Driving Techniques

Proper Sitting Positions

Adjust the driver's seat so your elbows are slightly bent with your hands on the steering wheel at either the 10 and 2 o'clock or 9 and 3 o'clock positions. Adjust the seat and/or steering wheel so your legs are slightly bent, even when operating the clutch and/or brake pedal. Do not overextend or straighten your legs when operating the pedals. The seat back (rake) should be adjusted so you can rest the bottoms of your wrists on the top of the steering wheel without stretching.

Note: If you are very tall or have an unaccommodating body structure, you may have to compromise your driving position to sit in the seat with your helmet on without hitting your head on the roof/headliner. Adjust the seat rake before compromising leg position.

If possible, use a four- or five-point harness. If you use the standard shoulder/lap belt, adjust it so it fits tightly enough that you will not move around in your seat. This can be done by pulling the belt out until the locking mechanism engages, then tightening it. This will enable you to concentrate more on your driving and less on staying in your seat.

Adjust your left-side view mirror and your rear-view mirror so you can see traffic that may come up behind you. Your instructor should adjust the right-side view mirror for his view so he can also watch oncoming traffic.

Try to keep your head as erect as possible — that is, keep it in the same plane as the car. Leaning your head into the turn will not make the car handle any better. Leaning into turns is more likely to distort your view of the course and negatively affect your driving.

Steering Techniques

Keep both hands on the steering wheel at all times, except at the start and when you're shifting.
Position your hands on the wheel at either the 10 and 2 o'clock positions or the 9 and 3 o'clock positions.

For most of your steering inputs, you will not have to adjust your hand positions. However, on courses with very tight turns, you may want to use what we call "Shuffle Steering." This will enable you to feed

the wheel from hand to hand without taking either hand off the steering wheel. First, imagine a vertical line through the steering wheel at 12 and 6 o'clock. The left hand stays on the left side of the wheel, and the right hand stays on the right side. To turn right, slide the right hand up to the top of the steering wheel at 12 o'clock, then pull the wheel down to the 6 o'clock position, meeting the right hand with the left hand, which has slid around the steering wheel to that position. To continue to turn the wheel, the left hand will now pull the wheel to the 12 o'clock position, and so on. To turn left, the left hand begins by pulling the wheel from the 12 o'clock position down to the 6 o'clock position, where the right hand meets it, then continues the arc to the left.

Remember: you use this process to turn into a corner and out of a corner, so you're guiding the wheel through the whole turn.

Don't let the steering wheel loose in your hands when coming out of a turn, and then grab it when you think it is straight. You will only be playing a guessing game. Also, most of the movement that you will do with this method will go beyond the 9 and 3 o'clock positions on the steering wheel. The more you practice this method, the easier it will work, and eventually it will be second nature. As you exercise the procedure, you will appear to be moving the wheel slowly but deliberately. Slow is smooth, smooth is fast. Take your time in a hurry!

Heel-and-toe Downshifting

Heel-and-toe downshifting is a crucial technique for making smooth, rev-matched downshifts (matching engine speed to road speed in the selected gear) while braking in a manual-transmission car. It involves using your right foot to brake and blip the throttle, and your left foot to depress the clutch for each gear change. The technique is used in braking zones, and if you get it right, you'll experience a smooth downshift when you let out the clutch pedal that doesn't disturb vehicle balance. Additionally, you'll be in the right gear to accelerate through the apex and out of the turn.

Three positions can be used to accomplish heel-and-toe:

- Ball of the right foot on the brake, heel on the bottom or middle of the accelerator
- Ball of the right foot on the accelerator, heel on the brake
- Left side of the right foot on the brake, and right side of the same foot on the accelerator — rolling the foot to the right to blip the accelerator.

There is no most correct position — choose the position that you are most comfortable with. Keep in

mind that vehicles differ in pedal setup, which may affect your heel-and-toe position.

