

The Clawbot uses a series of gears turned by the motor. These are used to transmit power from a motor to the wheels. The gear connected to a motor is called the driving or input gear, and the gear connected to a wheel is called the driven or output gear.

To determine the gear ratio, use the following formula:

$$\frac{\text{\# of Teeth on Driven Gear}}{\text{\# of Teeth on Driving Gear}} = \text{Gear Ratio}$$

Example:

$$\frac{40 \text{ (driven gear)}}{8 \text{ (driving gear)}} = \frac{5}{1} = 5:1 \text{ is the gear ratio}$$

Ask the students:

1. What is the gear ratio of the actual Clawbot?
2. Ramad and Jackson want to design a robot with a gear ratio of 2, using a 16 tooth driven gear. They have 24, 16, and 8 tooth gears available. What gear should they choose as their driving gear?
3. Susie is using a 40 tooth driving gear and a 24 tooth driven gear. What is the gear ratio?

Answers:

1. 1:1
2. 8 tooth gear
3. 0.6

Once we know this information, we can discuss the Clawbot's speed, torque, and power. The benefits of being able to determine this information is that you can use it to your mechanical advantage.

Speed is a way of measuring how fast an object is moving. Speed measures how far an object will travel over a given period of time.

Torque is a force directed in a circle, most often rotating an object. When torque is spinning an object, the object will create a linear (straight line) force at its edge, such as an axle spinning a tire and causing the tire to move in a straight line along the ground.

Power is the rate at which work is done. With VEX IQ, Smart Motors convert electrical energy into mechanical energy and produce power for a mechanical system.

Speed, torque, and power are basic principles that are fundamental to the design and performance of robotic build, such as the Clawbot. There is a trade-off between speed and torque. When the gear

ratio is 1:1, the amount of torque and speed is the same. However, as soon as you increase the gear ratio (1:5, for example), you're reducing the amount of torque but significantly increasing the amount of speed. If you reversed the ratio (say, 5:1), you would be reducing the speed but increasing the torque.