

How To Win At Craps

Let me say right up front, that I neither condone nor encourage gambling. But if you have decided to roll them bones anyway you will generally find it more fun to win rather than to lose. This article will show you how to win at craps and the exact probability of doing so.

If you are a player who believes in hunches, luck (good or bad), that so called 'winning streaks' can predict further wining, and that so called 'losing streaks' can predict further losing, **stop, read no further**. Further reading will only confuse you with facts. Go forth and lose your money happily with whatever mystical system you have devised. Or if you are in a real hurry to get rid of your money go "invest" it in the lottery.

To begin let's be sure that we are both swimming outside the same pool; let's review the modern day rules which are:

1. The shooter places a bet and a fader bets against him. The shooter then rolls the dice and if the number is 7 or 11, he wins immediately. If it is 2, 3, or 12 he loses immediately. In either case he continues to roll the dice.
2. Anything other than 2, 3, 7, 11, or 12 namely 4, 5, 6, 8, 9, or 10 is his point. If he rolls his point before he rolls a 7, he wins. If he rolls a 7 before he rolls his point, he loses. If he wins he continues to roll the dice, if he loses the dice are passed to the next player who then becomes the shooter.

Also, let me point out that this article assumes an honest game, honest dice, honest players, and an honest roll so that any one of the 36 possibilities are an equal probability each time the dice are rolled. Moreover, that there are no special rules favoring the house, such as 12 on the first roll loses for the shooter but does not win for the fader.

In the article I will use some statistics. Fear not. I will explain them so simply that anyone who has passed Mrs. Longnecker's ninth grade math will be able to easily understand them. Further, you will then be able to quote them with such conviction that you may be able to pass yourself off as a statistician.

However, if you prefer not to make noises like a statistician and would like to just skip right to the bottom line, click on Bottom Line.

Bottom Line

Let us begin with the 36 possibilities that can occur when you roll the dice. Since there are only 11 numbers which can be rolled (2 through 12), you are already asking how can there be 36 possibilities. And besides that how are a number and a possibility different, aren't they the same thing?? Not quite. Let's consider the 36 possibilities and the numbers attached to them. As we do so, the role of each will become clear.

On each face of each dice (die if you are a purist), there is a number from 1 through 6. Right off you're saying, "Oh, now I understand, $(6)^2$ is 36." Hey, not so fast, let's think this thing through.

Let's begin by naming the dice, Dice No.1 and Dice No. 2. When the dice are rolled either one of them can have any one of the six numbers. So that we can cover all the possibilities let's begin by saying that Dice No. 1 has a 1. Then when Dice No. 2 has each of its numbers in turn we have the six possibilities as shown in the table below.

Dice No. 1	Dice No. 2	Number	Possibilities
1	1	2	1
1	2	3	2
1	3	4	3
1	4	5	4
1	5	6	5
1	6	7	6

Now notice several things. First, we used up all of the possibilities when Dice No. 1 has rolled a one. Second, we have used 6 possibilities, which in this case only, are numerically equal to the numbers of Dice No. 2. Third, we have six numbers in order from 2 to 7. Easy so far! So since we have used up all the possibilities with a 1 on Dice No. 1, let's change it to a 2 and use those 6 possibilities as shown below.

Dice No. 1	Dice No. 2	Number	Possibilities
2	1	3	7
2	2	4	8
2	3	5	9
2	4	6	10
2	5	7	11
2	6	8	12

Notice that we now have 6 more possibilities for a total 12. Further, in the numbers column, we have used 5 of the numbers again. But we have dropped the 2 and picked up an 8. However, most have produced a number that had already been used with one of the other possibilities. This leads us to believe that some numbers might come up more frequently than others. And indeed, this is exactly the case.

In fact, to now get all of the possibilities and all of the numbers let's take these two tables and combine them. Then add to them the possibilities when Dice No. 1 is 3, 4, 5, and 6. The results follow.

