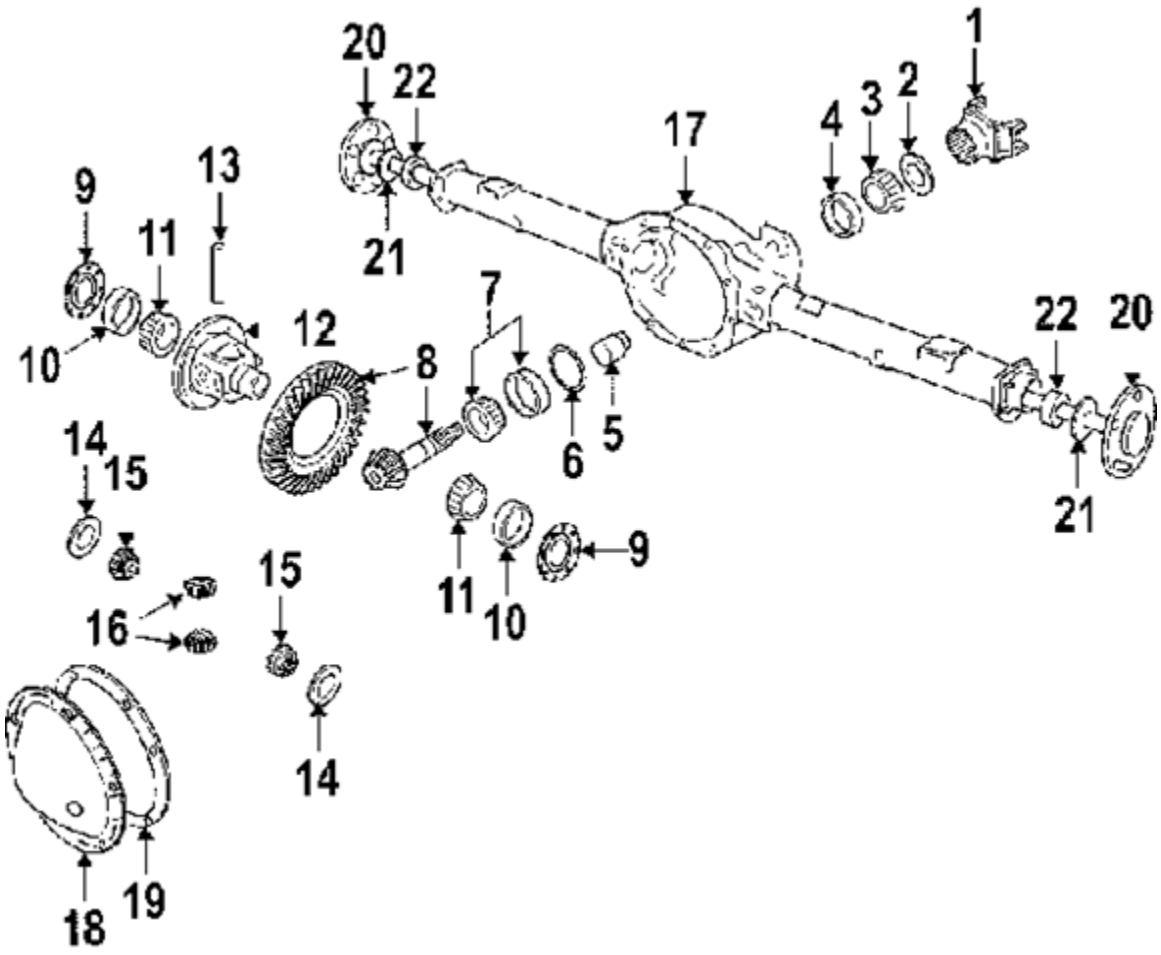
Rear End Gears 101

After seeing numerous threads about gears, I figured I would do a small write up. Hopefully when people search and find this, they find their answers. Maybe it is good enough to even become a sticky. If you feel anything is wrong or maybe I left something out, feel free to comment and I will add it accordingly.

What is a ring and pinion?

Simple answer: Your driveshaft spins a pinion. Your pinion in turn spins the vertically mounted ring gear. Your ring gear is directly bolted to your differential, which turns your halfshafts/axles.

