This is the third draft of the chapter on Pot Odds in Hold'em Brain by King Yao. Please email feedback, suggestions, comments, opinions, questions to KingYao@HoldemBrain.com or you could use the Feedback Form to email me at the bottom of the page.

Hold'em Brain: Pot Odds

The ratio of the size of the pot compared to the amount you have to put into the pot to stay in the hand is called the pot odds. For example, if the pot is seven big bets, and you must call one big bet in order to stay in the hand, it means you are getting pot odds of 7:1. If the pot is eight big bets and you have to call two big bets in order to stay, then you are getting pot odds of 8:2, which is the equivalent of 4:1.

Notation on Odds

When discussing odds, ratios will be used as well as the words. For example, 7 to 1 and 7:1 are the same thing and should be read the same way. When there is a decimal involved, I prefer using the word "to" instead of the symbol ":" because it will alleviate confusion. For example, 3.5 to 1 is easier to see than 3.5:1.

The amount that can be won is on the left side, while the amount that is risked is on the right side. If the odds are 6:1, then 6 is the amount that the player will win if he wins, and 1 is the amount he will lose if he loses.

It is usually easiest to have the lowest number in the ratio to be equal to 1. For example, if winning is worth 10, and losing is worth -2, then the odds would be 10:2, but this can be reduced to 5:1 (by dividing both sides by 2).

When the odds of the even occurring is a favorite, then the number on the right side will be larger. For example, if you win only 1, but lose 2, the odds are 1:2.

Converting odds to fractions - X to Y is the equivalent of Y / (X+Y). Examples: 7:1 is the equivalent of 1 / (7+1) = 1/8. 8:2 is the equivalent of 2 / (8 + 2) = 2/10 = 1/5.

Converting fractions to odds - A/B is the equivalent of (B-A) to A. Example: 1/5 is the equivalent of (5-1) to 1 or 4 to 1 or 4:1.

Casinos will sometimes use the term "for" when discussing odds. For example, they may offer 9 for 1 to the public on a wager. This is commonly seen at the craps table or on parlay cards in the sportsbooks. If the odds offered are 9 for 1, then the casino will pay a total of 9 if the player wins, but included in that 9 is the 1 that they had taken from the player already. Thus the player's winnings is only 8, and 9 for 1 is really the same as 8 to 1. It is phrased this way by the casino so it seems like the payoff is bigger. In this book, there is no need to fool anyone, so I stick with the "to" form.

In order to compute the winning percentage that is needed for a breakeven decision, one needs to convert the pot odds into percentages. The way to convert pot odds to percentages is to take the number of bets you need to put in to call divided by the sum of the pot size and the number of bets you need to put in to call. If we define the pot size as PS, and the bet you must put into call as BET, then the formulas are:

Pot Odds = PS / BET
Winning percentage needed for a breakeven decision = BET / (PS + BET)

Here's a short table on pot odds and winning percentages

Pot Size	Amount of Bet to Call	Winning Percentage needed for a breakeven decision
4	1	20.0%
7	1	12.5%
8	2	20.0%
10	1	9.1%

If the expected winning percentage of your hand is greater than the winning percentage needed for a breakeven decision, then you would have positive expectancy to stay in the hand. If the expected winning percentage of your hand is less than the winning percentage needed for a breakeven decision, then you would have negative expectancy to stay in the hand.

Outs and Pot Odds
The main reason we want to count the number of outs we have is to relate it to the pot odds. If the number of outs and non-outs are known, then we can compare it to the pot odds to see if we should be staying in the hand. For example, we know we have 10 outs and 30 non-outs, and the pot is 5 big bets. We only need to put in 1 big bet to see the last card, at which point we will know if we are a winner or not. We want to compare the pot odds versus the ratio of non-outs to outs. If the ratio of non-outs to outs is smaller than the pot odds, then it is a positive expectancy play to stay in the hand.

In that example, the pot odds would be 5:1, the ratio of non-outs to outs would be 30:10 or 3:1. Since the pot is offering us greater odds than the chance that we do not hit our hand, it means we have a positive expectancy play to stay in the hand.

These numbers can be compared to percentages as well. With the pot odds of 5:1, it means the winning percentage that is needed for a breakeven decision is 16.7% (1/6). If we have 30 non-outs and 10 outs, then we have a 25% (10/40) chance of hitting an out. Looking at the percentages gives us the same result.

A tougher example
These numbers are easy to compare because I have purposely given numbers that are easily divisible by each other. But what if the numbers are such: the pot is 7 big bets, but there was a raise so you have to put in 2 big bets to call. You have 37 non-outs and 9 outs. Should you call or not?

Now the decision is tougher because the numbers are not as simple as the previous example. We would have to compare the ratios and see if 7:2 (the pot odds) is greater than 37:9 (ratio of non-outs to outs). It turns out it is easiest to compare these numbers if we break them down. 7:2 becomes 3.5:1 and 37:9 becomes 4 1/9 : 1. Since the pot is offering us smaller odds than we need, it is not worth a call. This method is not an easy mental exercise for most people.

Another way is to convert the ratios into percentages. The pot odds of 7:2 becomes 22.2% (2/9), while the chances of us hitting an out becomes 19.6% (9/46). We arrive at the same conclusion, the winning percentage needed for a breakeven decision is higher than the winning percentage that we have, so we should fold. This method is also not an easy mental exercise for most people.

Although both of these methods are correct, neither method is easy to put into action at the table. In fact, both are very difficult when we have so many other issues to think about at the poker table. In this chapter, a method will be shown to make these computations easier with the same degree of accuracy.

Implied Pot Odds and Expected Pot Size
Before we get onto that method, we have to introduce the concept of implied pot odds and expected pot size. David Sklansky introduced the term implied pot odds in his book Hold'em Poker. It is a term used to describe the total pot odds that you are expecting at the end of the hand, even though you are not there yet. For example, there may only be six big bets in the pot when you make a decision to call a bet on the Turn, but if you hit your card on the River, you may be comfortably expecting that your opponent will call your bet. Therefore you will win seven big bets if you win your hand, which is the expected pot size. The expected pot size does not include the bets that you have yet to put in, although it does count the bets that you had put in previously. So in that case, the current pot on the Turn is six big bets and the pot odds would be 6-1, but that information is not as relevant as the expected pot size. The expected pot size is seven big bets and the implied pot odds would be 7:1. This change in the size of the expected pot may make a difference in your decision.

