

Dr. Nestler's Math 21 Worksheet on Odds vs. Probability using the Lottery on *The Simpsons*

Suppose that the probability that an event occurs is .10 (10%). Another way of expressing this is to say that the odds are 1 in 10, because  $\frac{1}{10} = .10$ . In general, if we can express probability  $p$  in the form  $p = \frac{1}{n}$  with  $n$  a whole number, we say that the odds are 1 in  $n$ . We can convert from probability to odds by rewriting this equation as  $n = \frac{1}{p}$ .

This can be a helpful way to express the likelihood of an event that is rather unlikely to occur; for example, if the probability of an event occurring is  $p = .000001$ , then we say the odds are 1 in a million. Likewise, if the probability of an event occurring is  $p = \frac{2}{15}$ , then the reciprocal of this number is 7.5, so we round this and say that the odds of the event occurring are 1 in 8.

In the episode "Dog of Death" (8F17) of *The Simpsons*, it is announced that the odds of winning the state lottery are 1 in 380 million. To play the lottery, you pick six different positive integers. Throughout, we assume that numbers are chosen at random from those available.

1. As a decimal number, what is the probability of winning the lottery with one ticket?
2. We need to determine the number of integers  $n$  that you would have to choose from in order for the odds of winning to be approximately 1 in 380,000,000. That is, we need to determine the number  $n$  such that  $\frac{1}{C(n,6)} \approx \frac{1}{380,000,000}$ . So we want  $C(n, 6) \approx 380,000,000$ . Kent announces that the winning numbers are 17, 3, 26, 41, 38, and 49, so  $n$  must be at least 49.
3. Homer buys 50 tickets. What are the odds that Homer wins the lottery using his 50 tickets?
4. Marge says that you can win money by matching any five of the six numbers. What are the odds that a ticket matches exactly five of the six numbers?
5. What are the odds that Homer matches five of the six numbers on at least one of his tickets?
6. Homer doesn't have the numbers 17 or 3. What are the odds that there is no 17 among all of Homer's numbers?
7. What are the odds that there is no 17 or 3 among all of Homer's numbers?
8. What are the odds that none of the winning numbers is over 50?
9. The next time the lottery numbers are drawn, the winning numbers are 3, 6, 17, 18, 22 and 29. (Recall that Marge and her friends would have won this time, had they played their usual numbers.) What are the odds that both 3 and 17 appear among two jackpot drawings?
10. What are the odds that none of the winning numbers is over 30?

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