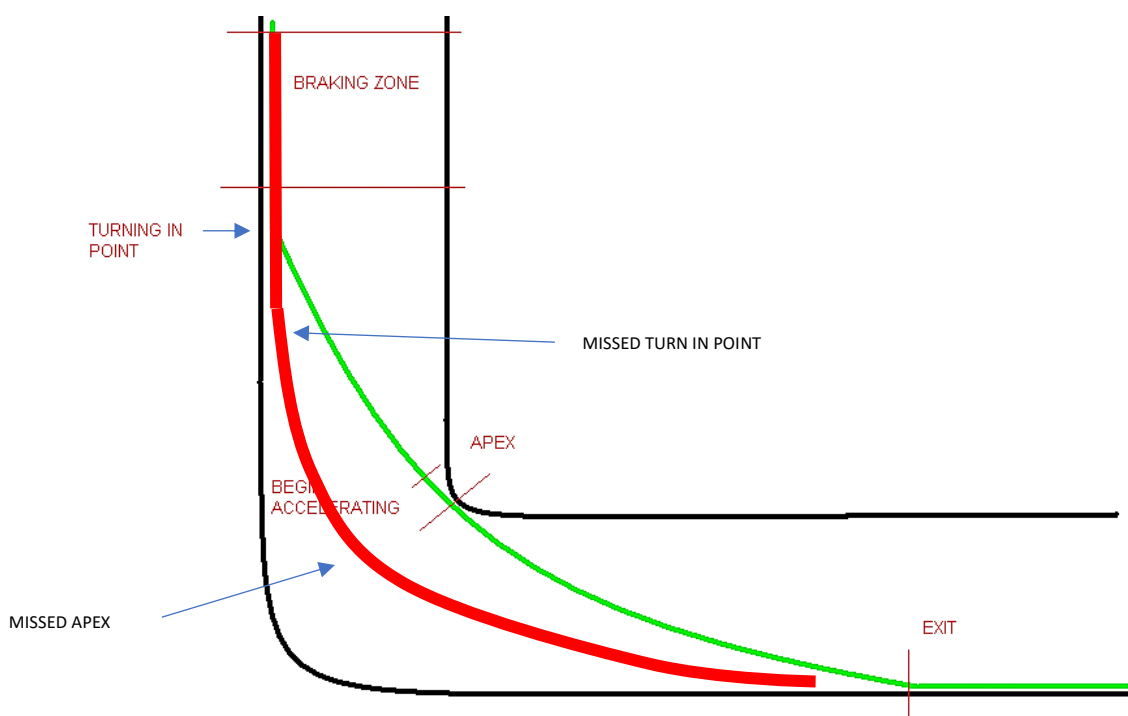


BRAKING AND THE RACING LINE

How you brake will play a big part in how you will take the rest of the corner. Paying close attention to what happens to the kart once you get into the corner itself. Is the front sliding, is the rear sliding, what are you doing with the steering wheel, and when/how are you moving back on to the throttle? How you brake influences all these factors, so will have a big part to play in how quick you go through the corner, and by extension, how quickly you get to the next corner.

The next part of the process we will examine, is turning into the corner. Again, the faster you go, the more difficult it can be to turn in at the correct point. As with our braking, a good idea is to look for a landmark to use as your turning in point. This could be a barrier, a tyre, a sign, or a mark on the track. This will help you get your turn in consistent.

So where do we turn in to a corner? Well generally, it is just before we get to the corner itself. Remember our beginners lesson? We want to use the minimum amount of steering to get through the corner, so we start turning slightly before the corner to reduce the steering angle, and to ensure that we get to the apex.



If we miss the turn in point, there is a good chance that we will miss the apex. This results in us having to increase the steering angle and reduce speed and have less room on the exit of the corner. All of these have the effect of slowing you down in the corner. In a race situation, this is also known as 'leaving the door open' meaning that you give an opponent a great opportunity to overtake you.

So how does the kart feel when you turn in to the corner. If we examine what we've done to this point, we can start to understand how the kart should behave.