The method that we will use in this book will rely more heavily on the expected pot size. Instead of converting into odds and looking at the implied pot odds, we will simply estimate the expected pot size and leave it at that. With that number, we can make simple calculations in our heads while at the table. This will help us make correct decisions.

Information needed
In order to apply pot odds analysis at the table, we need to know the following information:

1. The pot size and the expected pot size
2. The amount we need to risk

3. The number of outs we have
4. The number of non-outs we have

In the chapter on outs, we have already covered how to count the number of outs and the non-outs. Thus the focus here is on how to count the pot and the expected pot size, followed by an easy method to apply pot odds while at the table without being a mathematical genius or having a calculator.

Counting the pot in bets not dollars
It is easiest to think of the pot and the pot odds in terms of bets instead of actual dollars. There are two ways to do this. One way is to count in small bets on the pre-Flop and Flop round, and then convert it into big bets for the Turn and River rounds. For example, if there were 6 small bets in the pot after the Flop, then the conversion becomes 3 big bets (two small bets equals one big bet). Another way is to count every round in terms of big bets, so there is no need to convert small bets to big bets at any point. In that case, each small bet would be counted as half of a big bet. Either way will achieve the same goal. It is easy to show that counting in terms of bets is easier than counting in terms of actual dollars for most people. For example, if there are six big bets in the pot on the River, and your lone opponent has bet, making the pot seven big bets, you are faced with a decision to call or fold. If you call, you will be risking one big bet in order to win seven big bets. The pot odds would be 7:1 and you would have to win this hand 12.5% (1/8) of the time in order for your call to be a breakeven decision. But if you were counting in terms of dollars, and it was a 30-60 game, then you would have counted $360 in the pot on the River, another $60 from your opponent, making the pot $420. Your call is $60, so to convert that to pot odds, you would have to divide $420 by $60 to get 7:1. Counting the pot in terms of bets will save one step.

The Mechanics of Counting the Pot
The key to understanding your pot odds is simply to know how big the pot is relative to the bet that you must make. You must know the size of the pot and thus you must count the pot. It will take a little practice but is not too involved, and anyone who practices it a little should have no problem. You could always back-count the pot when you need to know the pot size by replaying the action in your mind, but that would cause three problems. First, it will slow down the game and your concentration will not be on the play of the hand. Second, other people may catch onto what you are doing as it is easy to give a visual clue that you are counting the pot. Third, you may be too lazy to count the pot when you are not in the hand. Thus, you will not know if another player has made a mistake on pot odds or is even taking pot odds into consideration. Counting the pot in progress takes some discipline, but it is worth the effort to gain any extra edge you can over the other players.

One way is to count the bets as they go into the pot. Since we want to count the bets in terms of big bets, the small bet on the Flop should be counted as half of a big bet. When the blinds have been posted, that would mean there are 0.75 big bets in the pot. If the next player calls, then the pot is now 1.25 big bets. If there is a raise, then that is two small bets that the raiser is putting into the pot, which is one big bet.

An easier way to count the bets in the pre-Flop round is to count the number of players that see the Flop and adjust it depending on the number of raises. If four players are in the hand and there is one raise, then that means there is now four big bets in the pot if both blinds are in the hand, since each of the four players would have put in one big bet. If both blinds have actually folded, but there are still four players who see the Flop for one raise, then there would be 4.75 big bets in the pot, since the blinds are 0.75 big bets. It would be simpler to round it off to 5 big bets. The small decrease in accuracy is offset by the larger increase in ease of counting the bets.

On the Flop, both ways to add to the size of the pot can be used with ease. On the Turn it would be advisable to count the bets as they enter into the pot, since it at this time where the pot odds comes into play most often. On the River, there are fewer reasons to count the pot. You may still want to keep track of the pot in order to make a decision to call or fold, but the additional bets that go into the pot on the River normally should not affect your decision of whether to call or fold.

The "Do I have Pot Odds?" Method or DIPO

Once you know the size of the pot, the amount you need to risk to stay in the hand, and the number of outs and non-outs that you have, you will now have enough information to figure out whether you have enough pot odds to stay in. Instead of using a complicated algebraic formula that most people can solve only with a pen and a piece of paper or a calculator, I will describe a way to make this calculation in your head with relative ease, which I will call the "Do I have Pot Odds?"method or simply DIPO. The DIPO method is best used directly during the betting on the Turn. Later on, there will be examinations on how to use it during the betting on the Flop.

In this method, we want to compare two numbers which we will call the Good Number and the Bad Number.

The first number is the Good Number, the number of outs times the expected pot size.
The second number is Bad Number, the number of non-Outs.

If the Good Number is greater than the Bad Number, then we have enough pot odds to stay in the hand. If the Good Number is less than the Bad Number, then we do not and it would be advisable to fold.

It is easy to see the advantages of using DIPO. You are able to put yourself in a position where you no longer have to guess and size up the pot compared to the strength of your hand. You also do not need to backtrack and count the pot after the fact, which could take your concentration on other factors of the game. If you count the pot size at a later point, you may unknowingly give a tell away by letting other players know you are counting the pot. The observant players may convey your tell into thinking you do not have a made hand and are on a draw, which is valuable information that you do not want to give away. DIPO is easier to implement than counting the pot in terms of dollars and calculating the pot odds relative to the odds you win the hand. The drawback of DIPO is that it takes some discipline and practice. Fortunately, most poker players do not have this discipline to think at the table. If you can use it, you will have one advantage over most of your competition.
Now I will go into detail on the math behind the method. This method is easier for most people to apply than comparing pot odds to the ratio of non-outs to outs because multiplication is easier for most to apply quickly than division. Feel free to skip to the next section if the math bores you. The section after the math section will into further detail about using the DIPO method with examples

and in different situations.

