

Poker Math That Matters

Simplifying the Secrets of No-Limit Hold'em



Owen Gaines

Poker Math That Matters

Simplifying the Secrets of No-Limit Hold'em

By

Owen Gaines

Poker Math That Matters
Copyright © 2010 by Owen Gaines
Published by Owen Gaines

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means without written permission from the author.

To request to use any part of this book in any way, write to:
owen@qtippoker.com

To order additional copies, visit www.qtippoker.com

ISBN-13: 978-0-615-39745-0

ISBN-10: 0-615-39745-X

Printed in the United States of America

Table of Contents

Acknowledgements	viii
About Owen Gaines	x
About this Book.....	1
Introduction	3
Why Math Matters.....	3
Quiz	6
Measurements.....	9
Your Surroundings	9
Quiz	14
Thinking About Bets in No-Limit Hold'em.....	15
Quiz	17
Your Expectations	18
Quiz	22
Getting Started with Numbers	23
Working with Fractions, Percentages and Ratios	23
Quiz	27
Expectation Value	29
Quiz	33
Hit the Deck.....	35
Counting Outs.....	35
Quiz	44
The 4/2 Rule	50

Quiz	57
Putting It Together.....	59
Pot Odds	59
Quiz	64
Implied Odds	66
Quiz	69
World of the Unknown.....	71
Combinations.....	71
Quiz	78
Equity Versus a Range	81
Quiz	87
Which Bucks?.....	89
Quiz	92
Aggression.....	93
Bluffing	93
Quiz	97
Semi-bluffing.....	99
Quiz	106
Value-Betting	108
Quiz	113
At the Table.....	117
A Bit of Memory	117
Quiz	120
Chunking	121
Quiz	126

Set-Mining.....	127
Quiz	130
How Much to Bet?.....	131
Quiz	137
Balanced Play	139
Quiz	145
Summary	147
Champions.....	147
Appendix A	149
True EV and Evaluative EV	149
Appendix B.....	151
When Villain is +EV	151
Quiz Answers	153
Why Math Matters Quiz Answers.....	153
Thinking About Bets in No-Limit Hold'em Quiz Answers.	154
Your Expectations Quiz Answers	155
Working with Fractions, Percentages and Ratios Quiz Answers.....	157
The 4/2 Rule Quiz Answers	172
Pot Odds Quiz Answers.....	174
Implied Odds Quiz Answers	176
Combinations Quiz Answers.....	178
Equity Versus a Range Quiz Answers.....	181
Which Bucks Quiz Answers.....	184
Bluffing Quiz Answers.....	186
Semi-Bluffing Quiz Answers	188

Value-Betting Quiz Answers.....	191
A Bit of Memory Quiz Answers	197
Chunking Quiz Answers.....	198
Set-Mining Quiz Answers	199
How Much to Bet Quiz Answers.....	200
Balance Quiz Answers	202
Glossary.....	205

Acknowledgements

One of the most valuable things for a professional poker player to have is friends who understand the game. Being a professional poker player can make you feel like you're on an island. Having those friends really helps you feel more connected. Outside of that benefit, these friends have not only enriched my life, but have also taken a lot of time to help me develop my poker game. I would not be the player I am today had it not been for their generous efforts.

I'd like to give special thanks to Steven Gallaher and Matt Hanes for patiently helping me learn the mathematics involved in analyzing poker situations. Without them, it's doubtful I ever would have understood the mathematical concepts I present in this book.

About Owen Gaines

I was always a bit fascinated with poker and had read a small book or two on it long before I ever got a chance to try playing. Then, one day in 2004, a friend told me I could play poker online. I decided to check it out. I knew very little about poker at that point, but I bought a lot of books on limit hold'em, joined a poker forum, and began to work very hard learning the game. I deposited \$300, but I lost that rather quickly in the \$.50/\$1 limit hold'em games. I decided to give poker one more \$300 attempt. That one stuck. I started to see the hard work pay off and built up a nice bankroll for the limit hold'em games. Since my hourly rate playing poker was double that of my entry-level, nine-to-five job, I felt playing poker professionally was the best option for me. So, I started playing poker professionally in the summer of 2005. From there, I played about a million hands of limit hold'em and experienced good results.