- We have approached the corner, taken our foot off the throttle and applied the brake, shifting our weight towards the front of the kart.
- We have come off the brake and changed the direction of the kart.

So, we've put a few inputs into the kart, which will have the effect of making it feel unstable. At this point, we want to allow the kart to stabilise itself and we want to guide it in toward the apex. If you are on the limit of the karts grip, the rear end of the kart may feel light, which may require some correction with the steering wheel. As we move towards the apex, we are not pressing either pedal and the kart is still slowing slightly. As the kart stabilises, we can now start to accelerate through and past the apex.

Now we've reached the apex. What now. Well, if you've been paying attention, you will have noticed that we have started to accelerate just before the apex? That's right. Now we're picking up speed as we exit the corner. But there are a couple of things to consider!

So, we are mid-corner, and on the limit of the karts grip. If you stamp on the throttle now, we will see a big weight shift towards the rear, outside corner of the kart, which could cause the tyres to lose grip and start a slide that could result in either a loss of speed or possibly a spin. When you are happy that the kart is stable enough, start to open the throttle gently, feeling for what the rear wheels are doing. If you are doing it right, the kart should maintain its stability and start to accelerate towards the exit of the corner. This process is a bit trial and error, so it is important that we feel for what the kart is doing. If it starts to slide, reduce the throttle input and bring the kart back into its grip window, before applying the throttle again. This process is called **feathering** the throttle. This is a very important skill to learn as it will teach you how to deal with and use different amounts of power. It will teach you to get the best out of low powered karts, as well as teaching you to drive smoothly with lots of power or on tracks with low grip.

Now we move towards the exit of the corner. The higher the speed we are doing on the exit of a corner, the faster we will get to the next corner. An explanation of this shows how important a good exit is:

We are doing 15mph on the exit of corner 'A' and accelerate to 25mph at the braking point of corner 'B', taking 10 seconds to cover the distance between corner 'A' and 'B'.

Now, if we are doing 17mph on the exit of corner 'A', we will accelerate to 27mph at the braking point of corner 'B', we will take, say 8 seconds to cover the distance between the corners.

What this shows is that it is not just the power of the engine that determines how fast a kart is down a straight, it's also about how well the driver has carried the speed through the preceding corner.

So, how do we do this? As we move through the apex of the corner, we have started to accelerate smoothly, we need to open up the steering, by straightening the wheel, and guiding the kart towards the outside of the track. Effectively, we're trying to straighten the kart up as early as possible. This is because it is more efficient travelling in a straight line,

and it is more stable, allowing us to increase the power delivery as early as possible. By the time we have got to the exit of the corner, we should be at full power and charging to the next corner.

And that's how you corner at speed. For most corners, this whole process can take as little as three seconds, so there is a lot to process. There are some common errors that a driver can make. Let's have a look at them here:

MISSING THE BRAKING POINT

Effect – missing the apex, running wide on the exit, late on the throttle

Possible Solutions – Work ahead and spot your braking point, readjust your turn in to recover the apex.

BRAKING TOO LATE

Effect – Too much speed into the corner, holding the brake on into the turn in, possible spin or loss of control, missing the apex, running wide on the exit, late on the throttle

Possible Solutions - Work ahead and spot your braking point, readjust your turn in to recover the apex.

LATE TURN IN

Effect – Missed apex, running wide on exit, late back on to the throttle

Possible Solutions – Readjust line to apex later, slight touch of brakes to adjust *kart balance*.

OVERSTEER ON CORNER ENTRY

Effect – Loss of control or spin

Possible Solutions – Stay off pedals and apply *opposite lock* to counteract the slide

MISSED APEX

Effect – Reduced exit space, late on throttle, more steering lock needed, drifting away from apex.

Possible Solutions – Focus on braking point, focus on turning in point and aim for apex. Work ahead to prepare for corner entry.

OVERSTEER ON CORNER EXIT

Effect – Loss of control, possible spin, reduced speed on exit, Incorrect line into the corner, too much power applied, power applied too early.