The Math behind DIPO

I am not a mathematician so this proof may not look like what it should in a mathematics textbook, but it makes sense and is correct. Feel free to skip this section if you do not care about the proof.

EPS = Expected Pot Size (not counting any bets you will put into the pot in the future)
Outs = Outs
Non-Outs = NOuts
Cards = Outs + NOuts (all the unknown cards to you)
Bet = The Bet we are facing

Assumptions: It is on the Turn and there is only one card left to come. Someone has bet and it is up to you to call or fold (lets disregard raising at this point). You are sure that if you hit any of your outs, you will have the winning hand. You are also sure that if you do not hit any of your outs, you will have a losing hand.

The equation for the expected value of calling the bet is:

EV of calling = EPS x Outs/Cards - Bet x NOuts/Cards

If this number is positive, then we have a positive expected value of calling the bet and we should. If it is negative, then we have a negative expected value of calling the bet and we should fold.

All of this is fairly simple algebra, but it is still too complicated to do in our heads when we are sitting at the poker table. So instead, we can simplify it even further to a comparison.

We want to compare the term [EPS x Outs/Cards] versus the term [Bet x NOuts/Cards]

When the first term [EPS x Outs/Cards] is greater than the second term [Bet x NOuts/Cards], the answer to the EV of calling equation is positive. Conversely, when the second term is greater than the first term, the answer to the EV of calling equation is negative. We only want to call if the EV of calling is positive, so we only want to call if the first term [EPS x Outs/Cards] is greater than the second term [Bet x NOuts/Cards].

In comparing these terms, we can eliminate the common variable Cards. So we are left with comparing [EPS x Outs] versus [Bet x NOuts]. When there is only one bet to you and you close the action on the Turn (meaning there are no players left to act after your call, thus you cannot be raised), then we know the variable Bet equals 1, and so that is how we get the comparison of EPS x Outs versus NOuts . We do not care how large the difference is between the two terms, all we care about whether the first term is greater than the second term. When there is more than one bet, then instead of comparing the first term to NOuts, it would be correct to compare it to NOuts x the Number of Bets. This is discussed with an example in a later section.

I learned about a method similar to this in an online post by Abdul Jalib. On HoldemBrain.com, links to some of his posts and articles can be found. I put the acronym of DIPO on it so I could refer to it more easily. Both the DIPO method and Abdul's method provide the same answer when the caller is faced with only one bet. When the caller is faced with two bets or more, it is easier to adjust DIPO to make the correct comparison than Abdul's method. In one of Abdul Jalib's online posts, he simplifies the method when the bet that is needed to call is only one bet. He compares the term Outs x (1+Expected Pot Size) to the Number of Unknown Cards. This is useful when there is only one bet because there is no need to use subtraction to adjust for the number of non-outs, and the second term is always constant when the bet size is 1. However, when there are two or more bets, it is more difficult to make the conversion. I prefer comparing the outs and non-outs because it is useful in every circumstance. When there is more than one bet to call, Abdul's formula can be adjusted to the comparison of [Outs x (Number of Bets x Expected Pot Size) / Number of Bets] compared to the Number of Unknown Cards. The computations for the first term in this case is difficult to do at the poker table. So I choose DIPO rather than his method because I believe it is easier in all cases.

Examples and Issues of Using DIPO on the Turn
To is easiest to illustrate the use of DIPO on the Turn, when there is only one more card to come and your action closes the betting. This means you are certain no one will raise behind you, which would increase the amount you would need to risk and change the calculations.

Example 1
You are in the big blind and find yourself holding A♠T♣ on the Turn with a board of K♣Q♠4♥3♦. Any J will give you the nut hand, as there are no flush possibilities and if a J comes on the River, there are no full house or four-of-a-kind possibilities. There has been enough betting that you suspect someone has a hand like AK, AQ, KK or QQ, so an A would not be an out for you, you are confident you only have 4 outs. Before the Turn, there was 9 big bets in the pot and two other players in the hand. The first player to act on the Turn bets, and the second player calls, which brings the pot up to 11 big bets. If you call, you will close the betting and the dealer will deal the River card. You suspect that if you hit your straight, you will get at least one more big bet out of them, and probably more.

Using a conservative Expected Pot Size of 12:
Good Number = Expected Pot Size x Outs = 12 x 4 = 48
Bad Number = Non-Outs = 46 - 4 = 42

The Good Number is greater than the Bad Number, so you can call knowing you are being offered the correct price to try to get lucky. We shall now move onto a more difficult hand.

Example 2
You have A♠K♠ against one lone opponent and the board is Q♦8♠3♣2♥. You are quite sure your opponent has a pair and may have an A or a K as a kicker. If both of your cards are indeed outs, then you would have 6 outs, but if one of them is your opponent's kicker, then you only have 3 outs. There is also a small chance he is semi-bluffing with a straight draw like JT or J9, in which case you would be ahead and have more outs. Taking everything into consideration, including how the player plays, you estimate that on average, you have 5 outs. Figuring out how many outs you have is as much science as art. You have to know your opponents well to get an idea of how they play. If your opponent is a maniac, then you likely have more outs since he would be bluffing

or semi-bluffing more often. If he plays like a rock, then you may have fewer outs since he would enter the pot only with premium hands. Sometimes you will have more, sometimes you will have less, but on average, if you were in this situation many times over, you would expect an average of 5 outs. Since there are 46 unknown cards on the turn, when you have 5 outs, it means you have 41 non-outs (46 - 5).

If the expected pot size is 8 bets, then:
Good Number = Number of Outs x Expected Pot Size = 5 x 8 = 40
Bad Number = Number of Non-Outs = 41

So it is close, but it is not worth a call if your estimates are correct. Poor players will repeatedly put themselves in a position where they are getting the worst of it, by calling in spots like this. During a session where these type of decisions may come up a few times, the loss in edge may seem negligible if the player gets lucky and hits a couple of these draws. But in the long run, playing hands in situations like this hundreds and thousands of times, the poor player will definitely lose to it.