Here is a quick illustration (please note that this is a solid axle system, not an independent rear suspension, like our cars have. I choose to use this picture, because I feel it is easier to grasp the concept of a ring and pinion through a solid axle)



Part number 8 is your ring and pinion. The part on the right is your pinion, the part on the left is the ring gear

What do the numbers "3.73" "4.10" "4.33" etc mean?

Simple answer: It is how many times your driveshaft turns for every time your wheel spins once. For example, with 4.33's, if your wheels spins once, your driveshaft will turn 4 1/3 times. A simple formula to figure out what gear ratio you have is to take the number of ring teeth there are and divide it by the number of pinion teeth there are.

Will I loose top speed if I do gears?
Simple answer: No! actually if anything you will gain top speed! A stock LS3 top speed in 6th gear, with factory gears is 269 mph! Your car will never see that kind of speed (well if yours does, my hats off to you!). Assuming your speed governer is removed, you will be limited by how much power you are making and aerodynamics. Putting a more aggressive gear ratio in will put you in a higher rpm, which means you will be putting more power to the ground, getting you to a higher mph.

What gear ratio is best for me?
Simple answer: Automatics: 3.73's Manuals: 4.10's

More in depth answer: It varies on your setup. The main factor (assuming that the car's goal is optimal 1/4 mile time) is that you want to be a few hundred rpms past your redline when crossing the traps in the 1/4 mile.

A quick run down, if you trap the following in the 1/4... then here's a general idea of what gear you should get (this is assuming you have a 6200 redline... if yours is different, then use the calculator found on the bottom of this post):

Manuals:
< 122 mph: 4.33's
122-129 mph: 4.10
129-142 mph: 3.73
142-153 mph: 3.45

Automatics:
< 106 mph: 4.33's
106-112 mph: 4.10
112-123 mph: 3.73
123-133 mph: 3.45
133-140 mph: 3.27

Now this is assuming you have the suspension and tires to effectively utilize the given gear ratio. Some people ask "Well can I put 4.10's in my L99/6L80E?" The quick answer: Yes... but it is going to be an interesting ride. GM isn't dumb and knew that this heavy car was going to need some help getting moving, and put a steep 4.027 for 1st gear in the automatics. Paired that 4.10's, it will be A VERY AGGRESSIVE 1st gear. If you have the suspension/tire to withstand it, it will be a very very aggressive launch.

That being said, putting a more aggressive ring and pinion allows you to get into your "powerband" faster. Your powerband is the "sweet spot," so to say, of your motor, where it makes the most useable power. The faster you get into it, the faster your car goes. On the other end of the spectrum, you can "run out of gear." This is when you go past your power gear (4th gear for our cars) and have to shift into overdrive. This does not offer an ideal 1/4 mile time

Can I install gears myself?

Yes, but I would highly recommend against it, unless you've had some practice. Setting up gears is very time consuming and takes a little experience to get it right. I would suggest having someone with you that has done a few, if you are attempting to do this yourself. It is very easy to mess something up, and gets very frustrating. And the results can be catastraphic.

If you do not have this knowledge/experience at your disposal, I would highly recommend getting the work done at a reputable shop.

Will I gain rwhp if I install a set of gears?

No. Actually if anything, you might lose a little bit of rwhp (a negligable amount) due to an increase in parasitic drivetrain loss. This is greatly offset, because you will be getting into your powerband faster. The "butt dyno" will think you gained a lot of power, because you will be climbing the rpms faster, but in reality, you will be at the same power level.

Are gears noisey?

Simple answer: Yes and No. It's kind of a trick question. Some gears will make noise... even when properly setup. However, a good indication that the gears are not setup properly is excessive noise. This is why it is highly recommended to have someone, who knows what they are doing, around. I'm not saying one can't have a "crash course" and get it right on their first try. But it is not worth the risk, in my opinion.

Should I do anything else when I'm doing the ring and pinion?

Simple answer: Yes! It is a great time to install a set of differential bushings, as the differential will already be out, and it's one of those "well while I'm in there" things. Differential bushings are fairly inexpensive and will save you time and money down the road.

I installed a set of gears, it lowered my ET, but my mph (trap speed) went down? What's wrong?!

Simple answer: Absolutely nothing! As mentioned before, you are not adding horsepower

with a set of gears, you are just accelerating faster. So your car just doesn't make it up to 115 mph to finish the 1/4 mile now, it only has to get up to 112 mph (I'm just making up numbers here, they are not accurate). Generally speaking, the higher you go with a gear, the lower your ET will get, but it will also lower your trap speeds. This is assuming you are not running out of gear in the last part of the 1320.