Here's a scenario where you might heel-and-toe downshift: You are accelerating down a long straight on the course and will be approaching a turn. To proceed through the turn properly, you will need to be in a lower gear once you're off the brakes. As you approach the turn, you brake. As you near the end of the brake zone, while still braking, push in the clutch with your left foot, then move your right foot to blip the accelerator. With the clutch pedal still depressed, you shift from the higher gear to the lower gear, blip the throttle, then let out the clutch. If it's done correctly, there will be no jolt forward (or screeching tires) when you let out the clutch pedal. With practice, the technique becomes seamless, with one action blending into the next. It keeps the vehicle's balance stable and ready for turn-in, and your driving line smooth.

Remember, this is a technique that should be practiced at slow speeds, in a parking lot, etc., until you can perform the routine smoothly and not have to concentrate too hard on it. It is an important technique that you can use in autocross, on a race track, or on the road.

Tips and Guidelines

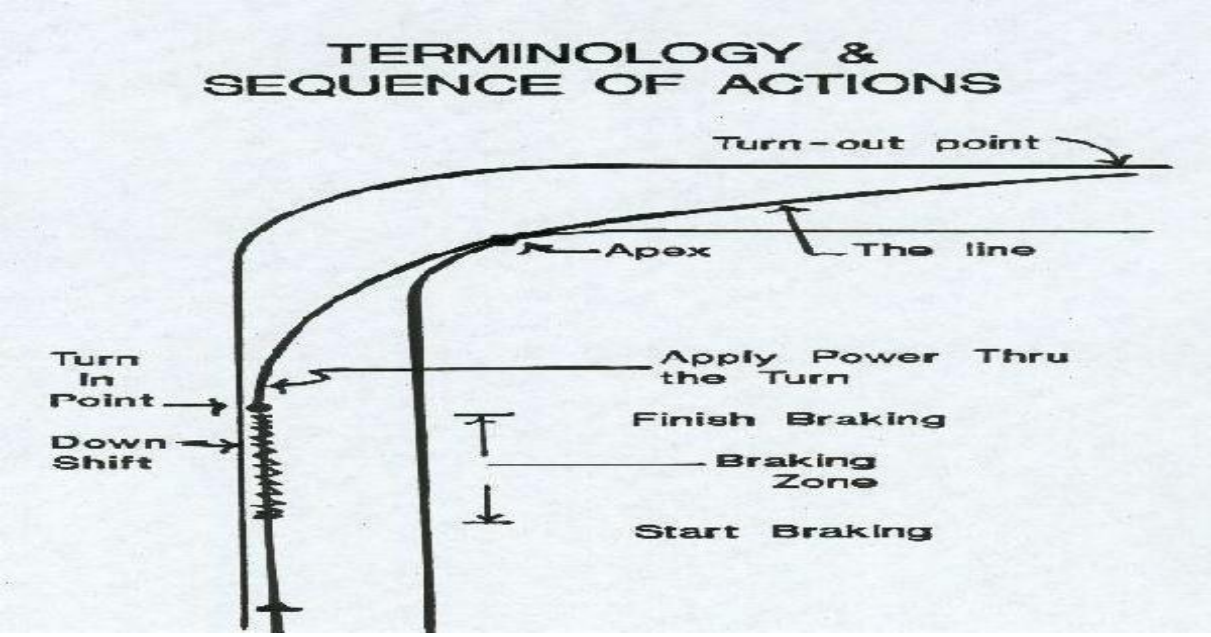
General Rules

- Never brake in a corner unless you are an advanced driver
- Enter turns slow, exit fast
- Use a consistent, comfortable braking point
- Maximize turn exit speeds by applying power sooner driving out of corners rather than trying to carry faster entry speeds