Possible Solutions – Prepare line before reaching the corner, readjust throttle application, feather throttle.

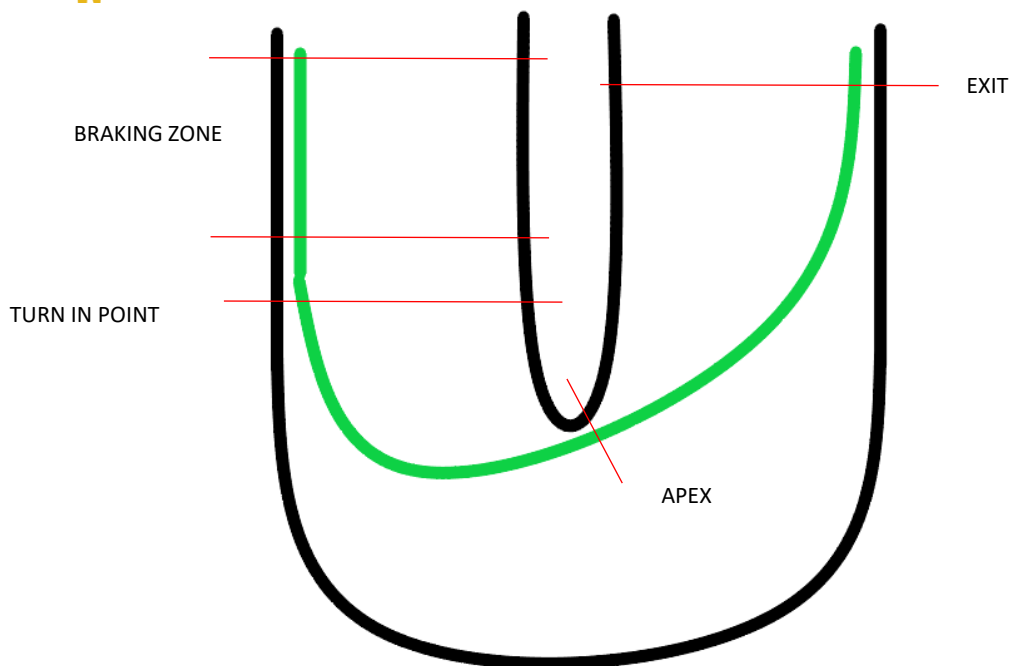
You may have noticed a couple of new words or phrases creeping in here. It's time for a quick catch up.

- **Opposite Lock** – What is this? This is when you correct oversteer by using the steering wheel. For example, if you are turning right, and the kart starts to oversteer, meaning the rear of the kart swings round to the right. To counteract this, you start turning left. This will have the effect of 'catching' the slide.
- **Kart Balance** – This is the weight balance between the front and rear of the kart and influences how the kart feels. Adjusting the kart balance can be used to alter the rate at which the kart changes direction. By using small inputs on the pedals, we can adjust the balance of the kart to change direction or correct small issues mid-corner. We will look at balance in more detail later.

Now we're going to look at more detail at racing line.

So far, we have looked at a very simple ninety-degree corner. However, we don't see too many of those on racetracks. Here we will look at a few different types of corners and how we approach them.

First, we'll start with the most common type of corner that we find in indoor karting. It's the *Hairpin*



Hairpin bends feature heavily in karting in general and can be key to both hitting good lap times and racing effectively. What do we see in the racing line for a hairpin that is different to the corner we have looked at before? There are two key differences:

- The turn in point is later
- The apex is further through the corner

Why is this?

