# How to Calculate the Probabilities of Winning the Nine PowerBall Prize Levels:

**PowerBall** numbers are drawn from two sets of numbers. Five numbers are drawn from one set of 69 numbered white balls and one **Powerball** number is drawn from a second set of 26 numbered red balls. The odds of winning PowerBall are calculated by combining the odds for both sets of numbers for all prize levels. The first, third, fifth, and seventh through ninth prize level odds are determined by the chances of choosing a given number of white balls correctly as well as the red **Powerball**. The second, fourth and sixth prize level odds are determined by the chances of choosing a given number of white balls correctly and the red **Powerball** incorrectly. Since the order of the items chosen is irrelevant, the applicable probability rule is the formula to determine combinations.

Before calculating the odds for the different prize levels, calculate the total number of combinations possible for each portion of the PowerBall draw.

A. Calculate how many combinations of 5 numbers can be drawn from 69 unique numbers:

The formula is as follows:

$$\frac{69!}{5!\,(69-5)!} = \frac{69*68*67*66*65*64!}{5*4*3*2*1*64!} = \frac{69*68*67*66*65}{5*4*3*2*1} = \frac{1,348,621,560}{120} = 11,238,513$$

where ! indicates a factorial, i.e., $n! = n * (n-1) * (n-2) * \ldots * 2 * 1$

Thus, there are 11,238,513 different ways in which 5 numbers can be chosen from a total of 69 unique numbers.

B. Calculate how many combinations of 1 number can be drawn from 26 unique numbers:

$$\frac{26!}{1!\,(26-1)!} = \frac{26*25!}{1*25!} = 26$$

Thus, there are 26 different ways 1 number can be chosen from a total of 26 unique numbers.

**1. Top Prize Level**: *Match all five numbers plus the Powerball* (*1 in 292,201,338 odds)*

Step 1: Calculate the number of ways in which 5 numbers can be chosen correctly out of 5 numbers drawn from 69 unique numbers.

The formula is as follows:

$$\frac{5!}{5!\,(5-5)!} * \frac{(69-5)!}{((69-5)-(5-5))!\,(5-5)!} = \frac{1}{0!} * \frac{64!}{(64-0)!\,0!} = \frac{64!}{64!\,1} = 1$$

(note: 0!=1)

This means that there is only 1 way in which 5 numbers out of 5 numbers drawn from a field of 69 numbers can be chosen correctly.

Thus, there is only 1 chance in 11,238,513 of correctly choosing all five numbers drawn in the first portion of PowerBall.

Step 2: Calculate how many ways the correct Powerball number can be chosen from 26 unique numbers.

The chance of correctly choosing the Powerball is simply 1 in 26.

Step 3: Determine the chance of choosing both correctly by multiplying these figures together:

$$\frac{1}{11{,}238{,}513} * \frac{1}{26} = \frac{1}{292{,}201{,}338} \text{ or 1 chance in 292,201,338.}$$

**2. Second Prize Level**: *Match all five numbers only (1 in 11,688,053.52 odds)*

Step 1: The chance of getting 5 numbers correct out of 5 numbers drawn from 69 unique numbers is 1 in 11,238,513 (see #1, Step 1 above.)

Step 2: The chance of correctly choosing the Powerball is 1 in 26. Therefore, the chances of incorrectly choosing the Powerball are, conversely, 25 in 26.

Step 3: Determine the chances of choosing 5 out of 5 of 69 correctly and getting the Powerball incorrect by multiplying these figures together:

$$\frac{1}{11{,}238{,}513} * \frac{25}{26} = \frac{25}{292{,}201{,}338} = \frac{1}{11{,}688{,}053{,}52} \text{ or 1 chance in 11,688,053.52.}$$

**3.** <u>**Third Prize Level:**</u> ***Match four numbers plus the*** <span style="color:red">***Powerball***</span> *(1 in 913,129.18 odds)*

> **Step 1**: Calculate the number of ways in which 4 numbers can be chosen correctly out of 5 numbers drawn from 69 unique numbers.