If the expected pot size is 9 big bets, then:
Good Number = 5 x 9 = 45
Bad Number = 41

Now a call is correct as there is positive value to it. The correct estimation of the number of outs is crucial. If the number of outs was only 4, then even with an expected pot size of 9, it would not be a good call. If the number of outs was 6 instead of 5, then even if the expected pot size was only 8, it would be worth a call. To make a good decision in a situation like this, you will have to be able to read your opponents' hands well so you can evaluate the number of outs you actually have, as well as knowing your opponent's playing habits so you can pinpoint the expected pot size better. To add even more complexity, lets go to the next example.

Example 3
You are in the cutoff with A♠K♠. Two players limp in front of you and you raise. Both blinds fold, but both limpers call. Going into the Flop, there are three players and 4 big bets (I round up the blinds which consist of only 0.75 big bets to one full bet for ease, the calculations will be a little bit off, but it makes it easier to calculate and less chance of a computational error)

Flop: Q♠7♣3♦

The first player checks, the second player bets (1 small bet which is 0.5 big bets), you decide to call with your overcards, and the first player folds. Going into the Turn, there are now two players and 5 big bets.

Turn: 2♦

You are quite sure you are beat. The player who had bet on the Flop is known to bet his hand and hardly every bluff. You know him to be a player who may limp in with hands such as AQ, KQ, QJ, QT (the latter two especially after another player has already limped) and since there were no straight draws or flush draws on the Flop, there is no chance he is betting on one of those. You suspect you will need at least an A or a K to win the pot, and maybe that is not even good enough. With the chance he has AQ or KQ, an A or a K may give him two pair. This means you have 6 outs if he does not hold an A or K kicker, or 3 outs if he does have one of those cards. He could also have a set (three-of-a-kind with a pocket pair in his hand and the third card on the board), which would mean you would have no outs and be drawing dead. Having already thought about situations like this previously, you estimate your expected number of outs is 4.5 (more on this estimate below).

Your opponent bets on the Turn, making the pot 6 big bets. If you hit your hand and win, you expect to win another big bet on the River for a total of 7 big bets. In this case, the Good Number is 31.5 (7 x 4.5), which is less than the Bad Number, 41.5 (you estimate 41.5 for the Bad Number because there are 46 unknown cards, and 4.5 expected outs, so the 41.5 remaining cards are non-outs). You decide to fold because you do not have enough pot odds to call. If you were aggressive and estimated that you had 6 outs, then the Good Number would be greater than the Bad Number (7 x 6 = 42 versus 46-6 = 40) and you would think you had enough pot odds to call. This shows how critical it is to be able to count the number of expected outs correctly. Doing so in this spot would allow you to make the correct decision.

Why did I estimate 4.5 outs on average? The reason is I expected the opponent has about a 40% chance to have AQ or KQ, 55% chance he has QJ or QT and a 5% chance he has a set. Given you have AK and there is a Q on the board, it means there are 3 A's left and 3 Q's unaccounted for, which means there are 9 ways for him to have AQ. Since you have the A♠ in your hand and the Q♠ is on the board, which leaves the A♣, A♦, A♥, Q♣, Q♦, Q♥. There are 9 ways to get AQ with these cards, and they are A♣Q♣, A♣Q♦, A♣Q♥, A♦ Q♣, A♦ Q♦, A♦ Q♥, A♥Q♣, A♥Q♦, A♥Q♥. The same analysis can be used for KQ, and it results in 9 ways for KQ as well. He has a higher chance of having QJ or QT because you do not hold either the J or T. There are 3 Q's left and 4 J's and 4 T's left. This means there are 12 ways for him to have QJ or QT. For him to have a set, he would have to have 77 or 33, which would only be 2 ways each.

Possible Hands	Ways to make it	Fraction	Percentage
AQ	9	9/46	19.6%
KQ	9	9/46	19.6%
QJ	12	12/46	26.1%
QT	12	12/46	26.1%
77	2	2/46	4.3%
33	2	2/46	4.3%

With those numbers, it turns out he would have a 39.2% chance to have AQ or KQ (19.6% + 19.6%), a 52.2% chance to have QJ or QT (26.1% + 26.1%) and an 8.6% chance to have 77 or 33

(4.3% + 4.3%). However with a set, most players would check-raise, or wait until the Turn to raise, rather than bet into the field, as they are looking to trap other players, especially a late position pre-Flop raiser. Therefore, I bump my estimate up to 40% for AQ or KQ, 55% for QJ or QT and 5% for 77 or 33. In order to make these estimates, I had to assume that this player was equally likely to play AQ, KQ by limping in as he would with QJ and QT. Some players are not, especially the tighter players. Thus against those players, you would have to give them greater credit for having AQ or KQ than QJ or QT.

If he has AQ or KQ, then your AK hand would have 3 outs. With QJ or QT, you would have 6 outs. Versus a set, you would have zero outs. We can use an Expected Value formula to calculate the number of outs we have.

Action	Computation	Result
Expected Outs	(40% x 3) + (55% x 6) + (5% x 0)	4.50 outs

On average, I expect the number of outs to be 4.5 against the normal player. Coincidentally, if we ignore the chance of being up against a set, 4.5 is exactly halfway between the optimistic view (6 outs) and the pessimistic view (3 outs). This is useful because in situations like this, we can simply use the halfway point to estimate the number of outs we have, which is an easy process and yet should be quite accurate as well. Keep in mind that against tighter early position players, the expected number of outs should be lower since they are less likely to limp in with QJ and QT than the average player. Also if the player check-raises, then we need to bump up the chances that he had a set. In both of these situations (a tight early position player and a check-raiser), instead of estimating 4.5 outs, I would estimate 4 outs instead.

Using DIPO on the Flop

So far, we have only discussed using DIPO on the Turn with only one card left to come. Applying DIPO on the Flop is useful as well, although it will not be as accurate. However, the small losses in accuracy are minuscule compared to the increased effectiveness of using DIPO compared to any other method. The only times when DIPO might be slightly less accurate than the Expected Value equations are when the solutions are very close to breakeven, zero expectation either way. If we understand the issues and pitfalls of using DIPO on the Flop, its benefits will far outweigh its small loss in accuracy compared to the Expected Value method.

