To “gear up” means to gear for speed (increasing the size of the powered gear), whereas to “gear down” means to gear for torque (decreasing the size of the powered gear).

One common way you can see how gearing works in real life is by looking at a bicycle. Just like a drive train, a bicycle has a “powered gear” (powered by your legs, rather than a motor), chain, and a “driven gear” which turns a wheel.

When you go up a steep hill on a bicycle, you switch to a “lower gear,” that is, gearing for torque. When you bike on a long, straight path, you switch to a “higher gear,” that is, gearing for speed. Notice that when gearing for torque, you pedal a lot but do not move forward a lot, though pedal easier due to higher torque. This is because you have a lower gear ratio; it takes more revolutions of the smaller powered gear to produce one revolution of the driven gear. Likewise, when you switch to a higher gear, you have a high gear ratio; one revolution of the larger powered gear produces many revolutions of the driven gear. This is harder to pedal due to lower torque.

In an application to this year’s game, Sack Attack: many teams have created robots which lift sacks using a “scoop and dump” approach. The scoop lifts sacks off the ground and places them into a “dump” which lifts them into the troughs. In this case the benefit of gearing the scoop and the dump for speed is that you will be able to pick up and dump sacks quickly in the game. The benefit of gearing for torque is to ensure that you will be able to pick up many sacks at one time. Remember that the field setup has many sacks in a row close to each other; if you want to be able to pick up all of them at one time, gearing for torque will be advantageous!

The following table is meant to help you fully comprehend a chart made by Ricky Torrance, a Vex engineer. The table will help you quantify the gearing of your robot:

Reduction Details					Velocity (FPS)			
Reduction Type	Driving Size	Driven Size	Overall Reduction	Output % of Motor	Tank Tread	2.75" wheel	4" wheel	5" wheel
Gear	12	84	7	14%	0.15	0.17	0.25	0.31
Chain	24	24	…	…	…			

Full Table Here (And based off of):
http://www.vexforum.com/gallery/showimage.php?i=72&c=4

"Reduction type" refers to how the gears are linked together (whether directly gear-to-gear or with chain.)

"Driving size" and *"driven size refer"* to the number of teeth in what we called the *"powered gear"* and *"driven gear"*

"Overall reduction" can be used as a multiplier of torque.

"Output %" represents the *"driven gear's"* rotations per minute compared with the motor. Notice that more torque means less speed and vice versa.

The final four columns give the speed in feet per second of a robot with the corresponding propulsion system.