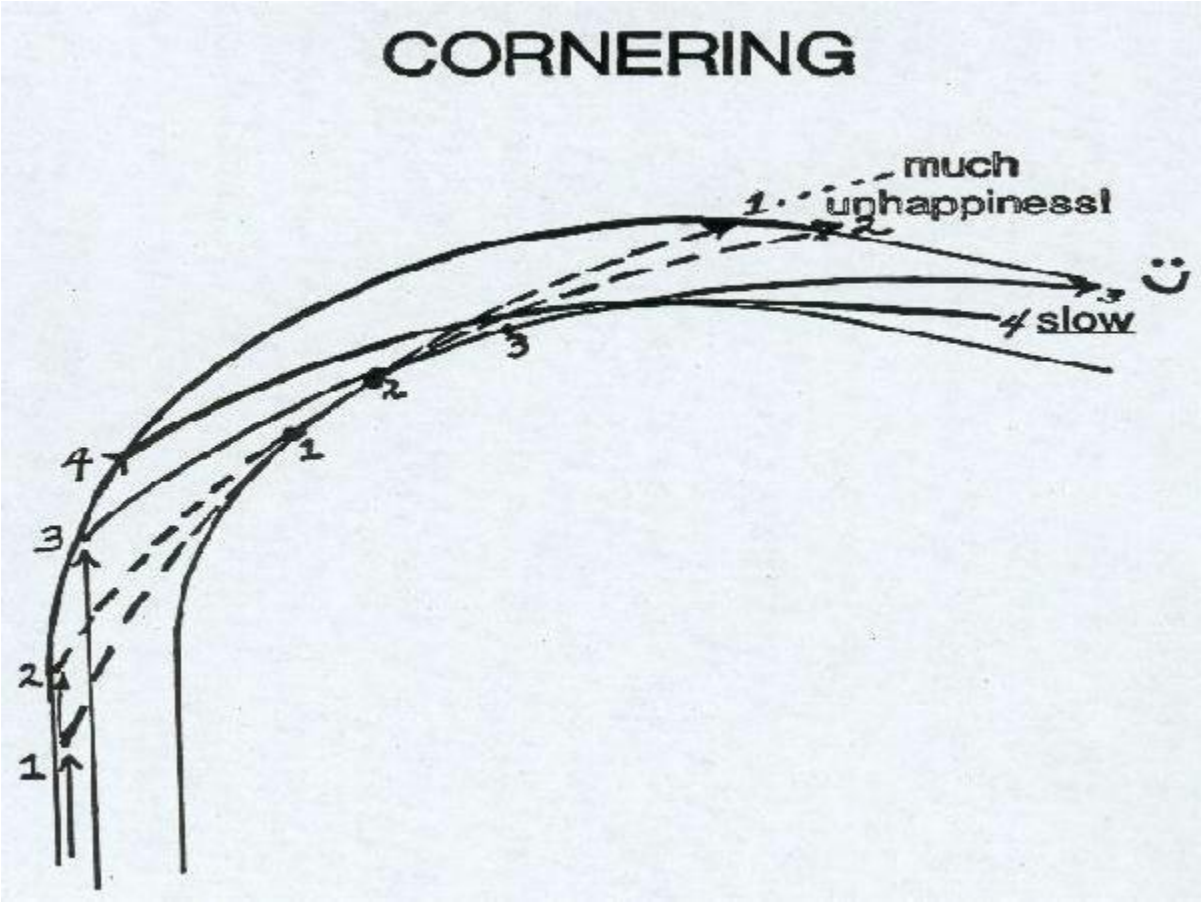
The Line

- "The line" is the route through a course which yields the lowest elapsed time.
- In a corner, it's the broadest arc that maximizes speed, given "g" as a constant in V(2) = 15 gr
- The line and the geometry of the edges of the pavement are usually different.
- There is only one line, but some people may have slight variations.
- Different cars require different approaches to stay on the line
- The most important corners are those leading to the longest straights.