When we use DIPO on the Turn, we look at the Turn/River dynamic. We consider the additional bets we can expect to win on the River if we do hit our hand, and we consider the outs and non-outs with one card left to come. To use DIPO on the Flop, we should only look at the Flop/Turn dynamic, in the same way that we looked at the Turn/River dynamic on the Turn. Without thinking further ahead to the River at this point, we keep the ease of use of DIPO without sacrificing much accuracy.

A few issues to consider when using DIPO on the Flop:

1. Be careful when you count the number of outs. You could in fact hit your out on the Turn and get redrawn on the River. For example, you could complete a flush draw on the Turn only to see

your opponent hit a full house on the River. This possibility means you should veer toward the conservative side when counting outs.

2. Do not go further than the Turn when counting the expected pot size. It is too easy to get carried away and count too many bets in the expected pot size if you extrapolate the hand all the way out to the River. If you catch your hand on the Turn and you bet accordingly, other players may fold, thus not paying you off on the River, and possibly not paying you off on the Turn either. To count all the bets through to the River will sometimes lead to decisions that are too aggressive.

3. If you use DIPO on the Flop and miss, do not be worried about using DIPO again on the Turn. Think of the chips you put into the pot on the Flop as a sunk cost, that money no longer belongs to you, but belongs to the pot, of which you have a certain equity in.

Here's an example:
There are three players in a hand that sees an unraised Flop. You are on the button and you have 8♥7♥.

Flop: A♥9♥2♠.

The first player bets and the other two players fold. You have a flush draw, should you call?

If we use the DIPO method and consider only the Flop/Turn dynamic (and leave out the River), we get the following:

Outs: 9 outs for the flush (we want to err on the side of cautiousness, so do not add in the other possible outs such as runner-runner straights or two pair)

Non-Outs: 38 (on the Flop, there are 47 unknown cards as opposed to 46 on the Turn. 47-9 = 38. If we assume the other player has an A, then the number of non-outs would be lower, but lets keep it at 38 for now to stay on the conservative side)

Expected Pot Size: On the Flop there are 4 small bets. You would expect to gain another 2 small bets on the Turn

Bet you must call: 1 small bet

Good Number = Outs x Expected Pot Size = 9 outs x 6 small bets = 54
Bad Number = Non-Outs x Bet size = 38 x 1 small bet = 38

The Good Number is greater than the Bad Number, so it is worth a call. Notice that we are using small bets in both the Good Number and the Bad Number, so they are comparable. On the Turn, if our flush does not come, we will have to go through the same analysis for the Turn/River dynamic.

This may be a bit confusing to some, as it seems if we miss the flush on the Turn, that we are basically putting in a total of 3 small bets (1 on the Flop and 2 on the Turn) to see an expected pot size of 8 small bets (4 on the Flop, another 2 on the Turn and 2 on the River). If we use these numbers, then it may seem that the Good Number is lower than the Bad Number. The Good Number would be 9 x 8 = 72. The Bad Number would have to be multiplied by 3 small bets, making it 114. So from this perspective, it looks like it is not worth a call. The confusion here is that if we want to use that analysis, instead of having only 9 outs, we in fact have much more. This is because even if we do not hit the flush on the Turn, we could still hit it on the River. In that case, we would have the equivalent of about 16 outs, because we have two chances to hit. The way I get the equivalent of 16 outs is that we have a 9/47 chance of hitting the flush on the River, but if we miss, which we will 38/47 times, we still have a 9/46 chance of hitting it on the River. The math shows that we would have a 35% chance of catching the Flush either on the Turn or the River, and that translates to about 16 outs (35% x 46 = 16.1). If we substituted 16 outs for 9 outs in the Good Number, the Good Number will be 16 x 8 = 128, which is now bigger than the Bad Number, and still shows it is worth a call. But doing it this way is a bit more complicated, thus I recommend looking at the Flop/Turn dynamic first before going on to think about the River. Using the DIPO method for the Flop/Turn dynamic by itself is easier and is correct also.

Comparing this to an expected value formula where we think through the Turn and River rounds, we would get:

Action	Computation	Result
EV of calling (words)	(Prob hit on Flush on Turn x EPS) + (Prob hit on Flush on River x EPS) + (Prob of not Flush at all x 3 small bets)	N/A
EV of calling (numbers)	(9/47 x 8) + (38/47 x 9/46 x 8) + (38/47 x 37/46 x -3)	+0.85

There are some rare cases when using DIPO on the Flop compared to using the Expected Value formulas would result in two slightly different solutions. One method may say a call is worthwhile while the other may say it is not. However, when this does occur, it is only when the Expected Value is very close to zero. Thus if a mistake is made because DIPO was slightly off, it is only a very minor mistake. These occurrences should not happen often but is the reason I recommend being conservative when counting outs on the Flop. The bottom line is that the ease of using DIPO on the Flop is a far greater advantage than these small concerns.

DIPO on Flop, DIPO on Turn, two different decisions
You have AKo (an Ace and a King of different suits) on the button, everyone folds to you and you raise. Both blinds call. There are three players seeing the Flop for 3 big bets.

Flop: Q-8-2 rainbow

It is checked to you and you bet. The small blind check-raises and the big blind folds. The decision is whether or not to call if you expect to have 4.5 outs on average. You expect that if you catch an A or K, your opponent will bet once, but if you call or raise, he will fold after that. So the expected pot size is 5.5 big bets or 11 small bets (there were 3 big bets before the Flop, your bet on the Flop made it 3.5 big bets, the check-raise made it 4.5 big bets, and you expect to make another big bet on the Turn if you catch).

Good Number = 4.5 x 11
Bad Number = 47 - 4.5 = 42.5

The Good Number is greater than the Bad Number (notice we do not actually need to multiply out the Good Number, we just need to be able to see that it is greater than the Bad Number), so calling is a good decision.

Turn: 6

A total blank. Your opponent bets again. Now he has made it 5.5 big bets. You suspect that if you catch your out on the River, you will win another big bet, so the expected pot size is 6.5. Now you want to use big bets instead of small bets, because now it takes one big bet to call his bet rather than one small bet like it did on the Flop.