> The formula is as follows:

$$\frac{5!}{4!\,(5-4)!} * \frac{(69-5)!}{((69-5)-(5-4))!\,(5-4)!} = \frac{5*4!}{4!\,1!} * \frac{64!}{(64-1)!\,1!} = \frac{5}{1} * \frac{64*63!}{63!\,1} = 5*64 = 320$$

> This means that there are 320 different ways in which 4 numbers out of 5 numbers drawn from a field of 69 numbers can be chosen correctly.

> Thus, the chances are 320 in 11,238,513 of correctly choosing 4 out of 5 numbers in the first portion of PowerBall.

> **Step 2:** The chance of correctly choosing the <span style="color:red">Powerball</span> is simply 1 in 26.

> **Step 3:** Determine the chances of choosing 4 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> correct by multiplying these figures together:

$$\frac{320}{11,238,513} * \frac{1}{26} = \frac{320}{292,201,338} = \frac{1}{913,129.18} \text{ or 1 chance in 913,129.18.}$$

**4.** <u>**Fourth Prize Level:**</u> ***Match four numbers only*** *(1 in 36,525.17 odds)*

> **Step 1**: The chances of getting 4 numbers correct out of 5 numbers drawn from 69 unique numbers are 320 in 11,238,513 (see #3, Step 1, above.)

> **Step 2**: The chance of correctly choosing the <span style="color:red">Powerball</span> is 1 in 26. Therefore, the chances of incorrectly choosing the <span style="color:red">Powerball</span> are, conversely, 25 in 26.

> **Step 3**: Determine the chances of choosing 4 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> incorrect by multiplying these figures together:

$$\frac{320}{11,238,513} * \frac{25}{26} = \frac{8,000}{292,201,338} = \frac{1}{36,525.17} \text{ or 1 chance in 36,525.17.}$$

**5.** <u>**Fifth Prize Level:**</u> ***Match three numbers plus the*** <span style="color:red">***Powerball***</span> *(1 in 14,494.11 odds)*

**Step 1**: Calculate the number of ways in which 3 numbers can be chosen correctly out of 5 numbers drawn from 69 unique numbers.

The formula is as follows:

$$\frac{5!}{3!\,(5-3)!} * \frac{(69-5)!}{((69-5)-(5-3))!\,(5-3)!} = \frac{5*4*3!}{3!\,2!} * \frac{64!}{(64-2)!\,2!} = \frac{5*4}{2} * \frac{64*63*62!}{62!\,2*1} = 5*64*63 = 20,160$$

This means that there are 20,160 different ways in which 3 numbers out of 5 numbers drawn from a field of 69 numbers can be chosen correctly.

Thus, the chances are 20,160 in 11,238,513 of correctly choosing 3 out of 5 numbers in the first portion of PowerBall.

**Step 2:** The chance of correctly choosing the <span style="color:red">Powerball</span> is simply 1 in 26.

**Step 3:** Determine the chances of choosing 3 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> correct by multiplying these figures together:

$$\frac{20,160}{11,238,513} * \frac{1}{26} = \frac{20,160}{292,201,338} = \frac{1}{14,494.11} \text{ or 1 chance in 14,494.11.}$$

**6.** <u>**Sixth Prize Level**</u>**:** ***Match three numbers only*** *(1 in 579.76 odds)*

**Step 1**: The chances of getting 3 numbers correct out of 5 numbers drawn from 69 unique numbers are 20,160 in 11,238,513 (see #5, Step 1, above.)

**Step 2**: The chance of correctly choosing the <span style="color:red">Powerball</span> is 1 in 26. Therefore, the chances of incorrectly choosing the <span style="color:red">Powerball</span> are, conversely, 25 in 26.

**Step 3**: Determine the chances of choosing 3 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> incorrect by multiplying these figures together:

$$\frac{20,160}{11,238,513} * \frac{25}{26} = \frac{504,000}{292,201,338} = \frac{1}{579.76} \text{ or 1 chance in 579.76.}$$

**7. <u>Seventh Prize Level</u>: *Match two numbers plus the <span style="color:red">Powerball</span>* (1 in 701.33 odds)**

    **Step 1**: Calculate the number of ways in which 2 numbers can be chosen correctly out of 5 numbers drawn from 69 unique numbers.