Dice No. 1	Dice No. 2	Number	Possibilities
1	1	2	1
1	2	3	2
1	3	4	3
1	4	5	4
1	5	6	5

1	6	7	6
2	1	3	7
2	2	4	8
2	3	5	9
2	4	6	10
2	5	7	11
2	6	8	12
3	1	4	13
3	2	5	14
3	3	6	15
3	4	7	16
3	5	8	17
3	6	9	18
4	1	5	19
4	2	6	20
4	3	7	21
4	4	8	22
4	5	9	23
4	6	10	24
5	1	6	25
5	2	7	26
5	3	8	27

5	4	9	28
5	5	10	29
5	6	11	30
6	1	7	31
6	2	8	32
6	3	9	33
6	4	10	34
6	5	11	35
6	6	12	36

So, we have now accounted for all 36 possibilities. Those are the only things that can occur when you roll the dice. We also have all the numbers that can occur. We have already discovered that some numbers seem to come up more often than others. But now we can count them so that we know exactly how often they do come up. You can make that count for yourself or see the following table where they are tabulated for you.

Numbers	Frequency of Occurrence
2	1
3	2
4	3
5	4
6	5
7	6

8	5
9	4
10	3
11	2
12	1

As we might have guessed, 2 (snake eyes) and 12 (boxcars) can each happen on average only once for each 36 rolls. Seven will occur 6 times and the other numbers correspondingly less depending on how far they are from 7. The frequency of occurrence is of course vitally important in determining the probability of winning or losing.

We will use the modern rules which we have already discussed and will now determine the probability of a win or loss for each number. We begin by taking the numbers in order beginning with 2.

Number	Probability of That Number	Probability of a Win	Probability of a Loss
2	$1/36$	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$

The probability of 2 occurring is only one in 36, so the probability of that number is $1/36$ as shown in the second column. In the third column there are two probabilities. In this case both are 0. The first 0 is the probability of a win once the number has been rolled. The second 0 is the probability of a win before the dice are rolled. This second probability is absolutely essential in eventually determining whether there is a greater probability of a win or a loss for the shooter.

In the fourth column are also two probabilities. The 1 is the probability of a loss after the number has been rolled and the $1/36$ is the probability of a loss before the dice are rolled. Notice that the probabilities are completely consistent with the rules. That is if you roll a 2 on the first roll, you lose. The probability of winning is 0 and the probability of losing is 1. Let's add the second number, which is 3 to our table. The two numbers behave somewhat similarly.

Number	Probability of That Number	Probability of a Win	Probability of a Loss
2	$1/36$	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$
3	$2/36$	$2/36 \times 0 = 0$	$2/36 \times 1 = 2/36$

The probability of a 3 is 2 possibilities out of 36. Remember our previous frequency of occurrence table. As before, the probability of a win is 0 in both cases. In the fourth column the probability of a loss after the number has been determined is again 1.

However, note that the probability of a loss before the dice are rolled has doubled and is $2/36$. This is completely consistent since we have already shown that a 3 is twice as likely to occur as a 2. Let's now add the number 4 and we will study how the probabilities occur when the shooter has a 'point'.

Number	Probability of That Number	Probability of a Win	Probability of a Loss
2	$1/36$	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$
3	$2/36$	$2/36 \times 0 = 0$	$2/36 \times 1 = 2/36$
4	$3/36$	$3/36 \times 3/9 = 1/36$	$3/36 \times 6/9 = 2/36$

The probability of a 4 is 3 possibilities out of 36, or $3/36$. Now we must refine our logic since the shooter has a point. Now the only numbers that matter are 4 and 7. All other numbers are ignored. From our frequency of occurrence table we see that 4 will occur 3 times out of every 36 and 7 will occur 6 times out of every 36.

However, we are not concerned with any numbers except 4 and 7. So because 4 will occur 3 times and 7 will occur 6 times, their total occurrence is $3 + 6 = 9$. Or in terms of the probability of occurrence the 4 will occur $3/9$ times and the 7 will occur $6/9$ times. This is where the $3/9$ in the third column comes from and where the $6/9$ in the fourth column comes from. Want to give the next number a try just to be sure you've got the hang of it before we do the entire table.

