Gears

Gears - What can they do?

1) They can change the direction of a motor or drive output.
2) They can increase or decrease the speed output of a motor. The speed that a motor turns at is called RPM- rotations per minute.
3) They can increase or decrease the power of a motor's turning. The power of a motor turning is called Torque. Torque is a measure of rotational force.

Gears - What can they do?

- **They can make one motor drive more than one part.**
- **They can drive a part not attached to the motor.**

WHAT IS A GEAR RATIO

A gear ratio defines the relationship between multiple gears.

Calculating Gear Ratio by Gear Teeth

Gear Ratio= $\frac{\text{Output gear \# teeth}}{\text{Input gear \# teeth}}$

For example, if our motor is attached to a gear with 60 teeth and this gear is then attached to a gear with 20 teeth that drives a wheel, our gear ratio is 60:20, or more accurately 3:1

Calculating Gear Ratios without teeth

- If you do not want to count a gears teeth (or if they do not exist), gear ratio's can also be determined by measuring the diameter of each gear.
- For example, if our motor is attached to a gear with a 1" diameter and this gear is connected to a gear with a 2" diameter attached to a wheel. Our ratio is 2:1.

How does a gear ratio affect speed:

- The gear ratio tells us how fast one gear is rotating when compared to another.
- If our input gear (10 teeth) is rotating at 5 rpms , and it is connected to our output gear (50 teeth), our output gear will rotate at 1 rpms.
- **Why? Our gear ratio is 50:10… or 5:1**

How does a gear ratio affect speed:

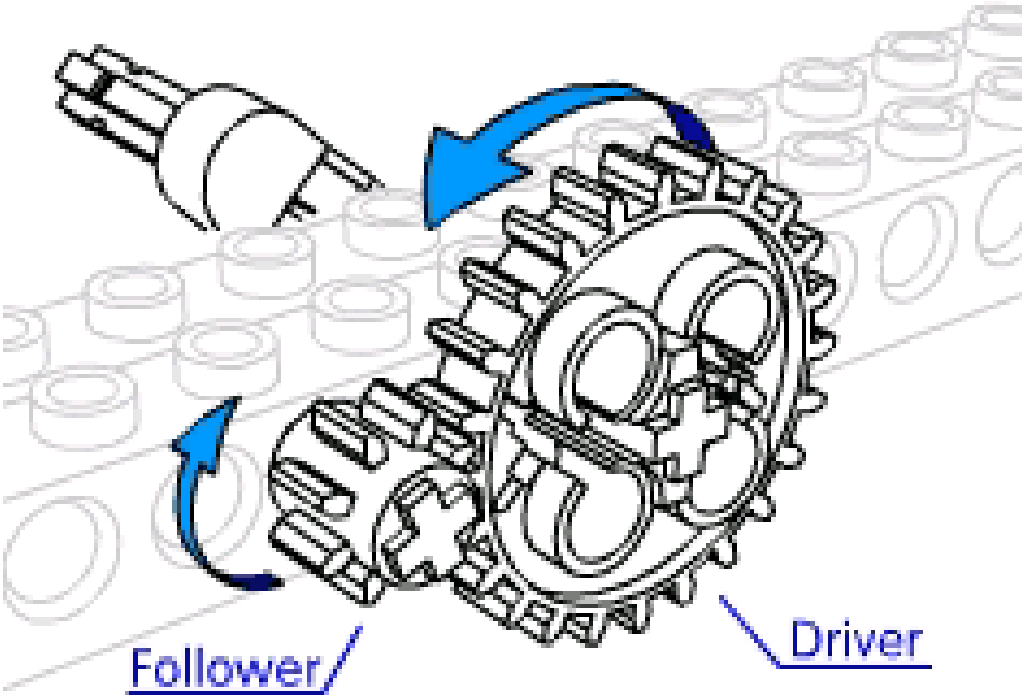
- If our small gear rotates 1 time, our large gear only rotates 1/5 rotation. It takes 5 rotations of our small gear to = 1 rotation of our large gear. Thus our large gear is rotating at 1/5 the speed.

How does a gear ratio affect speed:

- What if our gear ratio where 1:3?
  In this case our input gear is 3x larger as large as our output gear. If our input gear were rotating at 20 rpms…. each rotation, would result in 3 rotations of our output gear. Our output would be 60rpms.

Gearing Up

If you use a large gear to drive a small gear, the small one will turn faster.



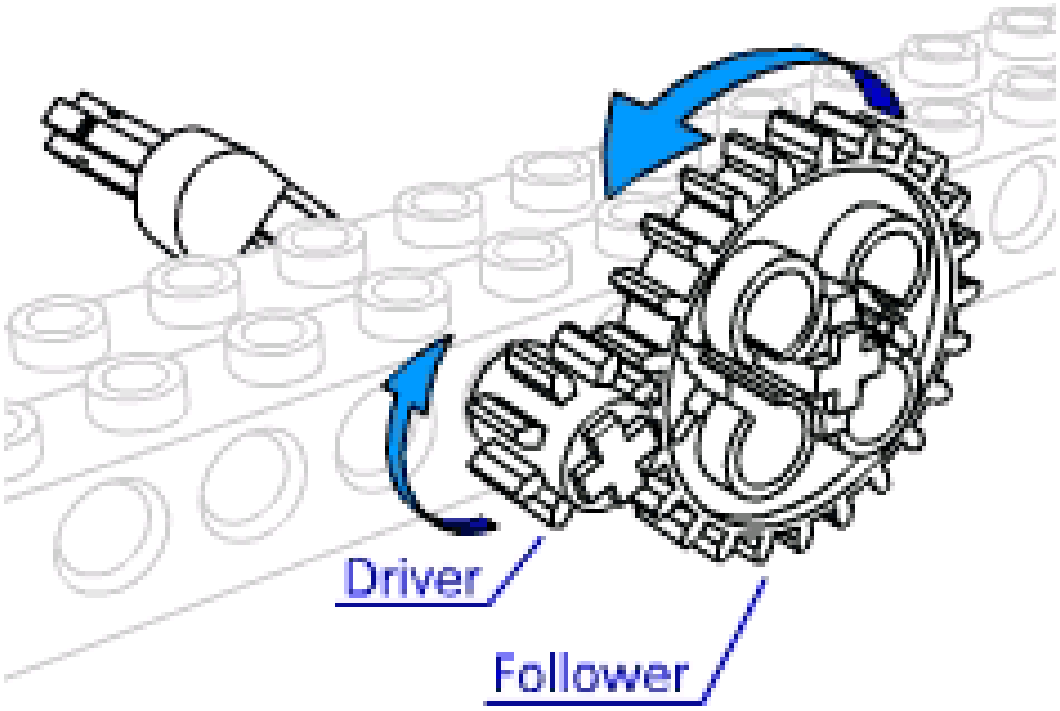
Gearing Up

- Gearing up increases speed, but decreases force.

- A example of a gearing-up system in real life is a 10-speed bike - when you shift into 10th gear, you turn a large gear with the pedals, which drives a small gear attached to the rear wheel.

Gearing Down

If you use a small gear to drive a large gear, the large one will turn slower.



Gearing Down

- Gearing down decreases speed but increases force. Since it's easy to turn a small gear at a fast speed, we use it to move the large one.

- A small driver gear makes a large follower gear turn more slowly.