Good Number = 4.5 x 6.5
Bad Number = 46 - 4.5 = 41.5

Again, you do not need to do the calculations if you can see that the Bad Number in this case is greater than the Good Number. So now you want to fold. Put in another way, the bet got expensive, too expensive compared to the pot size, and now it is not worth pursuing.

Myth Buster: Never Draw to an Inside Straight
The common wisdom of "Never Draw to an Inside Straight" may not be so wise all the time. Here is an example to demonstrate a situation when drawing to an inside straight is correct.

You are in the big blind and you have J♠T♠. The pot gets raised in early position and many other players cold call the raise. You call the raise also when it gets to you. A total of 7 players see the Flop for 2 small bets each.

Flop: 8♣7♦3♠

You check, the pre-Flop raiser bets and three players call. You call as well. Five players see the Turn with a total of 9.5 big bets in the pot.

Turn: A♥

You are quite sure that someone has either an A or a higher pair than J's, so you know the only card you can win on is a 9 to give you the nut straight. Since there are no flush possibilities, you do not need to be worried about hitting your straight and still losing. You have 4 outs, as any 9 will give you the nut hand. You check and the pre-Flop raise bets. Everyone else folds. At this point, there are 10.5 big bets in the pot, and if you hit the straight, you will likely win another bet or maybe more if you check-raise and get called. To be conservative, you estimate the expected pot size to be 11.5 big bets. There are 4 cards that will give you the winner and a total of 42 unknown cards that will make you muck on the River.

Good Number = 4 x 11.5 = 46
Bad Number = 46 -4 = 42

Using the DIPO method, the Good Number is greater than the Bad Number, so it is worth a call. The general advice to never draw to an inside straight is bad advice in this case. It is profitable to call and hope you draw out.

When there is a raise and more than 1 bet to call
Instead of having to call one bet, sometimes there will be two bets to call on the Turn. This can happen if there is a bet from one player, and then a raise from another player, and two bets need to be called in order to stay in the hand. Notice that it is possible it may wind up to be even more bets as other players can still raise, but lets focus on the situation when we know it is only two bets.

The assumption spelled out in the DIPO method is that the player only has to call one bet. If there are two bets, then an adjustment needs to be made. The simple adjustment is to double the Bad Number. The Bad Number would now equal NonOuts x 2 big bets. If the Good Number is still greater than the Bad Number, then the pot odds are enough to call. If the Good Number is now less than the Bad Number, then the pot odds are not enough to call. If there are three bets, then multiply the Bad Number by three and make the same comparison versus the Good Number. Keep in mind that if there is a bet and a raise, it may be prudent to adjust the number of possible outs you may have as two players are indicating they have strong hands.

Lets take a look at an example. You are on the button with A♠T♣. A decent player raises in early position and two players call. You decide to call, and the two blinds call as well. Six players see the Flop with 6 big bets in the pot already.

Your hand: A♠T♣
Flop: J♠6♠2♠
There are three spades on the Flop, and you have the nut flush draw with your A♠. It is checked to the pre-Flop raiser who bets. The two players between you and the pre-Flop raiser both call, and you decide to raise. Both blinds fold and the pre-Flop raise re-raises to make it three bets. One of the players between you and the pre-Flop raiser calls, the other player folds. You call. There are three players going into the Turn and 11 big bets in the pot now (5 big bets went into the Flop round).

Turn: 3♣

You did not complete your flush draw yet, and you are pretty convinced you will need to catch it in order to win the hand. You are quite sure the pre-Flop raiser has a set or AA, otherwise he would not be betting so aggressively. You are also worried that the other player already has a flush or is on a draw himself, in which case he either has taken away two of your outs or one of your outs.

The pre-Flop raiser bets and the other player raises. Now you are quite sure the other player has a flush, any other hand simply would not make sense. You are also quite sure the pre-Flop raiser will not re-raise since it is unlikely he is on the flush, and in any case, he would not have the nut flush. There are now 14 big bets in the pot. You expect the pre-Flop raiser to call the raise. You expect to only gain one additional big bet on the River if you catch your flush as it will be obvious to the other players that you hold the A♠. With this information, you calculate the expected pot size will be 16 big bets if you win. Normally you would think you had 9 outs since there are 9 flush cards left, but with the raise on the Turn, you suspect the raiser already has a flush, so you only have 7 outs left since he holds two spades. However you highly suspect the pre-Flop raise has a set of Jacks, which means a 3♠ will not be an out for you since it would make him a full house. This reduces your outs to only 6. There are normally 46 unknown cards on the Turn, but given your ability to pinpoint the other two players hands, you believe there are only 42 unknown cards. Now we have all the information to apply DIPO.

Good Number = 16 x 6 = 96
Bad Number = NonOuts x Number of bets to call = (46-2-2) x 2 = 42 x 2 = 84

The Good Number is still larger than the Bad Number. It is still worthwhile to call and hope a non-pairing spade comes on the River.

Observing other players while counting the pot

Example 1

Pre-flop action

The under the gun player raises. It is folded to the cutoff player who re-raises. Both blinds fold and the under the gun player calls. There are two players in for three bets each, so that is three big bets between the two of them. Add in the two blinds and we can approximate it as four big bets in the pot.

Action on the Flop

The under the gun player checks, the cutoff player bets and the under the gun player calls. That is an additional one big bet going into the pot, so now there are five big bets in the pot.

Action on the Turn

The under the gun player checks, the cutoff player bets and the under the gun player calls. That is an additional two big bets going into the pot, so now there are seven big bets in the pot.

Action on the River

The under the gun player bets and the cutoff player calls. The under the gun player turns over a straight which he caught on the River and wins the pot. You realize that with the pot being six big bets on the Turn, and possibly one more future bet to win on the River, the under the gun player should have expected to win seven big bets if he won the pot. With a straight draw, he should expect 8 cards as outs. 7 x 8 = 56, and since that is bigger than the number of non-outs, his call was a good decision.

Example 2

Pre Flop action
A passive player limps in middle position, the small blind completes and the big blind checks. Only three players see the flop for one bet each. The pot is 1.5 big bets.

