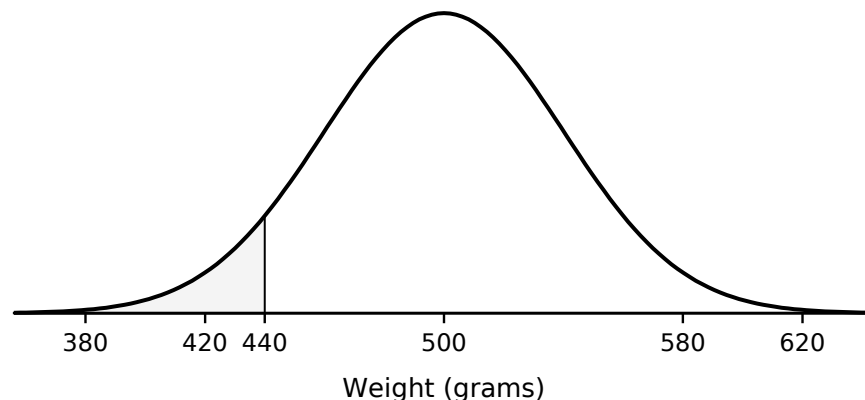
The time to complete a trail run is approximately normal with mean 250 minutes and standard deviation 30 minutes. Find the probability that a randomly selected runner finishes between 210 and 280 minutes.

#### Question 5 Percentiles and Unknown Parameters (3 points)

Resting heart rates in a group are approximately normal with mean 68 beats per minute and standard deviation 7.2. (a) Find the 85th percentile. (b) A second group has a normal distribution with mean 70 in which the 20th percentile is 63. Find its standard deviation.

#### Question 6 Tails of a Normal Model (3 points)

Weights of cereal boxes are approximately normal with mean 500 grams and standard deviation 40 grams. The figure shades the area below 440 grams.



*Cereal box weights: mean 500 g, standard deviation 40 g.*

- Find the proportion of boxes below 440 grams. (1 point)
- Find the proportion of boxes that weigh more than 580 grams. (1 point)
- Find the proportion of boxes that are either below 440 or above 580 grams. (1 point)

#### Question 7 Normal Approximation (3 points)

A school's attendance records show that 20% of students are late at least once a week. In a random sample of 300 students, let  $X$  be the number who are late at least once. (a) Verify the conditions for a normal approximation. (b) Approximate  $P(X \geq 70)$ .

**Question 8 Normal Then Binomial (2 points)**

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The thickness of a machined part is approximately normal with mean 5.15 mm and standard deviation 0.10 mm. A part is rejected if it is thinner than 5.00 mm. Find the probability that a part is rejected, then the probability that at least 1 of 5 independent parts is rejected.