One Rail Systems – Part 1

I'm writing a series of articles on diamond systems, specifically systems I've studied and learned playing 3-cushion that can be applied to your pool game. Many beginning and intermediate players don't know how to use the diamonds on a billiards table, and even advanced players may only know the basic 2-cushion (Plus Two) or 3-cushion (Corner Five) systems and not understand how to adjust for different ball positions or table conditions. There are dozens and dozens of systems out there - years ago they were passed down from player to player and held in secret, and not many people were "in the know". But thanks to the many books and DVDs now available, as well as the proliferation of information on the internet, a lot of these systems have been collected and shared by many knowledgeable players and authors.

Before I get started, remember that some systems are more accurate than others, and a lot of them have boundaries beyond which the system breaks down. Also, everyone's stroke is a bit different, and medium speed and one tip of english to one person may not be the same to another. I will try to describe these boundaries and the speed/spin required as best I can. I've personally worked with each system as I've learned about them over the years, and I experiment with them for my stroke and on the equipment I usually play on. If I find the calculations easy to remember and perform at the table and find them to be reasonably accurate, I document them and keep working with them until they become part of my repertoire. That experimentation and repetition also allows me to incorporate some feel into the shot and make slight tweaks where necessary – I recommend you follow a similar approach.

I thought it would be good to cover the basics starting with one rail kicking systems, most of which are based in simple geometry. I know, math, Yuck! But it's important to understand that a lot of the systems out there have their foundation in mathematics and more specifically geometry – ratios, parallel lines, properties of triangles and rectangles, etc. This will be a longer article, split into two parts, but I would like to teach you all of the one rail systems I've used over the years, most of which are very practical and useful during actual competition.