Flop action
Flop: K♣8♠5♦
Everybody checks.

Turn action
Turn: 2♥
Both blinds check and the passive player bets. The small blind folds and the big blind calls.

River action
River: A♦
The big blind bets and the passive player calls.

The big blind turns over 4♠3♠ for a straight. He had picked up an open-ended straight draw on the Turn. It is obvious he needed to hit the straight to have any chance of winning, because it is very unlikely that the passive player would bet without a pair. The big blind should expect that he has 8 outs going into the River and 38 non-outs. There were only 1.5 big bets going into the Turn, and the bet by the passive player made it 2.5 big bets. If the big blind was expecting that the passive player would call a bet on the River, then he could expect 3.5 big bets as the expected pot size. This means the Good Number was 8 x 3.5 = 28, which is smaller than the Bad Number, 38. Even though he made his straight on the River, the call had a negative expectation. If he played this hand over and over again, he would wind up a loser to the passive player. You should use this hand to add to your opinion of the player in the big blind.

Read my lips and eyes: This player gave himself away
I was playing in a friendly 20-40 game in Lucky Chances in the San Francisco area when this situation came up. I was involved in a pot with a player who was fairly tight and decent. I was in last position without a pair and I was a little bit worried that the tight player had a pair. I knew that he thought I played fairly solidly and tight as well. This piece of information was crucial to the way I played the hand.

I held Q♠J♠. On the Turn, the pot was relatively small and the betting was relatively tame. On the Turn, the board was:

K♣T♠7♣2♥

My opponent checked and I bet, hoping he would fold, and if not I still had a chance of hitting my straight. Then I saw something interesting. He was staring at the pot, then his eyes started to dance a little bit around the table, and his lips were moving! It was obvious at that moment that he was counting the pot size, by backtracking the previous action and counting every bet that had gone in up to this point. When he was done, he called. Right there I knew he could only be on a draw. It could be a club flush draw or it could be a straight draw. Maybe he had a hand like A♣J♥

or Q♣J♥. In either case I now knew that if he did not catch his draw on the River, I could easily steal the pot with a bet, even if I did not have anything.

A blank came on the River, he checked, I bet my no pair. He flashed me A♣J♦, grinned and said "I thought I had 7 outs, I can never hit against you" and mucked his hand. I smiled back at him, nodded my head and happily stacked my chips. If he had not given away the fact he was on a draw, maybe I would have still bet and stolen the pot or maybe I would have given up and checked thinking he was going to call a River bet anyway, I had not yet made up my mind. However, once he gave himself away, I was very confident the pot was mine. This hand is a good illustration of how counting the pot size at the time you need the information may hurt you if others can detect that is what you are doing.

More on Pot Odds

1. In lower limits, it is easier to play straight and flush draws, because the pot is usually bigger in terms of big bets since more players are seeing the Flop. This means it is almost always correct to go for the flush draws and open ended or double inside straight draws (inside straight draws still need to be careful). Even without knowing the size of the pot or the pot odds, most low limit players will make these decisions correctly simply because the pot almost always affords them enough to call with. They have not done the math, have not figured out the odds, but still have a sense that it is correct to chase. With overcards, or other hands that are behind, it is not always clear if chasing is a correct decision, and that is when these players normally fall into trouble. This is one of the reasons that most players get clobbered when they move up to a higher limit, where the pot is usually smaller and it is not correct to chase as often.

2. Going for a straight draw or flush draw regardless of pot size is not always correct. If you are counting the pot size and you notice a player hitting a draw on the River when they do not have correct odds, it could be a sign of a major leak in his game.

3. If there is another player behind you, and a player in front of you has bet, your pot odds calculations may be off because the player behind you may actually raise. If you are using DIPO, you are expecting to only put in one bet, but if a player behind you raises, then you would have to put in a total of two bets to see the next card. This is one of the advantages of "closing the betting," where you are the last to act on that specific round and no one can raise after you have called.

4. When the pot is large, the risk of raising and putting in more bets is compensated for by the increase in expectancy when an opponent who had outs actually folds. If the pot was smaller, the risk of putting in more bets may not be compensated for by the increased chance that others will fold, since the reward of the smaller pot is smaller.

When you are ahead

What about the situation when you are ahead and the opponent is on a flush draw? Then you would have 37 outs and 9 non-outs on the Turn, as any card that does not make a flush for your opponent keeps you ahead. Of course this information on the exact number of outs and pot odds are of little value in this situation since it is clear you should be involved in the pot with the hand that is ahead. This type of analysis of thinking in reverse may be useful when you can control how much your opponent has to put into the pot to see the River card. In Limit Hold'em, it is not controllable to the degree where it usually makes a difference unless you get cooperation from another player (I do not mean collusion, but just from normal play). In games like No-Limit Hold'em and Pot-Limit Hold'em, players can manipulate the pot odds much more easily and effectively. For example, they could bet enough to force a flush draw to fold due to expectancy reasons, whereas it is rarer for a fold to be correct in a limit game since the pot would have to be very small.

When you are ahead on the Flop then fall behind on the Turn
There will be situations where you are ahead on the Flop, fall behind on the Turn, but with a chance to catch up on the River. A typical situation occurs when you Flop two pair, your opponent picks up a straight or flush on the Turn, but you still have a chance to pick up a full house on the River. Depending on how sure you are that your opponent has a straight or flush, you may actually need to fold on the Turn and forgo your draw for the full house.

If you have two pair against his straight or flush, then you have 4 outs. This means you need the expected pot size to be greater than 11 big bets in order for a call to be correct. (If you do not get this, work out the Good Number and the Bad Number, and you will see that 11 is right around the breakeven point). Almost every player will still call in this spot in the hopes of catching a full house. With this simple analysis when we are 100% sure he has a straight or flush, a fold is correct if the expected pot size is less than 11. However, what if we are only 90% sure he has a straight or a flush. What if there is a chance he only has top pair or a lower two pair than ours? In that case, we are ahead the other 10% of the time, and maybe he only has 4 outs against us, which would mean we have 40 outs. Using those probabilities, that would mean the expected outs we have would actually be 7.6 as seen in the equation below.