The correct line through a 90-degree turn:

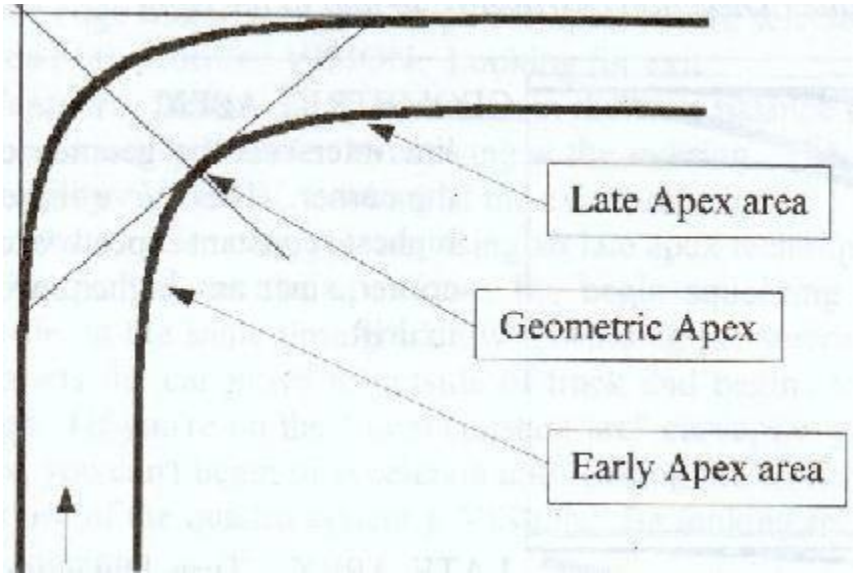


Four different lines through a corner, one of which is correct (no. 3):



Apex

The geometric apex is the point where the angle bisector of the tangent lines drawn from the turn entry and turn exit intersects the inside edge of the track. The driven apex is the point on the inside of the track that the driver chooses (hopefully intentionally) to divide the turn. If it is before the geometric apex, it is termed an early apex. If it is after the geometric apex, it is termed a late apex. In general, "late apex = safe apex." See the chart below for an example:



Vision

Vision is the most important element of high performance driving

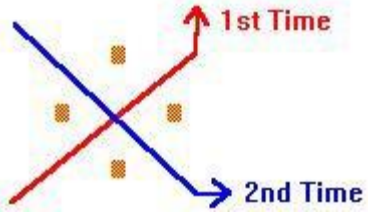
- Eyes up - don't look at the nose of the car.
- Where you're looking is where you're going.
- Look through a corner and beyond; expand your field of vision.
- When exiting a corner look ahead for:
- Flag Station and Corner Workers.
- Traffic - all around.
- Mirrors, gauges, etc.
- Do not fixate your attention on the car ahead of you.
- Do not fixate your attention on the cones.

Gate Summary

Start Gate

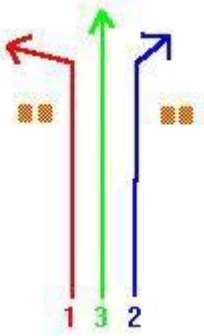
- Line up on the start line as directed.
- Start when ready after the start line worker gives the signal.
- Accelerate past the timing beam at the highest attainable speed.

Box



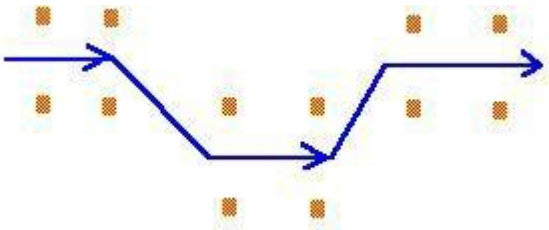
- Boxes are usually driven through at least twice.
- The course line crosses within the box.