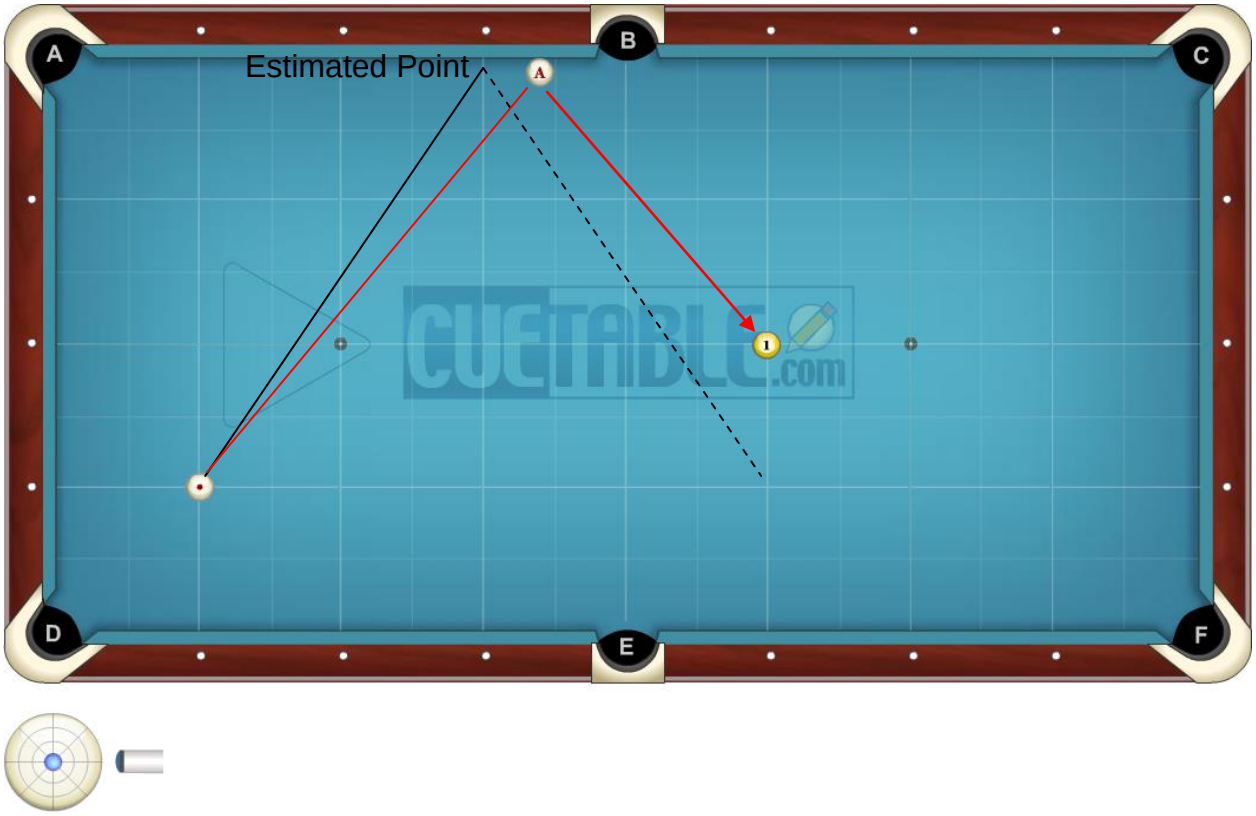
A lot of these one rail geometric systems are based on the principle that roughly speaking, the cue ball will leave a cushion at the same angle it enters, or angle in = angle out. This is not exactly true; since the cushions are not perfectly elastic, they "cushion" the impact of the cue ball, pardon the pun. This effect is enhanced if the cue ball is shot with a firmer speed; the cushion is compressed even more than normal and the rebound of the cue ball is less than anticipated. Any inadvertent draw or follow on the cue ball will also cause the cue ball to curve coming off the rail. Not to mention english, both cue ball and cushion-induced english, the amount of which varies with the speed of the cue ball and the entry angle into the cushion. Distance from the rail can also affect the rebound angle, when the cue ball is close to the rail it does not have time to attain normal roll and will rebound more sharply. Then add in dirty equipment, humidity, different types of cloth and rails, and it's a wonder kick shots or banks can be made at all! My advice to you is to be aware of these effects and try to simplify and standardize whenever possible. Assuming your stroke is solid, trying to keep your speed and spin as consistent as possible for "normal" kicks and banks will help to eliminate a few of the variables at least.

There is an important distinction to mention on aiming and measuring that applies to these systems and a lot of others as well. Let's say the system tells you to aim at the second diamond from the corner pocket. Do you aim at the diamond itself (the actual mark or point on the rail) or at a point opposite the diamond on the cushion? And when measuring, do you measure to the diamonds, the nose of the cushion, or the rail track (the worn line about an inch from the cushion where the bottom of the cue ball travels)? Well, the answer is that each system is a little different, and you have to pay

attention to these differences or the systems will not work as well as they should (or at all in some cases). As you'll see in most of these one rail systems in particular, you have a primary aiming point that is adjacent to the diamond on the cushion (in front of or at the diamond) but you can also aim through the actual diamond when using certain speeds or at certain angles. I will be very specific with these and other systems when mentioning measuring lines or aiming points, and will use the terminology in front of or at when referring to the point on the nose of the cushion opposite the actual diamond, and through the diamond when referring to aiming through the actual diamond on the rail.

Finally, regarding speed adjustments, I like to think about kicking using 3 speeds – slow (lag speed), medium (a "normal" hit), and firm to hard (anywhere from a pretty crisp hit to let it fly!). I typically try to kick at a slower lag type speed whenever it's possible to control the outcome (kick-safe). To adjust for this slower speed, you can shoot through the diamond instead of at the diamond, which really amounts to a 2 – 3" (or 2/10 – 3/10 of a diamond) adjustment toward the cue ball. To adjust for a firmer hit, I try to adjust a similar amount but closer to the object ball, about 5 - 10% of the distance assuming a roughly 45 degree angle into the rail. So if there is a 4 diamond spread between the balls, and I decide to use a firm to hard speed instead of medium, I would adjust between 2 and 4 tenths of a diamond (I would probably adjust about 3/10). If the angle into the rail is much different then I will adjust appropriately – maybe only 2/10 for a 30 or 60 degree angle, and maybe only 1/10 for a very shallow or very acute angle. You also may need to use some running english for very shallow or acute angles to compensate for the lack of cushion-induced english.