    The formula is as follows:

$$\frac{5!}{2!\,(5-2)!} * \frac{(69-5)!}{((69-5)-(5-2))!\,(5-2)!} = \frac{5*4*3!}{2!\ 3!} * \frac{64!}{(64-3)!\ 3!} = \frac{5*4}{2} * \frac{64*63*62*61!}{61!\,3*2*1} = \frac{5*64*63*62}{3} = 416{,}640$$

    This means that there are 416,640 different ways in which 2 numbers out of 5 numbers drawn from a field of 69 numbers can be chosen correctly.

    Thus, the chances are 416,640 in 11,238,513 of correctly choosing 2 out of 5 numbers in the first portion of PowerBall.

    **Step 2:** The chance of correctly choosing the <span style="color:red">Powerball</span> is simply 1 in 26.

    **Step 3:** Determine the chances of choosing 2 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> correct by multiplying these figures together:

$$\frac{416{,}640}{11{,}238{,}513} * \frac{1}{26} = \frac{416{,}640}{292{,}201{,}338} = \frac{1}{701.33} \text{ or 1 chance in 701.33.}$$

**8. <u>Eighth Prize Level</u>: *Match one number plus the <span style="color:red">Powerball</span>* (1 in 91.98 odds)**

    **Step 1**: Calculate the number of ways in which 1 number can be chosen correctly out of 5 numbers drawn from 69 unique numbers.

    The formula is as follows:

$$\frac{5!}{1!\,(5-1)!} * \frac{(69-5)!}{((69-5)-(5-1))!\,(5-1)!} = \frac{5*4!}{1!\ 4!} * \frac{64!}{(64-4)!\ 4!} = \frac{5}{1} * \frac{64*63*62*61*60!}{60!\,4*3*2*1} = \frac{5*64*63*62*61}{24} = 3{,}176{,}880$$

    This means that there are 3,176,880 different ways in which 1 number out of 5 numbers drawn from a field of 69 numbers can be chosen correctly.

    Thus, the chances are 3,176,880 in 11,238,513 of correctly choosing 1 out of 5 numbers in the first portion of PowerBall.

    **Step 2:** The chance of correctly choosing the <span style="color:red">Powerball</span> is simply 1 in 26.

    **Step 3:** Determine the chances of choosing 1 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> correct by multiplying these figures together:

$$\frac{3{,}176{,}880}{11{,}238{,}513} * \frac{1}{26} = \frac{3{,}176{,}880}{292{,}201{,}338} = \frac{1}{91.98} \text{ or 1 chance in 91.98.}$$

**9. <u>Ninth Prize Level</u>: *Match the <span style="color:red">Powerball</span> only* (1 in 38.32 odds)**

**Step 1**: Calculate the number of ways in which no numbers are chosen correctly out of 5 numbers drawn from 69 unique numbers.

The formula is as follows:

$$\frac{5!}{0!\,(5-0)!} * \frac{(69-5)!}{((69-5)-(5-0))!\,(5-0)!} = \frac{5!}{1*5!} * \frac{64!}{(64-5)!\,5!} = \frac{64*63*62*61*60*59!}{59!\,5*4*3*2*1} = \frac{64*63*62*61*60}{120} = 7,624,512$$

($Note:\ 0! = 1$)

This means that there are 7,624,512 different ways in which no numbers out of 5 numbers drawn from a field of 69 numbers are chosen correctly.

Thus, the chances are 7,624,512 in 11,238,513 of correctly choosing 0 out of 5 numbers in the first portion of PowerBall

**Step 2:** The chance of correctly choosing the <span style="color:red">Powerball</span> is simply 1 in 26.

**Step 3:** Determine the chances of choosing 0 out of 5 of 69 correctly and getting the <span style="color:red">Powerball</span> correct by multiplying these figures together:

$$\frac{7,624,512}{11,238,513} * \frac{1}{26} = \frac{7,624,512}{292,201,338} = \frac{1}{38.32}\ \text{or 1 chance in 38.32.}$$