Expected Outs = (Number of Outs when we are ahead x Percentage we are ahead) + (Number of Outs when we are behind x Percentage we are behind)
Expected Outs = (40 x 10%) + (4 x 90%) = 7.6

So we would only need the expected pot size to be greater than 5 for a call to be correct (again, work out the Good Number and Bad Number to check that the breakeven point is around 5). It would not be unusual for pots to be greater than 5 big bets and less than 11 big bets, so this decision can come up with regularity. Although most people probably do not think in these terms, their call when they have two pair against a possible straight may be correct if in fact there is a chance the other player is bluffing, semi-bluffing or actually has a worst hand without realizing it. So when they call, they may be making a correct decision without even knowing the reasons why.

Pot Odds Quiz

1. Exposed Hand
You are on the button and you hold A♠K♠. There is one limper in middle position, and when it comes to you, you raise. Both blinds call as does the limper. There are four players seeing the Flop and the pot is 4 big bets.

Your hand: A♠K♠
Flop: A♦J♥6♠

Everyone checks to you and you bet, two players call. There are three players seeing the Turn and the pot is 5.5 big bets.

Turn: 5♣

The first player to act bets out and says he is all-in. The second player folds. Right before it is your turn to act, the first player, who had bet on the Turn, exposes his cards and shows 6♣5♠ for two pair and says to you:

"Look, I know you have AK. I have two pair. I have you beat. I just put in all my chips and I don't want to suffer another bad beat, I'm having a bad night. Just fold and give me the pot."

Should you respectfully decline and call or should you acquiesce and fold?

Answer
Once the first player has bet out on the Turn, there are 6.5 Big Bets in the pot. You need to count your outs, which are any A, K, or J's (a J would give you two pair, A's and J's, which is better than your opponents two pair of J's and 6's as his pair of 5's no longer plays). There are two A's left, three K's left and three J's left, for a total of 8 cards. We can currently see 8 of the cards (your two cards, the first player's two cards and the board's four cards), which means there are 44 unknown cards left. 8 of those cards give you a winner, the other 36 gives you a loser.

Good Number = 8 x 6.5 = 52
Bad Number = 36

The Good Number is greater than the Bad Number, so there is value in calling. You should say to the first player: "Sorry buddy, but I gotta see the River", throw your chips in and hope for the best.

2. You have A♠2♠ in a four handed pot on the Turn. The board is K♠J♠4♣3♦. Before the Turn, there are 5 big bets in the pot. The first player to act bets, the second player raises, and the third player folds. You suspect neither of them are maniacs and they both hold hands that are legitimate. You see the first player's demeanor and it is clear to you that he is going to call and not re-raise. You are quite sure you will lose if a pair comes on the River as one of them will have a full house. You should expect to get at least one caller on the River, and if you are lucky, perhaps two callers for multiple bets. Should you call?

Answer
You have 7 outs for a flush (two of them will pair the board and give someone a full house, so those are not outs), and 3 outs to make a straight (only 3, because the 4^{th} 5 is a spade which we have already counted), for a total of 10 outs. At the moment, there are 8 big bets and you fully expect the initial Turn bettor to call, making it 9 big bets before the River. If you hit your draw, you expect at least one more big bet. Using that as our conservative estimates, we can calculate the Good and Bad Numbers.

Good Number = 10 x 10 = 100

Bad Number = 36 x 2 = 72

The Good Number is higher than the Bad Number, so we can call.

3. You have K♠Q♣ in the big blind. On the Turn, there are four other players left. There are 5 big bets in the pot before the betting on the Turn, and the board shows A♣Q♠T♣3♠. The small blind bets and it is up to you to act. Should you call?

Answer
The most aggressive way to approach this problem is to assume you have up to 6 outs (two Q's for trips and four J's for straights). However there are many other ways you can lose even if you hit one of these cards. There are only 2 cards, J♦ and J♥, that would give you the nut hand. There are now 6 big bets and you can probably expect to get more bets if you hit your hand, however there are still two players left to act. If you call, one of them could raise thus making you put in two big bets to see the River. With the most aggressive numbers, using 6 outs, an expected pot size of 8 big bets and no raises behind you, DIPO looks like this:

Good Number = 6 x 8 = 48
Bad Number = 40

And it looks like you should call. However, the variables we put in are very aggressive. It would be wiser to adjust your outs down to a lower number and to raise the possibility you may have to put in more than one bet. A more conservative estimate of the variables may indicate only 4 outs, and having to put in 1.5 big bets on average, which would mean half the time a player behind you will raise. With these variables, we can actually increase the expected pot size since another player looks like he will be in for the ride if we do hit our hand. With these more cautious estimates, DIPO looks like this:

Good Number = 4 x 10 = 40
Bad Number = 40 x 1.5 = 60

Now it is a clear fold, and that would be the correct decision.

4. In the quiz section of the Outs chapter, the following problem was mentioned:
You have T♣3♣ in the big blind. There is only one limper and the small blind calls and you check.

Your hand: T♣3♣
Flop: J♣6♦2♠

Everyone checks on the Flop.

Turn: 4♣

You now have a flush draw and an inside straight draw. The small blind bets out and you are sure it means he is not bluffing because you know how he plays. You are sure he has a J. How many outs would you estimate you have? And should you call?

Answer
The answer to the number of outs is 12 (see the answer in the quiz section of the previous section). There were 1.5 big bets in the pre-Flop round and no bets on the Flop. On the Turn, the small blind made one big bet. If we expected he will call on the River, then we can expect 3.5 big bets.

Good Number = 3.5 x 12 = 42
Bad Number = 46 -12 = 34

This may look like it is worth a call. However, if he is only 50% to make the call, then it becomes much closer.

Good Number = 3 x 12 = 36
Bad Number = 34

Add into the fact that the original pre-Flop limper may raise, now there is a problem. Instead of putting in 1 big bet to see the River, you may have to put in 2 big bets. If we estimate that the probability of the pre-Flop limper raising is 10%, then it no longer looks so good.

Good Number = 36
Bad Number = 34 * 1.1 = 37.4