Equal Angles, or Angle In = Angle Out

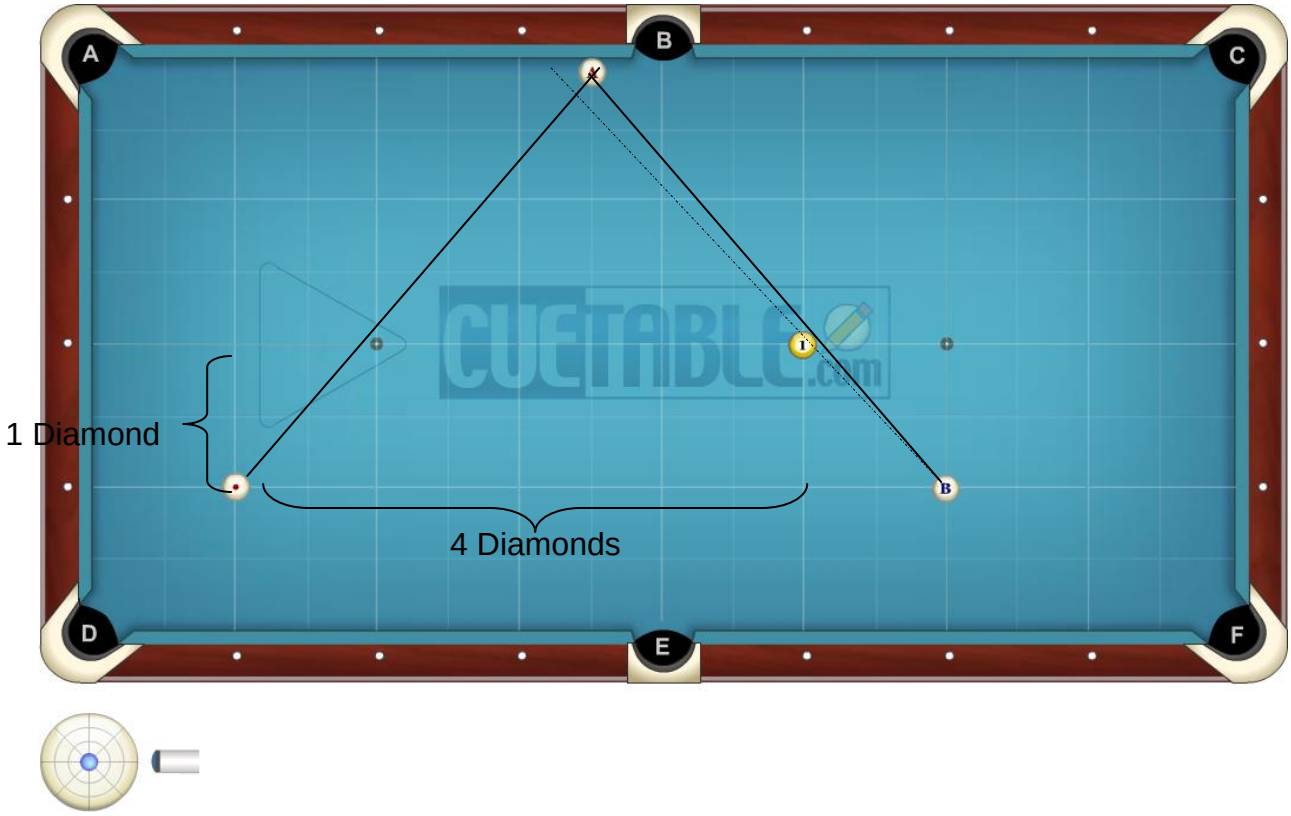


This is the method that a lot of pool players use. You have a kick or bank, you eyeball it and estimate the angle of the cue ball into the rail and the angle out of the rail, and when you find a point where you think the angles match that's your aim point. Not always very easy to judge, but this is the way a lot of people estimate their kick shots, through eyeballing a half way point and trial and error. In the example above, I picked a point on the rail, but as I continue to look the angles don't look like they match (the matching angle for the initial point I chose is actually shown by the dashed line). So I pick a point a little closer to the 1 ball and see if that feels right, and so on until I think I find one exactly in the middle between the cue ball and object ball. (The correct point is actually indicated by cue ball A, and the correct line is shown by the red line, and we'll prove that in the systems to follow.)

I aim at this point on the rail track where the center of the cue ball will travel (at or in front of the diamond) with a medium to medium-firm speed and a center ball and I should make the hit. At normal angles like this, you can also shoot through the diamond with a slow speed (lag speed). This minor adjustment of a few inches will account for the cue ball picking up cushion induced english and the forward roll and slower speed lengthening the angle somewhat off the rail. You can also try a firm speed with running english (½ tip of follow, ½ tip of sidespin). Try all three approaches to see what I mean. Be aware that as the angle into the rail is more acute (more of a straight on angle) the slower speed might not work as well since the cue ball won't pick up as much cushion induced english and therefore won't lengthen as much. In this case just adjust maybe an inch or so to account for the slower speed rather than aiming through the diamond.

The major problem with this system is that it's hard to judge accurate entry and exit angles in space without any references, especially if the balls are far apart or different distances from the rail. If you are going to try and do this, it's usually helpful to estimate the point by standing on the same side of the table as the aim point and looking back and forth to both balls. You'll see people doing this, measuring the angle with their stick and trying to find a point that looks like it bisects the angle.

