PLTW: Automation & Robotics
Lesson: Mechanisms Day 2 [April 7th]

Learning Target:
Students will continue their review the basics of mechanisms, and the relationship between gear ratios, speed and torque.

Let's Get Started

*To complete the notes and practice electronically, click here

Warm-up: Mechanisms and Speed & Torque

Take a look at this VEX webpage and watch the video.

As you read the page take notes over important information you find.

- As you watch the video think about how you can use what you have learned about torque and speed to you advantage when building a mechanism.

Notes

Mechanisms and Speed

We know that speed measures how fast an object is moving and that we use speed to measure how far something travels over a certain period of time.

When determining the speed of a mechanisms we always compare the output gear to the input gear.

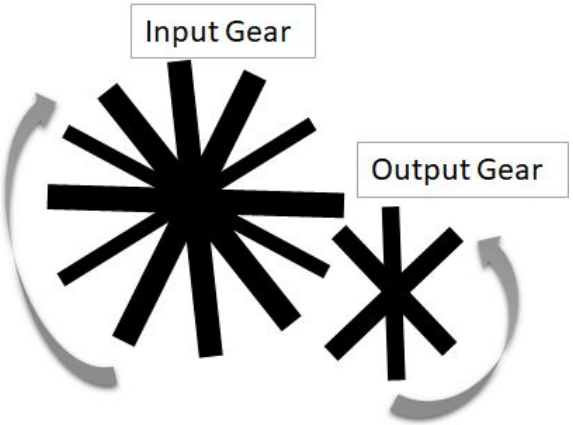
<u>There are two rules we always follow for speed:</u>

Follower/Driven
#1 If the output gear is larger than the Driver input gear the speed will decrease

Follower/Driven
#2 If the output gear is smaller than the Driver input gear the speed will increase.

***If both the Input and Output gears are the same size then Speed will be constant.**

Example:
Input gear = 12 teeth
Output gear = 6 teeth
Gear Ratio = 12:6
Simplified Gear Ratio = 1:2



In this example Speed will increase because the output gear is smaller than the input gear.

Mechanisms and Speed: Practice

For the gear ratios below determine if Speed is **constant**, **increasing** or **decreasing** and explain why. If you get stuck look at page 3.

1. **15:3**

Speed is _____ because

2. **1:5**

Speed is _____ because

3. **4:3**

Speed is _____ because

Mechanisms and Torque

We know that torque is a push or pull (force) in a circular direction

Torque is the opposite of Speed when looking at gear ratios.

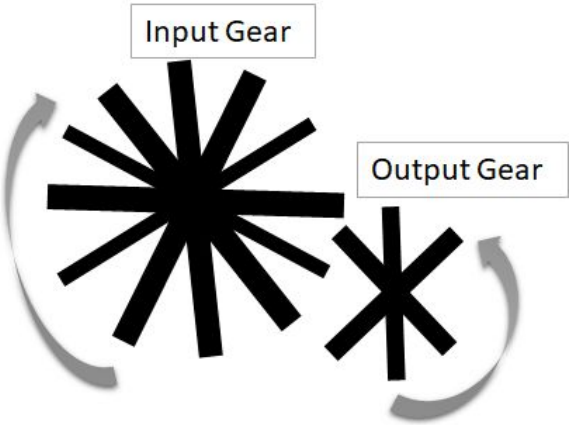
There are two rules we always follow for torque:

#1 If the output (Follower/Driven) gear is larger than the input (Driver) gear the Torque will increase

#2 If the output (Follower/Driven) gear is smaller than the input (Driver) gear the Torque will decrease.

***If both the Input and Output gears are the same size then Torque will be constant.**

Example:
Input gear = 12 teeth
Output gear = 6 teeth
Gear Ratio = 12:6
Simplified Gear Ratio = 1:2



In this example Torque will decrease because the output gear is smaller than the input gear.

Mechanisms and Torque: Practice

For the gear ratios below determine if Torque is **constant**, **increasing** or **decreasing** and explain why. If you get stuck look at page 5.

1. **14:14**

Torque is _____ because

2. **45:5**

Torque is _____ because

3. **3:7**

Torque is _____ because

Mechanisms and Speed: Practice ANSWER KEY

For the gear ratios below determine if Speed is **constant**, **increasing** or **decreasing** and explain why. If you get stuck look at lesson pages 3.

1. **15:3**

Speed is _increasing_ because the output gear is smaller than the input gear.

2. **1:5**

Speed is _decreasing__ because the output gear is larger than the input gear.

3. **4:3**

Speed is __increasing__ because the output gear is smaller than the input gear.

Mechanisms and Torque: Practice ANSWER KEY

For the gear ratios below determine if Torque is **constant**, **increasing** or **decreasing** and explain why. If you get stuck look at page 5.

1. **14:14**

Torque is _constant__ because the input gear and the output gears are the same size and there is no change in torque between them.

2. **45:5**

Torque is __decreasing__ because the output gear is smaller than the input gear.

3. **3:7**

Torque is _increasing___ because the output gear is larger than the input gear.

Self Assessment

For the gear ratios below Simplify the gear ratio and determine if Torque and Speed are **constant**, **increasing** or **decreasing** and explain why. If you get stuck look at lesson pages 3 and 5.

1. 25:45

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

2. 21:7

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

3. 36:8

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

A. 75:75

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

B. 2:7

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

C. 5:30

Simplified gear ratio _____
Torque is_____Speed is_____
Because _____

Extend Your Learning

To learn about Speed, Torque and Horsepower check this video out.