# Gear Ratios

AUTOMOTIVE SERVICE TECHNICIAN, HEAVY EQUIPMENT TECHNICIAN, AGRICULTURE EQUIPMENT TECHNICIAN AND PARTS TECHNICIAN

| GRADES | LEARNING OBJECTIVE | CONCEPTS |
|---|---|---|
| • Grade 5<br>• Grade 6 | Students will examine part-part, part-whole relationships and ratios through gear sets. | • Part-part<br>• Part-whole<br>• Ratios |

## Curriculum Connections

### GRADE 5 MATH

Guiding question: How can ratios provide new ways to relate numbers?

Learning outcome: Students employ ratios to represent relationships between quantities.

Skills and procedures:

- Express part–part ratios and part–whole ratios of the same whole to describe various situations

### GRADE 6 MATH

Guiding question: In what ways can equivalent ratios support proportional reasoning?

Learning outcome: Students apply equivalence to the interpretation of ratios and rates.

Skills and procedures:

- Determine whether two ratios are equivalent
- Solve problems involving ratios, rates, and proportions

## Description

In this hands-on activity, students will explore ratios by using a gear system. Students can use the three different gears to compare the partial revolution of one gear to the whole revolution of another. Ratios can be determined using rotations and / or the number of teeth on a given gear.

Automotive service, heavy equipment, agriculture equipment, and parts technicians must understand gear systems and ratios as they source parts and work on transmissions for vehicles and power trains for vehicles and implements.

| TIME | MATERIALS |
| --- | --- |
| • 20–30 minutes | • 3-D printed gear set or 3-D printing file |

# Procedure

## PREPARATION

- Each gear set comes with three different gear sizes, a board, and a handle. Check each gear set to make sure all components are accounted for and in working order.
- Print the *Gear Ratios Worksheet* found on the website.

## STEPS

1. Introduce the gear set to students by demonstrating that the gears can be removed from the board and relocated to a different position.
2. Explain that part–whole relationships can be demonstrated by counting the number of rotations one gear makes in relation to another based on whole revolutions or, to be more exact, by counting the number of teeth of each gear.
3. Students can then rearrange the order of the gears on the board and write a ratio based on the new gear placement. Students can write their ratio using the chart on the accompanying worksheet or a piece of paper.
4. Students can also rearrange the placement of the handle, varying their drive gear in each gear train that is created.
5. Students write each arrangement as a ratio.
6. Ask students to complete the four questions at the bottom of the worksheet, then discuss them together as a class.

## Assessment suggestions

### WRITTEN ASSESSMENT

Students record the different gear trains as ratios in the chart on the accompanying worksheet or in their workbook.

### DISCUSSION

Facilitate a class discussion using the students' responses to the last four questions on the gear ratio worksheet.

## Extension

Students can explore the concept of mechanical advantage as it relates to the size of gear being the drive gear in the gear train.

## Web resources

- Gear Ratio Worksheet
- Gears Kit: Activity Guide
- Trade Talks: Mechanical Advantage (Gears)

## Contributors

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