Decision Gate



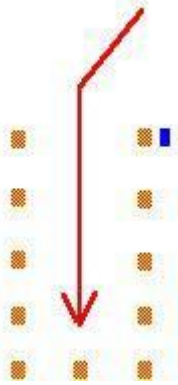
- Locate decision gates and memorize sequence of direction changes when passing through gate, i.e., first time, turn left; second time, turn right; etc.
- Decision gate sequence can be in any order or combination of that shown above.

Offset Gates



- Smooth control inputs
- Maintain a flowing line without abrupt changes.

Stop Gate

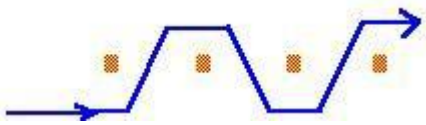


- Come to a complete stop in the stop garage.
- Hitting a large center (end) cone disqualifies the run.

Slaloms

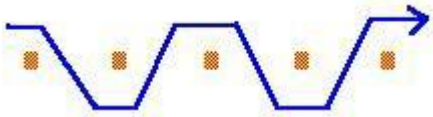
Even Slaloms

- Constant speed, smooth steering inputs. Slalom entry and exit are on the opposite sides.



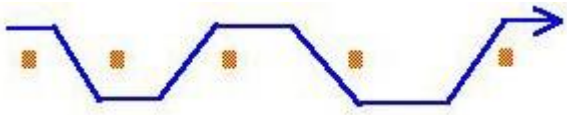
Odd Slaloms

- Constant speed, smooth steering inputs. Slalom entry and exit are on the same side.



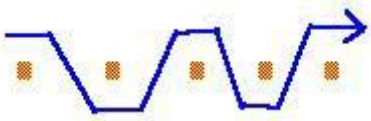
Expanding Slaloms

- Increase speed gradually, maintain smooth steering.



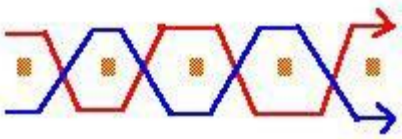
Decreasing or Compressing Slaloms

- Decrease speed (possibly using brakes), maintain smooth steering.



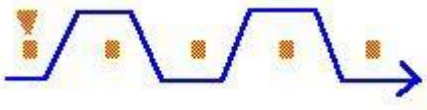
Optional Slaloms

- Enter on either side.



Mandatory Slaloms

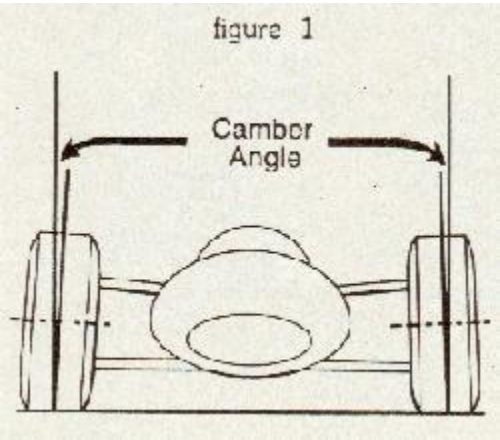
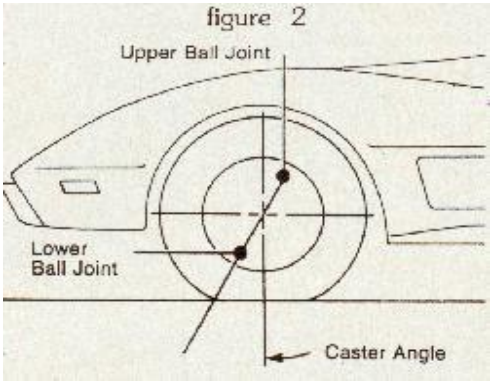
- Enter side opposite the arrow.