Equal Angles with Equal Distance



This is a slight variation of the equal angle method that estimates the midpoint of the distance between the two balls. It's usually easier to estimate the distance between the balls and simply divide in half, rather than estimating the angles, but you can only do that if the balls are the same distance from the rail. If they aren't, project an imaginary line close to an estimated point (see dashed line above as an example) and imagine that one of the balls is even with the other. Then you can simply divide the distance in half and aim for that point. In the diagram above, ball B is on an extended line from our estimated aim point (even though it's not the correct aim point) through the 1 ball and even with the cue ball. The distance between them happens to be an even 5 diamonds, so we divide in half and see that the midpoint is 2 ½ diamonds. So we aim at ball A (2 ½ diamonds from the position of the cue ball) to make the hit. You can see that even though our estimated point is not correct, we still calculate a pretty decent line to the object ball that should still result in a hit. In my opinion, if you have to make a pure estimate, this method works a bit better than the previous method of judging actual angles in and out of the rail since distances are a little easier work with than angles.

There is another method that works pretty well and also factors in the balls being different distances from the rail. Count the diamonds, or fractions of diamonds, between the cue ball and object ball. In this example, they are 4 diamonds apart. So our initial aim point would be half way between them, or 2 diamonds from the cue ball. Now estimate the difference in the distance from the rail to the cue ball and to the object ball. This one is easy – the cue ball is 3 diamonds from the rail, and the object ball is 2 diamonds away, so the difference is 1 diamond. Cut that in half to get ½ diamond, and add to our previous midpoint of 2 diamonds if the object ball is closer to the rail than the cue ball, subtract if the object ball is further away. Since our object ball is closer, we add ½ to 2 to get a midpoint of 2 ½ diamonds (marked by cue ball A) and aim at that point to make the hit. Remember to aim at the diamond with medium speed, or through the diamond at a slow speed for normal entry angles.