In early 2007, after a short break from the tables, I set aside \$300 to mess around playing no-limit hold'em. I had never really been interested in no-limit, but I had heard good things and decided to check it out. Fortunately all of my limit experience helped me transition to no-limit very easily. I started playing a lot of no-limit and worked my way up the stakes. I also found I really enjoyed playing no-limit. In 5 months, I turned the \$300 into \$30,000 and have been playing no-limit hold'em as my main game ever since.

As of the summer of 2010, I've played about three million hands of poker and have been playing professionally for over five years, providing the sole income for a family of five. Online

poker fits my family's lifestyle very well, and my family and friends have all adjusted to it.

I've always enjoyed teaching and have taught in several different fields. In early 2009, I started offering personal poker coaching and making poker-training videos for dragthebar.com. I've had a great time helping others develop their poker skills, and I hope players continue to improve from my efforts in this book.

About this Book

While I'm normally a quick learner with new material, understanding how to play good poker came to me a bit more slowly than I had hoped. Often times a concept would finally sink in and I would find myself wondering why I'd never seen someone explain it in a simpler manner. The mathematics of poker was certainly one of those topics. I got a hold of every book on poker math I could find, but none of them was helping me. Who cares about the odds to **flop** a straight flush or that 19,600 flops can come down? It seemed I was always left with a pile of numbers and no way to put the pieces together to really play great poker. I continued working on my own and probing for information; finally, the pieces started coming together. Understanding the mathematics of poker has made a dramatic difference in my poker game. This book is an attempt to help those who do not have a strong inclination to math or game theory but would really like to improve their poker skills. I designed this material in an attempt to not leave any reader behind. I started with the most basic concepts and worked up from there. When finished with this book, you will be able to think clearly about no-limit hold'em and analyze even some of the most complex decisions in the game. This will make you a force at the tables, and your wallet will thank you. Besides, as a friend of mine likes to say, winning is just *way* more fun!

Because poker is full of jargon, many times beginning players quickly get lost when reading a poker book. To avoid this, every time I introduce a term I consider poker jargon, I've put the font in bold so you know you'll be able to look up that term in the glossary at the back of the book.

Throughout this book, you will see hand notations for **hole cards**. When you see an "s" at the end of the hand (like 67s), this indicates the hand is suited. When you see an "o" at the end of the hand (like 67o), this indicates the hand is **offsuit**. If neither letter is present after the hand, this means it includes both suited and offsuit hands. I use a similar notation when describing the **community cards**. KTs2 would be a flop where the K and T are the same suit and the 2 is a different suit. When you see a "+" after a hand (like TT+), it indicates that hand and every other hand type that's stronger than it. So, TT+ indicates a pair of Ts, but also every pair higher than that (JJ, QQ, KK and AA). AT+ indicates AT but also every other non-pair A holding with a card higher than a T (AJ, AQ, AK). Also, I also like to use the term "Villain" to describe an opponent in a hand. So, of course, that makes us the "Hero".

I'm also a firm believer in testing your comprehension of the material presented in a given chapter. So, you'll find a quiz after every chapter. Take your time, and make sure you understand the material before moving on. If you'd like to practice a concept more, you can always grab a deck of cards and make your own scenarios. The better you grasp the concepts, the more thoroughly you'll be able to apply the concepts in real-time at the poker table.

Finally, you'll notice I'm rounding numbers and using estimates in most of the math I present in this book. This book is designed for practical use at the poker table. My goal is not precision three places to the right of the decimal.

Introduction

Why Math Matters

Poker is a seemingly simple game on the surface. But, as many people coming to learn the game have discovered, it's actually quite complex. However, every complex decision in poker can really be boiled down to two things, the two keys to good poker. So, without further ado, here are the two keys to good poker.

1. Accurate assumptions
2. Making the best decision

It's so simple, but it really defines the decision process for players. This concept is the foundation of anything I do with poker and will really help beginners and experts alike put the game in perspective, create goals and analyze poker situations.

Let's begin by defining these two keys. First, let's look at accurate assumptions. I find it easiest to break this into two sections. One is concerning our opponent's **range** of hands, and the other is how he will play that range. This key uses deductive reasoning to determine what hands are likely for the opponent to have. Players like to call this "**hand-reading**". This key also uses deductive reasoning to predict what decisions (like betting, calling or folding) the opponent will make with those hands.