Are 4.10's prone to breakage?

I feel this is a touchy subject. Some say yes, I say no. There have been a few failures. But what you don't read is how many people haven't broken their 4.10's. I hope no one hijacks this thread and turns it into a "are 4.10s weak?" thread, but in this thread, it will just be left as: "Do a search, and make your own decision"
If you feel I should add anything, or anything is incorrect, please say so, and I will adjust this post accordingly. I will end this with an old saying that I was once told:

"Don't fear the gear!"

A few numbers that people will ask....

Manual transmissions (LS3/TR6060)

3.45 gears:
Top speed in X gear:
1st: 51 mph
2nd: 74 mph
3rd: 107 mph
4th: 153 mph
5th: 182 mph
6th: 269 mph

RPM at XX mph in 6th gear:
60 mph: 1380 rpm
70 mph: 1610 rpm
80 mph: 1850 rpm

3.73 gears:
Top speed in X gear:
1st: 47 mph
2nd: 68 mph
3rd: 99 mph
4th: 142 mph
5th: 169 mph
6th: 249 mph

RPM at XX mph in 6th gear:

60 mph: 1500 rpm
70 mph: 1750 rpm
80 mph: 2000 rpm

4.10 gears:
Top speed in X gear:
1st: 43 mph
2nd: 62 mph
3rd: 90 mph
4th: 129 mph
5th: 154 mph
6th: 226 mph

RPM at XX mph in 6th gear:
60 mph: 1650 rpm
70 mph: 1925 rpm
80 mph: 2200 rpm

4.33 gears:
Top speed in X gear:
1st: 41 mph
2nd: 59 mph
3rd: 85 mph
4th: 122 mph
5th: 145 mph
6th: 214 mph

RPM at XX mph in 6th gear:
60 mph: 1733 rpm
70 mph: 2025 rpm
80 mph: 2325 rpm

Automatic transmissions (L99/6L80E)

3.27 gears:
Top speed in X gear:
1st: 40 mph
2nd: 68 mph
3rd: 106 mph
4th: 140 mph
5th: 190 mph
6th: 242 mph

RPM at XX mph in 6th gear:
60 mph: 1525 rpm

70 mph: 1800 rpm
80 mph: 2050 rpm

3.45 gears:
Top speed in X gear:
1st: 38 mph
2nd: 65 mph
3rd: 100 mph
4th: 133 mph
5th: 180 mph
6th: 230 mph

RPM at XX mph in 6th gear:
60 mph: 1625 rpm
70 mph: 1900 rpm
80 mph: 2125 rpm

3.73 gears:
Top speed in X gear:
1st: 35 mph
2nd: 60 mph
3rd: 90 mph
4th: 123 mph
5th: 166 mph
6th: 212 mph

RPM at XX mph in 6th gear:
60 mph: 1750 rpm
70 mph: 2033 rpm
80 mph: 2333 rpm

4.10 gears:
Top speed in X gear:
1st: 32 mph
2nd: 55 mph
3rd: 84 mph
4th: 112 mph
5th: 151 mph
6th: 193 mph

RPM at XX mph in 6th gear:
60 mph: 1933 rpm
70 mph: 2033 rpm
80 mph: 2566 rpm

4.33 gears:
Top speed in X gear:
1st: 30 mph
2nd: 52 mph
3rd: 80 mph
4th: 106 mph
5th: 143 mph
6th: 183 mph

RPM at XX mph in 6th gear:
60 mph: 2033 rpm
70 mph: 2366 rpm
80 mph: 2700 rpm

If you have a different redline or different than stock height tires, and feel like doing the calculations yourself. Or if you are bored and feel like playing with some numbers, I use this calculator:

http://f-body.org/gears/

The Gear Ratios for a TR6060 (manual) are:
1st: 3.01
2nd: 2.07
3rd: 1.43
4th: 1.00
5th: 0.84
6th: 0.57
R: 3.28

The Gear Ratios for a 6L80E (automatic) are:
1st: 4.027
2nd: 2.364
3rd: 1.532
4th: 1.152
5th: 0.852
6th: 0.667
R: 3.064