

Nearly half the 440 million tickets sold during Saturday night's Powerball drawing had the exact same six-number combination as at least one other ticket that had already been sold.

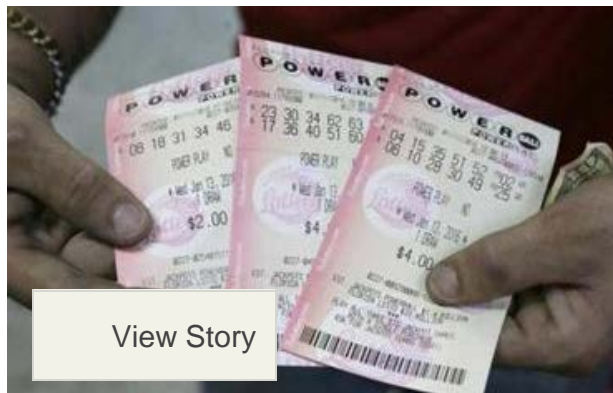
And experts expect to see an even higher ratio of duplicate tickets for Wednesday night's drawing.

Duplicate tickets — not to mention the astronomically long odds — are part of the reason why no one has won the grand prize for 19 consecutive drawings. They're also the reason that odds now favor multiple winners having to split the \$1.5 billion jackpot, if someone wins.



Calculating the duplicates

Powerball features more than 292.2 million possible six-number combinations.



Powerball jackpot swells to \$1.5 billion

The grand prize could get even bigger, depending on ticket sales leading up to the late-night drawing.

For Saturday's drawing, 77.8 percent of the possible combinations — or about 227.3 million of them — were played.

But 440 million tickets were sold. That means that about 213 million tickets, or about 48 percent of all tickets sold, had the exact same combination as at least one other ticket that had already been sold.

Duplicates, even in such large numbers, are expected

As odd as that may seem at first glance, it's actually in line with what numerous professors who are experts on probability said they would expect.

“That’s kind of the way probabilities work,” said Professor Timothy Norfolk, chair of the mathematics department at the University of Akron and an expert on gambling and probabilities. “For example, if you roll a dice six times, you’re fairly unlikely to see it roll a different number each of the six times.”



Human nature explains some of the repeat entries

The seemingly high number of duplicate tickets is due at least partly to our obsession with numbers we think are lucky — birthdays, anniversaries, the jersey number of our favorite athletes.

When it comes to picking Powerball combinations manually — as opposed to letting machines generate random combinations — players tend to gravitate toward certain numbers, and avoid others, which increases the likelihood that numerous tickets will feature the same six-number combination, experts said.

“Some of it depends on the psychology of people. People tend to pick things like dates that are important to them,” like birthdays and anniversaries, Norfolk explained. Thus, numbers up to 31 tend to be more common.

The game, however, allows players to choose five numbers between 1 and 69 and a sixth number, called the Powerball, from between 1 and 26.

“There are also certain combinations that people don’t tend to play, like six of the same numbers or six numbers in a row,” Norfolk said. “They think somehow it looks wrong. It doesn’t look random.”

But much of it also comes down to chance

Only between 20 and 30 percent of Powerball players pick numbers themselves, according to the game’s official website. The rest of players rely on the game to pick numbers for them — a Quick Pick — using a random number generator.

And the results of Saturday’s drawing — that about 48 percent were duplicates — actually fit with what about experts would expect if every number combination was selected at random.

Victor Matheson, professor of economics and accounting at the College of the Holy Cross, MIT mathematics professor Tanya Khovanova, and University of Buffalo statistician Jeffrey Miecznikowski all said that if every combination played in Saturday’s drawing was chosen at random, about 45 percent of the tickets would have matched at least one other ticket already in play.

“It’s very likely to have that percentage of replicates,” said Miecznikowski. “It doesn’t seem that players’ bias in picking numbers has a large effect. I’m not sure picking dates and other things is really as big of a bias as we thought.”

Those machine-generated Quick Picks don’t prevent duplicates

When people opt for a Quick Pick, the machine-generated number combination can still be a duplicate.

“They are just random generators, which can very easily come up with the same numbers,” said Norfolk.

Kelly Cripe, a spokeswoman for the Texas Lottery Commission and for the Multi-State Lottery Association, which runs the Powerball game, said that Quick Picks, the random number generator that lottery each terminal uses, “has no memory of what it previously selected and that is why you could get the exact same Quick Pick numbers on the same ticket or numerous players could end up with the same identical set of Quick Pick numbers.”

The more tickets in play, the more duplicates

The larger the jackpot, the more people play. And the more tickets that are purchased not only

increases the percent of possible combinations that are put in play, but also increases the percentage of duplicates.

For example, a Globe analysis of the last four drawings showed that the percentage of duplicates climbed from about 6 percent on Dec. 30, to 9 percent on Jan. 2 and then to 25 percent on Jan. 6, before reaching 48 percent for the last drawing on Saturday.

Miecznikowski said the pattern is “almost spot on with what you would expect.”

“It’s really a function of the numbers game,” he said. “There’s only a finite number of combinations but people are buying more and more tickets so the percentage of replicates is going to go up.”

Given the strong likelihood that ticket sales will be higher for Wednesday’s drawing, he said it’s likely the percentage of duplicates will be larger, too.

The bottom line: The odds now favor multiple winners

Experts said the large number of duplicates improves the odds of multiple winners.

“If the jackpot is won [on Wednesday], there’s a pretty reasonable chance that at least two people will win,” said Matheson.

“That’s why for the big pots you typically get more winners,” added Norfolk.

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