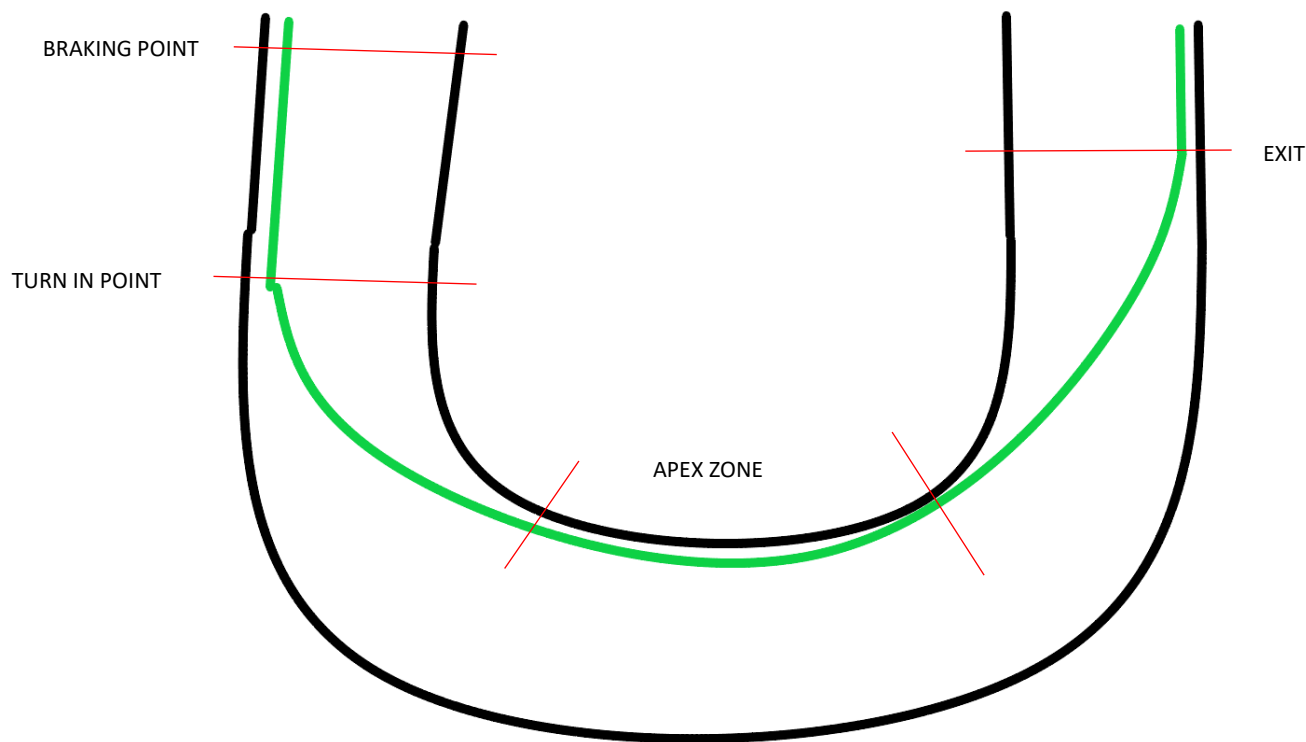
Let's return to our point that the higher your speed is when you leave a corner, the quicker you will get to the next corner. If we were to use a normal apex point, i.e., in the middle of the corner, we would have more steering lock on and be later the throttle. It is the case with most hairpin corners, that we take the following action:

- Brake deeper into the corner to give you a slightly later turn in point. Be careful though. Braking deeper does not mean taking more speed into the corner. Excess speed can be your worst enemy in this type of corner.
- Turn in slightly later and aim to apex the corner slightly past the midpoint of the corner. This allows you to carry out all the steering in the first half of the corner.
- As you get close to the apex, open up the steering as much as possible. You should be steering more or less straight as you move past the apex.
- Apply the power as you move past the apex and focus on keeping the rear from wheel-spinning.

You can see, the principles we learned about in the earlier lessons still apply, we just adapt them to suit the corner.

Next, we are going to look at a *Long Apex Corner*. This is the type of corner that drivers love. Generally medium to high-speed corners where you can push the kart hard. Think Parabolica at Monza, Spoon corner at Suzuka, or the Porsche Curves at Le Mans. What is special about

these corners is that you have to hold the kart (or car) close to the inside of the corner for an extended period of time. Lets have a look at an example.



