

## **Lottery Jackpots**

There are many states in the USA that have lotteries with various amounts of prize levels. One often wonders how impossible it may be to win the lottery. Here is the proof of just that.

Using basic probability techniques of combinations (since the order of the lottery numbers do not matter), the actual odds of winning will depend on how many numbers (which we will call white balls) there are and how many are drawn to win the lottery jackpot.

### **New York Lottery**

Let's take the New York State lottery for example. This lottery system uses 59 white balls with 6 of them being drawn to win. The definition of the combination is as follows:

$$n C r = \frac{n!}{r! (n-r)!}$$

where n is the number of balls in the pool and r is how many it takes to win. So therefore, using the formula above, we get the following:

$$\begin{aligned} 59 C 6 &= \frac{59!}{6! * 53!} \\ &= \frac{59*58*57*56*55*54}{6*5*4*3*2*1} \\ &= 45,057,474 \end{aligned}$$

Which means, the odds of winning the NY state lottery are 1:45,057,474. Yeah right....

### **Mega Millions Lottery**

Another example is the Mega Millions jackpot. This is a multistate lottery system that uses 5 white balls from 1 to 56 and a mega ball from 1 to 46. You need to match all 5 white balls and the orange mega ball to win. So therefore, this results in two different combinations multiplied together:

$$56 C 5 * 46 C 1 = \frac{56!}{5! * 51!} * \frac{46!}{1! * 45!}$$

$$= \frac{56*55*54*53*52}{5*4*3*2*1} * 46$$
$$= 175,711,536$$

That means the odds of winning the mega millions is 1:175,711,536. Hahahahaha..... Here's a good tip, **DON'T PLAY THE LOTTERY!!!**

**You Try It**

Below are some more lotto jackpots to try for yourself.

1. What are the odds of winning a lottery with a pool of 40 white balls with 5 being drawn for a winner?
2. What are the odds of winning a lottery with a pool of 60 white balls and 7 needed to win?
3. What are the odds of winning a lottery with a pool of 50 white balls and 30 bonus ball with 6 white and 1 bonus ball needed to win?
4. What are the odds of winning a lottery with a pool of 45 white balls and 45 bonus balls with 5 white and 1 bonus ball needed to win?

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