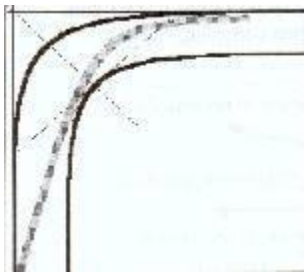
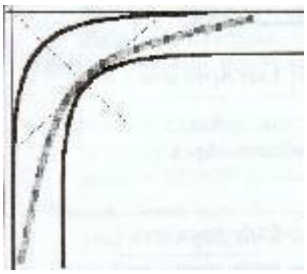
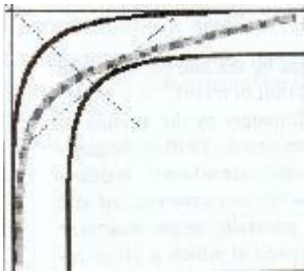


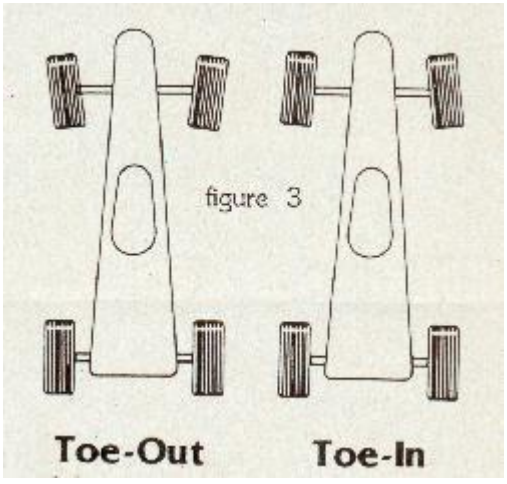
Suspension Adjustments

Suspension Component	Causes Oversteer	Causes Understeer
Front Spring Rate	Thinner torsion bars or spring wire (lighter)	Thicker torsion bars or spring wire (heavier)
Rear Spring Rate	Thicker torsion bars or spring wire (heavier)	Thinner torsion bars or spring wire (lighter)
Front Anti-roll Bar	Thinner or longer arms (lighter)	Thicker or shorter arms (heavier)
Rear Anti-roll Bar	Thicker or shorter arms (heavier)	Thinner or longer arms (lighter)
Weight Distribution	Rear-biased	Front-biased
Front Shock Absorber	Softer	Harder
Rear Shock Absorber	Harder	Softer
Front Camber	More negative	More positive
Rear Camber	More positive	More negative
Front Tire Width	Wider	Narrower
Rear Tire Width	Narrower	Wider
Front Tire Pressure	Lower	Higher
Rear Tire Pressure	Higher	Lower
Front Track	Wider	Narrower
Rear Track	Narrower	Wider
Front Spoiler	Larger	Smaller
Rear Spoiler	Smaller or less angle	Larger or more angle

Glossary

Acceleration	The addition of speed is usually caused by an engine either pulling or pushing a car.
Aerodynamics	The science dealing with a car passing through the air.
Apex	The center point of a turn with respect to entering and exiting
Brake Modulation	Easing off the brakes slightly when you feel the wheels locking and then reapplying the brakes. ABS does it automatically.
Camber	The tilt of a wheel from the vertical, viewed head-on (see figure 1). Positive camber means the top of the wheel leans away from the vehicle centerline. Negative camber has the wheel leaning toward the centerline. Any wheel camber has two effects: a wheel tends to run in a circular path toward the direction it leans, and at any time when a wheel is not running at a right angle to the road surface, the flat tread is not entirely in contact with the road. Since a vehicle tends to lean into a turn due to centrifugal force, and the wheels tend to lean with it, negative camber is sometimes used so that the tread is flat on the road surface when it is on the outside of a corner. This is when you most need traction if you are in a hurry.  figure 1
Caster	The more-or-less vertical axis about which a wheel rotates during steering (see figure 2). When the top of this axis leans toward the rear, like the front fork of a cycle, it is positive caster. The primary effect of positive caster is that the tire contact patch on the pavement trails behind the point at which this axis contacts the pavement. This causes the wheel to tend to follow the caster axis and run straight ahead after a turn.  figure 2