More Equal Angles

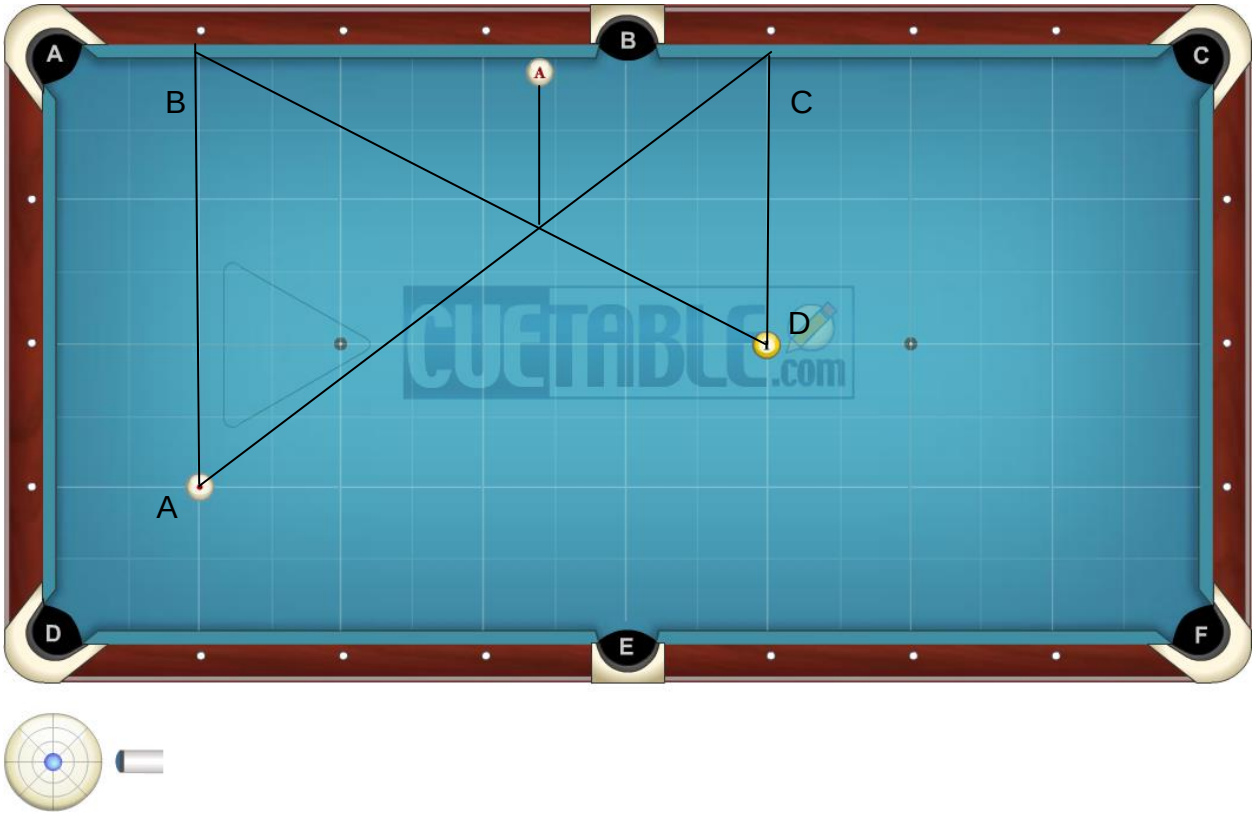
This is another way to look at the equal angle or equal distance principle by using rail numbers to figure out the track lines. Most people learn at some point how to use the diamonds to create equal angle tracks. Shooting from the corner pocket to diamond 1 goes to diamond 2, shooting into diamond 2 goes to diamond 4, etc. If we are lucky enough to have a kick or bank on one of these tracks, everything is easy. Unfortunately, most of our kicks or banks don't line up quite so nicely.