What do we need to think about with this type of corner?

Firstly, our braking and turn in look fine. Nothing unusual there!

It's after the turn in point that things start to change.

- The corner itself is quite long. We can't open up the corner any more than it is already as we are taking the best line we can. This means that we are going to stay close to the inside of the corner for an extended period of time.
- If we move away from the apex, then we start to run out of space on the exit of the corner, meaning that we must apply more steering lock, or come off the throttle towards the exit. Not ideal.

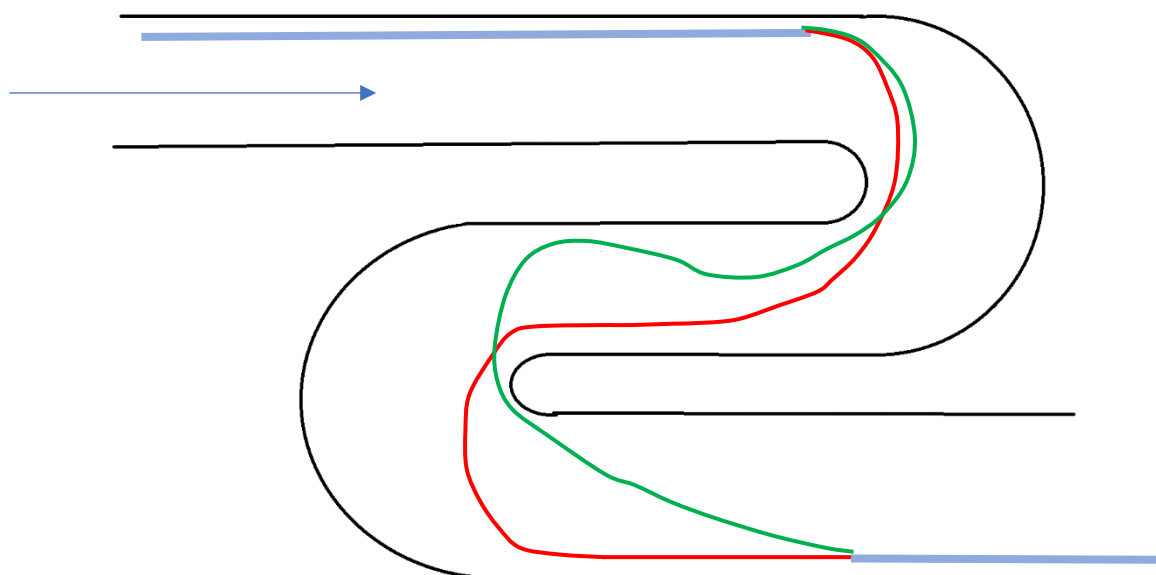
So, what do we need to be aware of?

- We will need to make sure that we are balancing the kart on the throttle. Too much and we will start to slip off the apex, potentially inducing understeer, or overloading the rear tyres and drifting the kart through the corner.
- You will need to feel for the grip and keep the kart on the limit, increasing the power as you reach the exit.
-

Corners Packed Closely Together - Complexes

What happens if you have corners packed closely together? Do we use a normal racing line, or is there something else we need to consider? It is very common for tracks to have one corner immediately after another, especially in an indoor track.