Number	Probability of That Number	Probability of a Win	Probability of a Loss
2	$1/36$	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$
3	$2/36$	$2/36 \times 0 = 0$	$2/36 \times 1 = 2/36$
4	$3/36$	$3/36 \times 3/9 = 1/36$	$3/36 \times 6/9 = 2/36$
5	$4/36$	$4/36 \times 4/10 = 1.6/36$	$4/36 \times 6/10 = 2.4/36$

As before the 4/10 and 6/10 come from the fact that a 5 will be rolled 4 times out of 36 and the 7 will be rolled 6 times out of 36. So the probabilities are $4 + 6 = 10$, giving 4/10 and 6/10 respectively. So, this statistics stuff isn't all that tough after all. Right? Right. So let's just put up the whole table and then we can calculate with complete precision what the probabilities of winning and losing are **before** the dice are ever rolled. Okay? Ready?

Number	Probability of That Number	Probability of a Win	Probability of a Loss
2	$1/36$	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$
3	$2/36$	$2/36 \times 0 = 0$	$2/36 \times 1 = 2/36$
4	$3/36$	$3/36 \times 3/9 = 1/36$	$3/36 \times 6/9 = 2/36$
5	$4/36$	$4/36 \times 4/10 = 1.6/36$	$4/36 \times 6/10 = 2.4/36$
6	$5/36$	$5/36 \times 5/11 = 2.273/36$	$5/36 \times 6/11 = 2.727/36$
7	$6/36$	$6/36 \times 1 = 6/36$	$6/36 \times 0 = 0$
8	$5/36$	$5/36 \times 5/11 = 2.273/36$	$5/36 \times 6/11 = 2.727/36$

9	4/36	$4/36 \times 4/10 = 1.6/36$	$4/36 \times 6/10 = 2.4/36$
10	3/36	$3/36 \times 3/9 = 1/36$	$3/36 \times 6/9 = 2/36$
11	2/36	$2/36 \times 1 = 2/36$	$2/36 \times 0 = 0$
12	1/36	$1/36 \times 0 = 0$	$1/36 \times 1 = 1/36$

17.746/36

18.254/36

As promised, we will now make use of the probability numbers which we calculated for the wins and loses. Notice carefully that these are the probabilities for win or loss **before** the dice are rolled. For the probability of a win the total is 17.746/36 and for a loss it is 18.254/36. In order for these two numbers to be valid they must equal to one. That is, the probability of winning plus the probability of losing has to equal one since there are no other possibilities. So let's add them.

$$\frac{17.746}{36} + \frac{18.254}{36} = \frac{36.000}{36} = \frac{1}{1} = 1$$

Bottom Line

They do indeed total to one, so we have verified the validity of our calculations. We now see an amazing fact. **The shooter is at a considerable disadvantage to the fader.** So, let's quantify that disadvantage. If the shooter bets a dollar and rolls for a point 36 times he will have $\$17.746 \times \$72 = \$35.492$. Or for the 36 tries he will have lost \$0.51.

So, guess who has the money he lost. You are exactly correct, the fader. After 36 tries he has: $\$18.254 \times \$72 = \$36.508$. We used \$72 in our calculations since both the shooter and the fader each put up a dollar for each of the 36 trials for a total of $\$36 \times 2 = \72 . Also bear in mind that these are statistically correct numbers. However, by definition the actual random results will vary, so it may take a fairly large number of rolls before the statistics begin to assert themselves.

So, is this a good way to make a lot of money in a hurry? Perhaps not, but there are some things to consider. First, if the shooter had been betting \$1000 each time instead of \$1, then the fader would have won \$508 rather than 50.8 cents. Second, you can multiply your advantage by fading as often as you can with as much money as the

game will allow. Third, pass the dice when it is your time to shoot or if that is not permitted, shoot only the minimum the game will allow.

In using these proven statistical methods, you will win at craps by fading rather than shooting. If you are using these methods and are not winning there are some other things to consider. Remember that I pointed out in the beginning that there is always the assumption of: (1) an honest game, (2) honest dice, (3) honest players, and (4) an honest roll so that any one of the 36 possibilities are an equal probability each time the dice are rolled. Moreover, that there are no special rules favoring the house, such as 12 on the first roll loses for the shooter but does not win for the fader.

If you are certain that all of these conditions are satisfied, then you only need to play long enough for the statistics to assert themselves. If you are the fader, **you will win!**