In the diagram above, we have a length of the table kick on the 6 ball. We start by finding the natural cue ball equal angle path to the corner pocket (numbered 0 above), and we number the diamonds by tens to make the math easier. So by pivoting our cue stick a bit, we see that we are on a line from 35 to 17 ½ (shown by the dashed line) that will take us to 0 (the corner). Once we find that path, we look from where the cue ball hits the rail on the top rail down to where we want to hit the 6 ball. We want to ideally hit the 6 ball a bit on the side, so we are aiming toward diamond 7 on the bottom rail. Since we are 7 away from our perfect track line to 0 (the corner), we cut that distance in half and adjust our first rail hit point accordingly. In this case, we add 3 ½ to our original aim point of 17 ½ to get a final aim point of 21. We aim through diamond 21 with a lag speed and a rolling cue ball and we will make the hit and hopefully leave the cue ball safe behind the 8 ball as the 6 ball rolls up table.

As another way to calculate the aim point, we can also add the cue ball and adjusted end point together (35 + 7 = 42) and then divide by 2 (42 / 2 = 21) to get the same number. If you need to kick with a firm speed, try hitting the same point but using ¼ to ½ tip of running english.

This system is easiest to use when the cue ball and/or object ball are close to a rail, otherwise trying to find track lines by pivoting the cue can be difficult and time consuming. But it does work, and it can be used as diagrammed or across the width of the table.