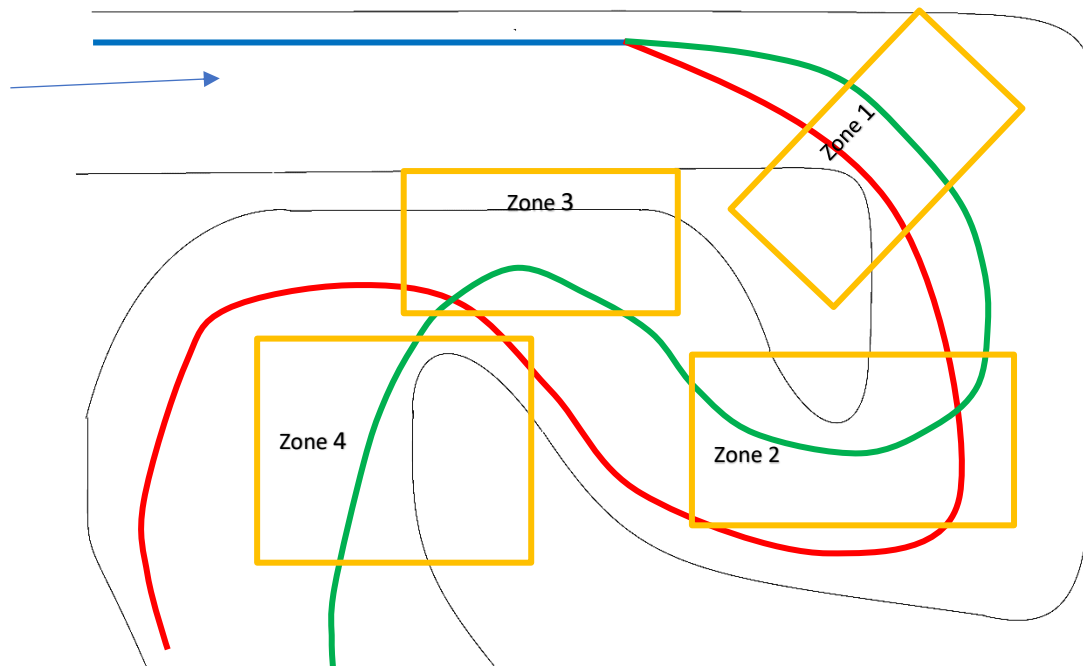
We can refer to these as 'complexes'. In order to be most effective in these sections of track, we need to change our lines or speed into and out of the corners and adapt our driving to get through the complex as quickly as possible. Most commonly, this means that we will change our exit on the first corner to enable us to get the line right for subsequent corners. The focus needs to be on achieving as good an exit as possible. Let's have a look at a couple of examples:



The red line is the normal line. By taking this line for the first corner, it puts us to the inside of the track for the next corner. This means that we are well off the normal racing line, so we will be slow off of the second corner, having to wait to accelerate and turn. We will also be well out of position, and vulnerable to attack from another driver.

Now, if we follow the green line, we can see where the differences are. Firstly, we will slightly change the approach to the corner, turning in slightly later and with slightly less speed. This allows us to move the **Apex** further around the corner. The effect of this is to keep us closer to the right hand side, putting us on the racing line for the second corner. And hey presto, we're on for a quick exit.

The corner may feel slower, and you will have to sacrifice speed on the way into the corner to make sure that you can alter the line on the approach to the second half of the complex. You will also need to make sure that you are not going too hard in-between the two corners, otherwise you risk messing that corner up. Let's have a look at a different example:



Here, we have a fast approach to a right hand bend that tightens as you go into it. It then turns left, and doesn't open up immediately, but keeps on turning left through the exit. A very tricky and technical corner. The standard approach (the red line) would see us brake and turn in to the first apex. This would force us wide on the exit. This in turn sets us up on the wrong line into the left hander, and we are slow coming out of the complex.

So how do we approach it? We think backwards. We need to think about how we are going to get the best exit. Let's take it from there:

- We need a late apex on the last corner, we'll call this zone 4, allowing us to open the steering and accelerate hard.
- This means we need to take a wide line into the last corner, so we need a line that will allow us to take the kart to the right hand side of the track for the left hander. This is zone 3.
- To do this, we need a later apex on the corner marked zone 2.
- Now we can see that if we take the normal apex into the first corner, zone 1, we will not be able to achieve our aim of getting the best line through the corner. So we will have to change the approach so that we miss the apex on zone 1, and focus on setting up for the remaining zones.

If we faced any of these corners in isolation, we would approach them completely differently. What we are doing here is getting the best compromise in each of the corners to get the best result out of the complex. It needs to be thought through and worked out, and there may well be a number of different solutions to taking this section. You will find sections like this in a number of different tracks.