

EXAMPLE 6 Winning a Lottery Twice: Fraud?

The likelihood of winning a major state lottery is very small. Yet some people have won state lotteries more than once. Does this indicate fraud? Explain your reasoning.

Lottery Luck Strikes Twice in Three Months

ST. LOUIS - You are as likely to win the lottery as you are to be struck by lightning. Ernest Pullen, a Missouri resident, has won the lottery twice in a matter of three months. In June, he won his first cash prize for \$1 million. In September, he won his second cash prize for \$2 million. One lottery official called it an amazing coincidence.

SOLUTION

This problem is difficult because there is not enough information to analyze it completely. Even so, consider a simplified example.

- There is a drawing every day with one winner.
- The same million people play each day.
- The probability of winning with one ticket is one-millionth.

With these assumptions, the mathematical strategy for the solution is the same as that in the “Birthday Problem” in Example 3 on page 386.

$$\begin{aligned} \text{Probability that all } & \overbrace{\left(\frac{1,000,000}{1,000,000} \right) \left(\frac{999,999}{1,000,000} \right) \left(\frac{999,998}{1,000,000} \right) \cdots \left(\frac{999,636}{1,000,000} \right)}^{365 \text{ factors}} \\ \text{365 tickets have} & = \\ \text{different owners} & \\ & \approx 0.936 \end{aligned}$$

$$\begin{aligned} \text{Probability that at} & \\ \text{least 2 tickets have} & = 1 - 0.936 = 0.064 \\ \text{the same owner} & \end{aligned}$$

So, there is about a 6.4% chance that during 1 year, someone will win the lottery twice. At the end of 2 years, this probability increases to 23.4%. By the end of 3 years, it increases to 45.1%.

Be sure you see that this is not the probability that *you* (or any other given person) will win the lottery twice. It is simply the probability that *someone* will win it twice. The point is this—having someone win twice is not an indication of fraud.

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You win a state lottery for \$1 million and you have the choice of receiving \$50,000 a year for 20 years or \$500,000 in a lump-sum payment now.

- Suppose you live in California and take the lump-sum payment. How much state and federal tax do you have to pay on your winnings? (See Section 5.2.)
- Canadian citizens do not have to pay income tax on lottery winnings. Do you agree that Americans should have to pay state income tax on a lottery sponsored by the state? Explain.