The second key is making the best decision. We'll simply say this key involves making the decision that makes the most money. After we've determined our assumptions in the first key, the second key comes along with mathematics to show us what play makes us the most money on average. And, of course, that's the focus of this book. We use mathematics to decide what play is best.

Let's talk a bit about how to develop these skills. Take a few seconds to examine Figure 1.

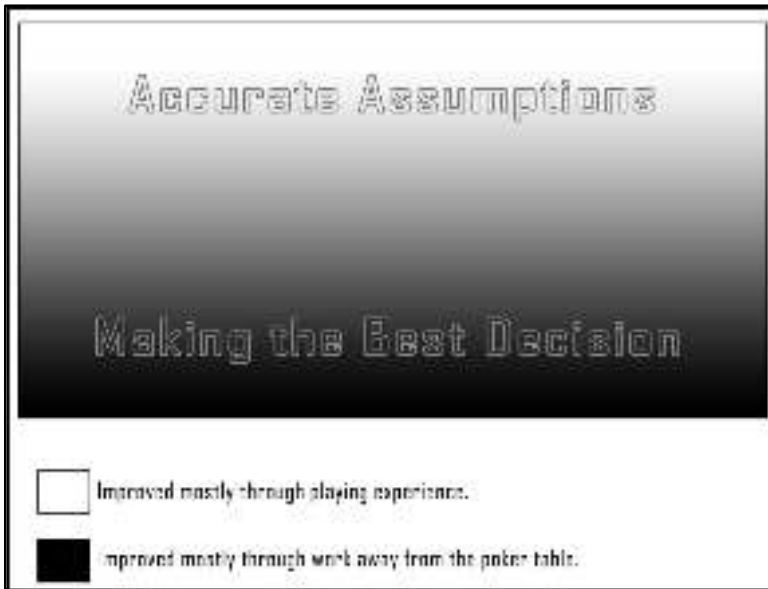


Figure 1. How the two keys to good poker are improved.

Notice I've shown that developing accurate assumptions is mostly improved through playing experience while making the best decision is mostly improved through away from the table work. I'm going to submit to you that making the best decision is the most important part to develop, especially for a beginner. Let's take a look at a hand example to see this at work.

Hero's hole cards - 6♦7♦

Villain's hole cards - Unknown

Flop - 4♠5♦A♦

Looking at this flop, we can see our hand has a lot of ways to make a very strong hand. Any diamond will give us a **flush**. Also, a 3 or an 8 will give us the best **straight** possible. That's a lot of cards that can give us a very powerful hand. Now, let's pretend the pot is \$75, and we have \$1,000 left in our **stacks**. Villain makes a \$60 bet.

Now, let's go through the two keys to good poker and fill in the blanks. First of all, what are our assumptions about his hand range, i.e. what hands do we believe he can have? Just as we get started answering that, he flips his hand over for some reason and shows us **A♠K♠**. Well, no need for assumptions now. We *know* his hand. The next part is our assumptions about his strategy, i.e. how he plays that hand. Just as we start to think about that, he truthfully declares to us that he'll not fold to any size raise we make. He's ready to get **all-in** with the hand. Again, we have no need for assumptions. We *know* his strategy. So, the first key to good poker is covered. Now let's change the rules to this game just a bit and say we can either fold or **push**. We have no other option. Which is the best decision of the two? Now, you may answer fold or push, but you need to understand why. Now let's change his hand and make it **K♦Q♦**. We'll use the same strategy and rules as before. Now are you going to fold or push? Why? Are you certain?

Notice that even though the first key to good poker is completely answered, we still are not ready to play good poker because we do not know how to make the best decision. And in real poker, all the hand-reading in the world will do you no good if you do not know what to do with the information you gain. So, making the best decision is the most important key to focus on at first. And notice it's the key that's most improved through time spent away from the tables. This means most of your time as a beginner should be spent away from the tables. Many beginners

want to just play, play, and play. And while experience is important, you can now see how important it is to dedicate valuable time away from the tables working on your poker skills. The work you'll be doing away from the poker table will involve math.

Some would say that math isn't important in poker. They like to call themselves "feel players". They just feel out the situation and make the decision they think is best. However, do not be fooled. The good players saying this are actually *feeling* the math in the game. There isn't a good poker player who doesn't understand the numbers we're going to go over in this book.