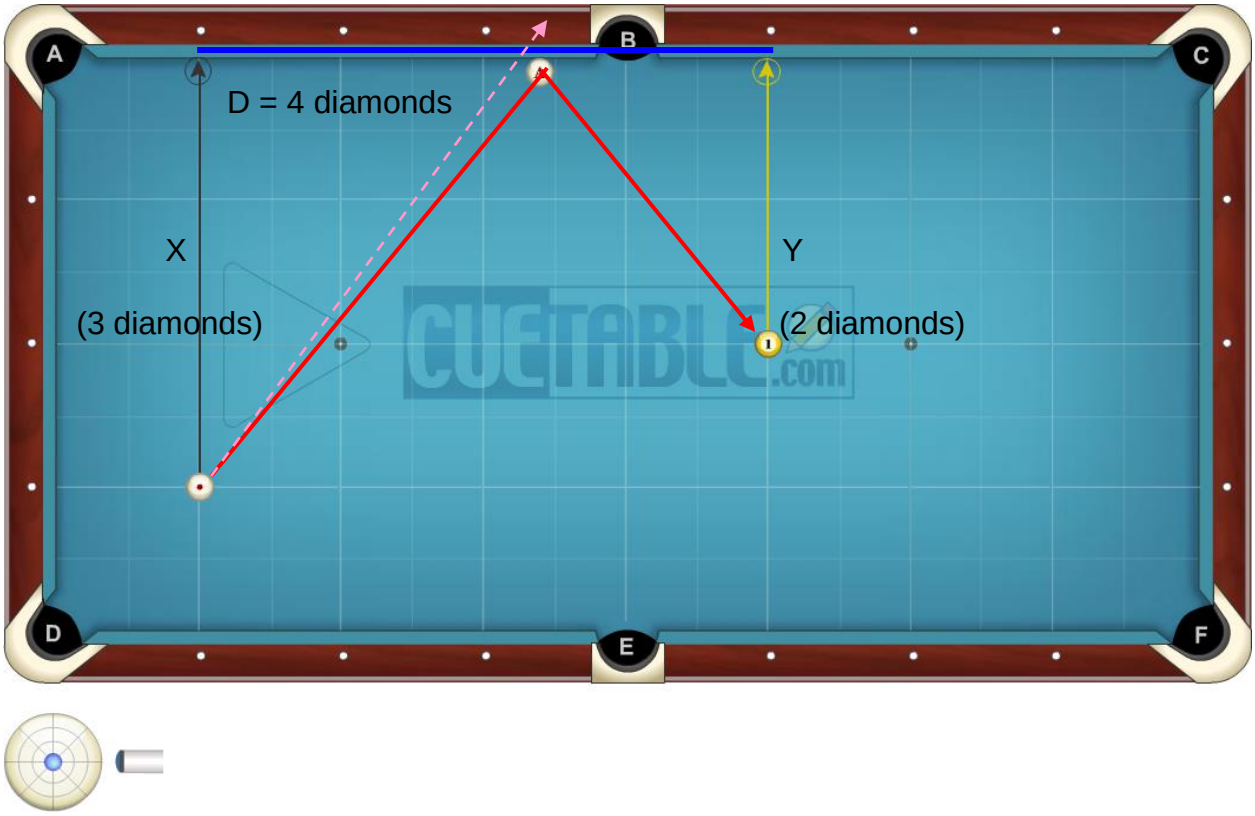
Criss-Cross or “X” System



This is a pure geometric system that really is the foundation of some of the systems to follow. To start, imagine lines from the middle of the cue ball and object ball perpendicular to the rail (lines AB and CD above). Now imagine diagonal lines between each ball and the opposite point on the rail (lines AC and BD, or drawing the “X”). In theory the points on the opposite rails should represent the centers of the balls, so the points should be on the rail track (a little over an inch from the cushion), but practically speaking it’s good enough to just estimate to the nose of the cushion. Where the lines cross, draw a line perpendicular to the rail and that’s your aim point, here marked by cue ball A. This is the geometrically correct aiming point, in this case about 2.4 diamonds from the location of the cue ball, or 3.4 diamonds from corner pocket “A”. As with previous systems, you can aim at this point on the cushion with a medium speed and center ball hit or through the diamond with a slower lag speed hit and ½ tip of follow.

This system has been referenced a lot over the years for both kicks and banks. It’s easiest to use your cue stick to estimate one of the diagonal lines, laying it on the table along that line, and then sighting down the other line to find the midpoint. This is great in practice, but in formal competition it’s a bit awkward, could cause inadvertent movement of the balls if you’re not careful, and letting go of the cue stick for measuring purposes could even be illegal under certain rules. Luckily there are shortcuts to the geometry used to find the point, and we’ll explore those below.

Equal Triangles System



This system uses triangles and proportions to determine the aim point. As you see in the diagram, we can form two triangles by drawing a few lines – one side of the triangles is formed by drawing perpendicular lines from the cue ball and object ball to the rail we are kicking into, one side by drawing a line down the rail, and the diagonal lines are formed by the cue ball path itself (angle in = angle out). The interesting thing is that we don't know the aim line, but we do know it has to connect the two balls and that the angles in and out should be equal. Since we know the lengths of the sides of the triangles, we can calculate the lengths of the bottoms (along the rail) and find our aim point.

Okay, enough geometry – well, not really... For this system, the formula is A = DX / X + Y. Please refer to the lines and labels in the diagram above. Take the total distance between the balls along the rail (D) and multiply that by the distance of the cue ball from the rail (X). If the numbers aren't exact, just round as necessary to make things easier. Now divide that by the sum of the lengths of the cue ball and object ball from the rail and you will determine your aim point.

In the example above, the distance between the balls (D) is exactly 4 diamonds. The length of the cue ball from the rail (X) is 3 diamonds. And the length of the object ball from the rail (Y) is 2 diamonds. So using the formula, we have A = 4 x 3 / 3 + 2, or 12 / 5, which is 2 and 2/5. This means our aim point is 2 and 2/5, or 2.4 diamonds from the cue ball position on the rail we are kicking into (shown by the red aiming line). Notice this is the same aiming point that we previously calculated, and as before center ball medium speed at the diamond (red aiming line), ½ tip of follow and slower speed through the diamond (lighter dashed pink line).

This system is nice, and mathematically correct, but as you can see the math can get tricky, especially if the balls are not even distances from the rail and each other. Luckily simpler options exist, the ones I use most often in a game, and we'll cover those systems in part two of this lesson.