

INTRODUCING YOUR CHILD TO STEM

VOCABULARY TO KNOW

TORQUE

A **twisting** force.

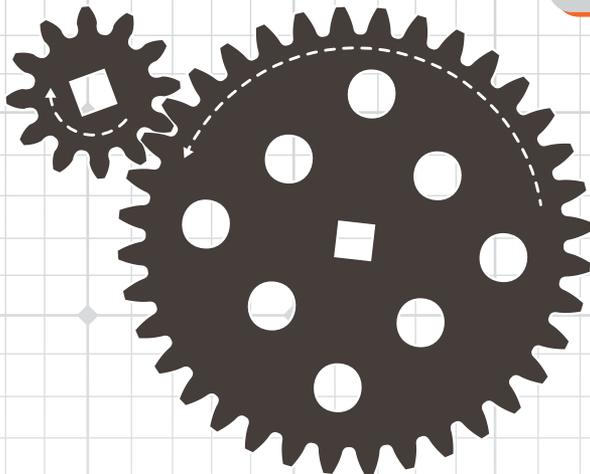
GEAR RATIO

The number of turns the **driven** (output) gear makes with one turn of the **driving** (input) gear.

KEY FORMULA

DRIVEN GEAR
12 TEETH

DRIVING GEAR
36 TEETH



Science, Technology, Engineering and Mathematics (**STEM**) education provides young adults with the opportunity to participate in many themed **hands-on activities**, including those with connections to sports, history, and other subjects.

Activities involving the VEX Robotics® construction toys helps individuals learn more about **math**, **physics**, and **engineering** by engaging in activities that are useful and enjoyable while providing them hands-on experiences in those key areas.

This activity with the VEX® Warhead provides a fun and interesting way for students to learn about **math**, **gears**, **speed**, and **torque**.

$$\text{Gear Ratio} = \frac{\text{Driven}}{\text{Driving}} = \frac{12 \text{ teeth}}{36 \text{ teeth}} = \frac{1}{3}$$

The gear that is being turned by some outside force such as a motor is called the **input** or **driving gear**.

The gear that is turned by the driving gear is called the **output** or **driven gear**.

The notches in the gears are called **teeth**. The **larger** the gear is in diameter, the **more teeth** it will have.

EXTEND YOUR LEARNING

DISCUSS

What type of robot would you design if you were competing on BATTLEBOTS®?

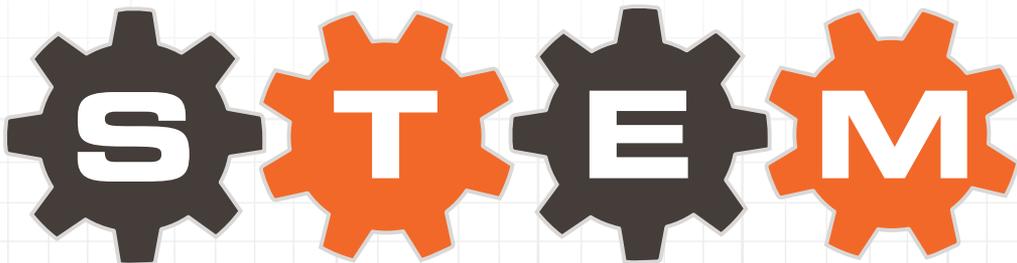
APPLY

Where are gear ratios applied in real life? Cyclists often use gearing when they are climbing hills or trying to increase the speed of their bike on a flat surface. Can you think of other examples?

EXPLORE

You can explore additional engaging hands-on activities with VEX/HEXBUG toys here: <https://www.vex.com/help/build-instructions>

STEM STANDARDS ADDRESSED



HS-PS-2-1

Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration

MS-PS-2-1

Apply Newton's Third Law to support a solution to a problem involving the motion of two colliding objects

MS-PS-2-4

Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects

HE-ETS-1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering

HS-PS-3-3

Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy

ISTE1.1A

Students articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes

ISTE1.1D

Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies

ISTE3.3D

Students build knowledge by actively exploring real world issues and problems, developing ideas and theories while pursuing answers and solutions

ISTE4.4C

Students develop, test and refine prototypes as part of a cyclical design process

ISTE4.4D

Students exhibit a tolerance for ambiguity, perseverance and the capacity to work with open-ended problems

ISTE7.7C

Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal

ETS1.A

Defining and delimiting engineering problems

ETS1.B

Developing possible solutions

ETS1.C

Optimizing the design solution

CCSS.MATH.PRACTICE.MP1

Make sense of problems and persevere in solving them

CCSS.MATH.PRACTICE.MP4

Model with mathematics

CCSS.MATH.PRACTICE.MP7

Look for and make use of structure

CCSS.MATH.CONTENT.6.RP.A.1

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities

CCSS.MATH.CONTENT.6.RP.A.2

Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship

CCSS.MATH.CONTENT.6.RP.A.3

Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number-line diagrams, or equations

CCSS.MATH.CONTENT.3.NF.A.3.B

Recognize and generate simple equivalent fractions

STANDARDS REFERENCED

MATH

Common Core State Standards for Math
<http://www.corestandards.org/Math/>

SCIENCE & ENGINEERING

Next Generation Science Standards
<http://www.nextgenscience.org/>

TECHNOLOGY

International Society for Technology in Education
<http://www.iste.org/standards>