Center of Gravity	The center point at which the vehicle will balance
Centrifugal Force	The force towards the outside of the circle
Centripetal Force	The force towards the center of a circle
Cornering	Driving in an arc predetermined by either a limiting barrier, such as a pylon, or by mental design on the part of the driver.
Deceleration	The slowing of a vehicle is usually done by applying braking pressure.
Dive	A word sometimes used to describe the pitch motion in a car under braking.
Early Apex	The line intersects the inside of the curve before the geometric apex. Note that the sharpest part of this turn happens at the end. If the driver hasn't slowed sufficiently, the car will drift right off the track beyond this point. 
Entry Angle	The position of a car relative to an approaching corner
Esses	A series of turns in the shape of an S
Exit Angle	The position of a car relative to leaving a corner and approaching a straightaway
Geometric Apex	Note that the turn line intersects the geometric apex of the corner. This curve shows the maximum constant speed around the corner, since higher speeds result in drift. 
Heel-and-Toe	A driving method in which the right foot controls both the accelerator and the brake.
Late Apex	The turn line intersects the inside of the curve after the geometric apex. Note that the sharpest, and therefore slowest part of the turn is at the initial turn-in. After that, the curve becomes less sharp, thus the driver can accelerate out of the turn. 
Left-Foot Braking	Using the left foot to operate the brakes in an autocross car, thereby maintaining chassis set.

Line	The physical line of movement that a car takes through a turn from the turn-in-point to the apex, to the track-out-point. The correct line will make you fast and smooth.
Negative Camber	A situation where the wheel leans away from the car at the road level. The top of the tire is leaning inward from vertical.
Neutral Handling	The car feels balanced and responsive; the driver feels more comfortable and in control.
Oversteer	The car wants to over-respond to your steering inputs. The rear end of the car feels light, and it acts as if it wants to spin toward the inside of the corner.
Pylon	Those critters we try not to hit during autocross are usually fluorescent-orange traffic cones made of rubber or plastic.
Pyrometer	A technical instrument used to accurately gauge the temperature of the rubber compound on a tire.
Roll Bar	More correctly called an anti-roll bar, this device reduces body roll and is usually mounted laterally at the front and rear of the car. Also called a sway-bar or anti-sway-bar
Shock Absorber	A dampening device used in conjunction with springs to reduce bounce and stabilize the ride of a vehicle
Springs	Devices of various shapes that support the weight of a vehicle in a resilient fashion
Threshold Braking	Maximum braking with the wheels on the verge of locking
Toe	The alignment of the wheels as viewed from above (see figure 3). "Toe-out" means each wheel points away from the centerline. "Toe-in" means each wheel points in, toward the vehicle centerline. The primary purpose for the seeming misalignment of toe-in is to preload the steering and suspension linkage and take out all the linkage slack or springiness. It does this because the centerline of the tire usually lies outboard of the caster axis, and forward motion tends to push the wheel and tire rearwards in an arc so that the wheels tend to toe-out. The amount of static toe-in is such that the wheels are pointing at or near straight ahead after the car is in motion and all the slack is taken out of the system.  figure 3 Toe-Out Toe-In

Torsion Bars	A supporting device much like a spring, only instead of moving up and down, they torque or twist.
Track-out Point	The point on the course at which the car should be when you have completed the turn.
Trailing Accelerator	A condition whereby the driver maintains a lag in acceleration while beginning to apply the brakes.
Trailing Brake	A condition whereby the driver maintains a lag in braking while cornering, the accelerating
Trailing Throttle Oversteer	Oversteer caused by lifting off the gas or braking while in a corner. Rear engine cars are noted for doing this.
Understeer	Often called "push" or "plow", the car feels like it is unresponsive to your steering inputs, will continue straight ahead, and feels like the wheels are not turned enough. The initial response (the wrong response) is to turn the wheels more.