Do not get worried; math scares me as much as it scares you. Math has never been a strong subject for me. I worked really hard over a long period of time to understand the math in poker, but the reward has been great. I've simplified everything I've learned and designed easy shortcuts for you. After you've mastered the material in this book, you'll be able to make the best decision quickly at the poker table and rake in the chips.

Quiz

(Answers on pg. 153)

1. What are the two keys to good poker?
2. Into what two sections can we break up accurate assumptions?

-
3. Which of the two keys to good poker is developed mostly through playing experience?

 4. On which of the two keys to good poker should beginners spend a lot of time?

 5. How can we use mathematics in poker?

Measurements

Your Surroundings

There are many things to consider in just a single decision during a NLHE (no-limit hold'em) cash game. Let's begin by getting familiar with these different variables. First let's talk about how most of the variables in the game are quantified.

Most of the measurements in NLHE are based on the size of the big blind (bb). Let's say we've come to a game where the blinds are \$0.50/\$1. The majority of the measurements in the game will be based on \$1 increments since that's the size of the big blind. The term "**buy-in**" is used to define how much money a person brings to the table. In online games, normally the minimum a person can bring to the table is 20 times the size of the big blind, and the maximum buy-in is normally 100 times the size of the big blind. Since the big blind is \$1, 20 times the bb would be \$20, and 100 times the bb would be \$100. Even though poker sites vary on the amount you can bring to the table, 100 times the bb is the standard meaning when someone talks about a buy-in. For this reason, a \$0.50/\$1 NLHE game is often referred to as a NL100 game. The amount of chips a person has in front of them while playing is commonly called their stack. When someone talks about a player's stack size, they're talking about how much money they have at the table. Table 1 shows a common breakdown of stack sizes.

Table 1. Common descriptions of stack sizes.

Times the big blind	Description
1 – 40	Short Stack
41 – 80	Medium Stack
81 – 100	Deep Stack

While the table shows 100 times the big blind as a deep stack, some people still consider that to be a medium stack and do not consider stacks to be deep until players are around 150 times the big blind or more.

A player's stack size can drastically impact their strategy. Many players feel the biggest stack in the game is going to push people around. However, this idea is mostly for tournaments and has little to do with cash games. The smallest stack in a hand is called the **effective stack** for the hand. For example, let's say player A has a \$50 stack, and player B has a \$400 stack. If these two players got involved in a hand, we would say the effective stack size for the hand is \$50. Player A only has \$50 so that's the maximum amount that can be wagered in the hand. Since stack sizes are so important in a hand, when you're asking someone about a hand, always make sure you include the effective stack size of the hand. For example, if player A and B got involved in a hand, I would start discussing the hand with someone like this.

"I'm in a NL100 game. The effective stack size is \$50."

One last thing I'll mention about stack sizes is the best player at the table generally wants to have more money than everyone else. The better player wants to **cover** worse players so that if he does get a good hand, he can get the bad player's entire stack.

Another measurement to understand is concerning **upswings** and **downswings**. When a player wins or loses a lot of money in a given period of time, these wins or losses are often referred to as swings. An upswing is winning a lot, and a downswing is losing a lot. These swings are often measured in buy-ins. So, if a NL100 player won \$500 in a **session**, he would say he had a 5 buy-in upswing since \$100 is the standard buy-in there. Similarly, if he lost \$500 in a session, he would say he had a 5 buy-in downswing. The swings in poker can be extreme. Having a 7-10 buy-in downswing for a professional player can be very commonplace. Many professionals experience 20 buy-in downswings with some regularity. Some professionals have even reported having 40 buy-in downswings. This leads us to another measurement, **bankrolls**.

Players have bankrolls to reduce their chance of losing all the money they have set-aside to play the game. A bankroll is also measured in buy-ins. Let's say you decided you wanted to have a 30 buy-in bankroll. You wanted to play in a NL100 game. How much money would you need? A buy-in in a NL100 game is \$100. So, 30 buy-ins would be \$3,000.

It's common for beginners to overestimate the number of times they're going to end a session having won money. Over the millions of hands I've played, I've won money in a little more than half of my sessions. Of course, this means I've lost money in about half of my sessions. A common mistake beginners make is to deposit \$300 and then sit down to a NL100 game. This player is only armed with three buy-ins, and even a good player can drop three buy-ins very quickly in this game.

