

In Pennsylvania's Match 6 Lotto game, a bettor selects six numbers from 1 to 49 (without repetition), and a winning six-number combination is later randomly selected. Find the probabilities of the following events and express them in decimal form.

- You purchase one ticket with a six-number combination and you get exactly four winning numbers. (*Hint: Use $A = 6$, $B = 43$, $n = 6$, and $x = 4$.*)
- You purchase one ticket with a six-number combination and you get all six of the winning numbers.
- You purchase one ticket with a six-number combination and you get none of the winning numbers.

5-4 Parameters for Binomial Distributions

Key Concept Section 5-2 introduced the general concept of a probability distribution, and Section 5-3 focused on binomial probability distributions, which constitute a specific type of discrete probability distribution. This section continues with binomial distributions as these two goals are addressed:

- Provide an easy method for finding the parameters of the mean and standard deviation from a binomial distribution. (Because a binomial distribution describes a *population*, the mean and standard deviation are *parameters*, not statistics.)
- Use the range rule of thumb for determining whether events are *unusual*.

Section 5-2 included Formulas 5-1, 5-3, and 5-4 for finding the mean, variance, and standard deviation from *any* discrete probability distribution. Because a binomial distribution is a particular type of discrete probability distribution, we could use those same formulas, but if we know the values of n and p , it is much easier to use these formulas:

For Binomial Distributions

Formula 5-6	Mean:	$\mu = np$
Formula 5-7	Variance:	$\sigma^2 = npq$
Formula 5-8	Standard Deviation:	$\sigma = \sqrt{npq}$

As in earlier sections, finding values for μ and σ can be great fun, but it is especially important to *interpret* and *understand* those values, so the range rule of thumb can be very helpful. Here is a brief summary of the range rule of thumb: Values are unusually high or unusually low if they differ from the mean by more than 2 standard deviations, as described by the following:

Range Rule of Thumb

maximum usual value: $\mu + 2\sigma$

minimum usual value: $\mu - 2\sigma$

Example 1 Parameters

The brand name of McDonald's has a 95% recognition rate (based on data from Retail Marketing Group and Harris Interactive). A special focus group consists of 12 randomly selected adults to be used for extensive market testing. For such random groups of 12 people, find the mean and standard deviation for the number of people who recognize the brand name of McDonald's.