A frequent question from beginners is "What is the right size bankroll?" Or in other words, they would like to know how many buy-ins they should have for the game they're playing. Well, first things first. A bankroll is for a winning player. A

losing player does not need a bankroll; he needs a budget. As a beginner, there's a good chance you will not be a winning player for a while. So, make sure you're playing at a game size where losing many buy-ins is not going to have a large negative impact on your finances or your emotions. As a general guideline, I like to see an amateur have at least 30 buy-ins for their game. If someone is planning to go pro, I would like to see them have at least 100 buy-ins and 6-12 months of living expenses saved on top of that. For those who have put a certain amount of money into a game and do not want to add more, it's important to understand this concept. If you lose a certain portion of that money, you need to move down in stakes. So, if that NL100 player wanted to keep 30 buy-ins for his game, he may start with \$3,000. However, if he loses \$1,000, now he only has \$2,000 left, which is only 20 buy-ins for the NL100 game. If he has decided on 30 buy-ins, he now needs to move down to NL50 until he can rebuild his bankroll for the NL100 game. Moving down is very common for players, but it takes a good deal of discipline to do. Bankroll management is a very important skill. I've often told professional players "If you don't stress your bankroll, it will stress you!"

The final measurement we're going to discuss is **win rates**. A win rate is the measure of a player's results in the game. It lets a player know at what pace they're either winning or losing money. A win rate is measured in a specific number of big blinds per every 100 hands (bb/100). So, if a NL100 player won \$1 in 100 hands, he would have a win rate of 1 bb/100. Win rates get a lot of attention by players because we're extremely interested in our results in terms of money won or lost. However, it's important to understand there are many factors that can dramatically impact a win rate over many, many hands. I've played 100,000-hand sections with dramatically different win rates even though I was playing the same stakes during both

those sections. For a beginning player, it's simply best not to focus a lot of attention on your win rate and rather focus your energy and attention on learning the game.

I also want to make you familiar with two different terms of measurement for win rates so you're not confused if you look at some poker sites or forums. I always refer to NLHE win rates in terms of big blinds, using lowercase "b"s. However, some players talk about a win rate in terms of big bets (BB) with two uppercase "B"s.¹ These both measure a win rate, but simply use a different tool to measure. It's like deciding whether to use inches or centimeters when measuring something. Without getting into the history of these different measurements, simply understand that a big bet is twice the size of a big blind. So, 1 BB/100 is equal to 2 bb/100. Some have categorized win rates as shown in Table 2.

Table 2. Common descriptions for win rates.

bb/100	Description
0 – 4	Marginal winner
4 – 7	Nice win rate
7+	Crushing the game

However, as I said, win rates can vary based on many different criteria. I've played in games where I would be extremely proud to have a long-term win rate of 1 bb/100. I've played in other games where I'd be very disappointed not to have a long-term win rate of 8 bb/100. Again, the important thing for beginners is not to focus on the money but rather their thought process.

¹ This is especially common in limit hold'em.

- [read online **The Chess Tactics Detection Workbook online**](#)
- [download online **How to Draw Animals**](#)
- [Catching Up or Leading the Way: American Education in the Age of Globalization.pdf](#)
- [read Wong Kar-wai \(Contemporary Film Directors\)](#)
- [download online *Eleven Kinds of Loneliness*](#)
- [The Scarlet Impostor \(Gregory Sallust, Book 2\) book](#)

- <http://junkrobots.com/ebooks/The-Chess-Tactics-Detection-Workbook.pdf>
- <http://damianfoster.com/books/Contemporary-Poetry-and-Contemporary-Science.pdf>
- <http://www.1973vision.com/?library/Philosophy--Sophistry--Antiphilosophy--Badiou-s-Dispute-With-Lyotard--Bloomsbury-Studies-in-Continental-Philos>
- <http://berttrotman.com/library/Hell-In-A-Very-Small-Place--The-Siege-Of-Dien-Bien-Phu.pdf>
- <http://paulczajak.com/?library/Cthulhu-Now--Call-of-Cthulhu-.pdf>
- <http://thermco.pl/library/Love-s-Tender-Fury--Marietta-Danver--Book-1-.pdf>